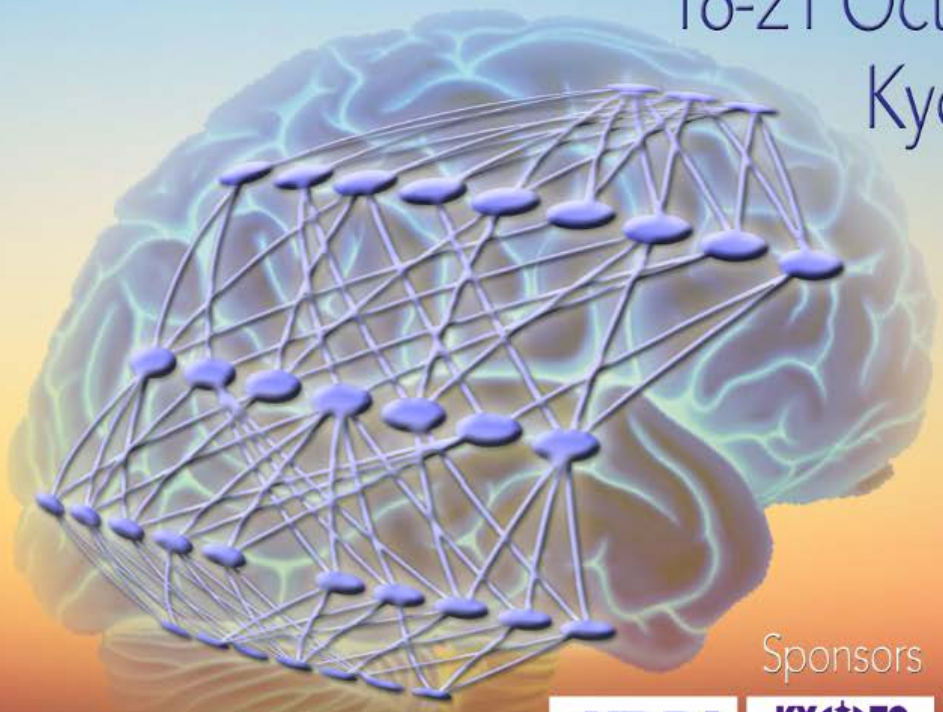
The 23rd International Conference on Neural Information Processing

ICONIP 2016

Programme & Abstracts

16-21 October 2016

Kyoto, Japan



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APNNS Asia Pacific Neural Network Society

JNNS Japanese Neural Network Society

Photo: Kyoto university

Contents

Welcome Message

Welcome to Kyoto, Japan! Welcome to 23rd International Conference on Neural Information Processing (ICONIP 2016), October 16 to 21, 2016, organized by Asia-Pacific Neural Network Society (APNNS, `http://www.apnns.org/`) and Japanese Neural Network Society (JNNS, `http://www.jnns.org/`). ICONIP 2016 Kyoto is the first Annual Conference of APNNS, which has started in January 2016 as a new society succeeding Asia-Pacific Neural Network Assembly (APNNA). APNNS aims at local and global promotion of neural-network research and education with emphasis on diversity in members and cultures, transparency in its operation, and stability in event organization. The ICONIP 2016 Organizing Committee consists of JNNS board members and international researchers to plan and operate the Conference.

In these years, neural networks attract many people not only in scientific and technological communities but also widely those who live their lives in diversity because of various topics such as Big Data, TrueNorth (IBM), Deep Learning, AlphaGo (Google DeepMind) as well as big projects such as SyNAPSE project (USA, 2008), The Human Brain Project (EU, 2012), and The AIP Project (Japan, 2016). Any fields and areas in science and technology have its up-and-downs more or less. The predecessor APNNA promoted not only active fields but also others at leveling off. APNNS takes over this direction, and further enhances the function to hold social-interaction events where even those who extended and moved into new/neighbor areas come back to talk lively, discuss widely, to generate and cultivate novel seeds in neural networks and related fields.

The ICONIP 2016 Kyoto Organizing Committee received 431 submissions from 38 countries and regions worldwide. Among them, 296 (68.7%) have been accepted for presentation. The largest presenters by country/region of first authors are Japan (100), China (78), Australia (22), India (13), Korea (12), France (7), Hong Kong (7), Taiwan (7), Malaysia (6), United Kingdom (6), Germany (5) and New Zealand (5).

Besides the papers published in the Proceedings in four volumes, the conference technical program includes

- 4 Plenary talks by Kunihiko Fukushima, Mitsuo Kawato, Irwin King and Sebastian Seung,
- 4 Tutorials by Aapo Hyvarinen, Nikola Kazabov, Stephen Scott, and Okito Yamashita,
- 1 Student Best Paper Award Evaluation Session,
- 5 Special Sessions, namely, Bio-inspired/energy-efficient information processing, Whole brain architecture, Data-driven approach for extracting latent features from multi-dimensional data, Topological and graph based clustering methods, and Deep and reinforcement learning,
- 2 Workshops: Data Mining and Cybersecurity, and Novel Approaches of Systems Neuroscience to Sports and Rehabilitation,

as well as exhibitions and a technical tour.

Kyoto is located in the central part of Honshu, the main island of Japan. Kyoto formerly flourished as the imperial capital of Japan for 1,000 years after 794 A.D., and known as "The City of Ten Thousand Shrines." There are 17 heritage sites (13 temples, 3 shrines, and 1 castle) that form the UNESCO World Heritage Listing named as the "Historic Monuments of Ancient Kyoto (Kyoto, Uji and Otsu Cities)." In addition, there are three popular, major festivals (Matsuri) in Kyoto, one of which, called "Jidai Matsuri (The Festival of Ages)," will be held on October 22nd, just after ICONIP 2016. Please enjoy your stay at the deepest heart of Japan.

We would like to express our sincere gratitude to everyone involved in making the conference a success. We wish to acknowledge the support of all the ICONIP 2016 sponsors and supporters, namely, APNNS, JNNS, KDDI, NICT, Ogasawara Foundation, SCAT, as well as Advanced Telecommunications Research Institute International (ATR), Kyoto Prefecture Kyoto Convention & Visitors Bureau, Mitsubishi Electric Co., and Springer Verlag. We also thank deeply the keynote,

plenary and invited speakers, exhibitors, student paper award evaluation committee members, special session and workshop organizers, all the organizing committee members, reviewers, conference participants, and contributing authors.

Please enjoy the Conference and the historic city!

October 2016

Akira Hirose
General Chair, ICONIP 2016

Seiichi Ozawa
General Co-Chair, ICONIP 2016

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Asia Pacific Neural Network Society JNNS Japanese Neural Network Society

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Available Cafeteria of Kyoto University Coop with a lunch ticket of ICONIP 2016

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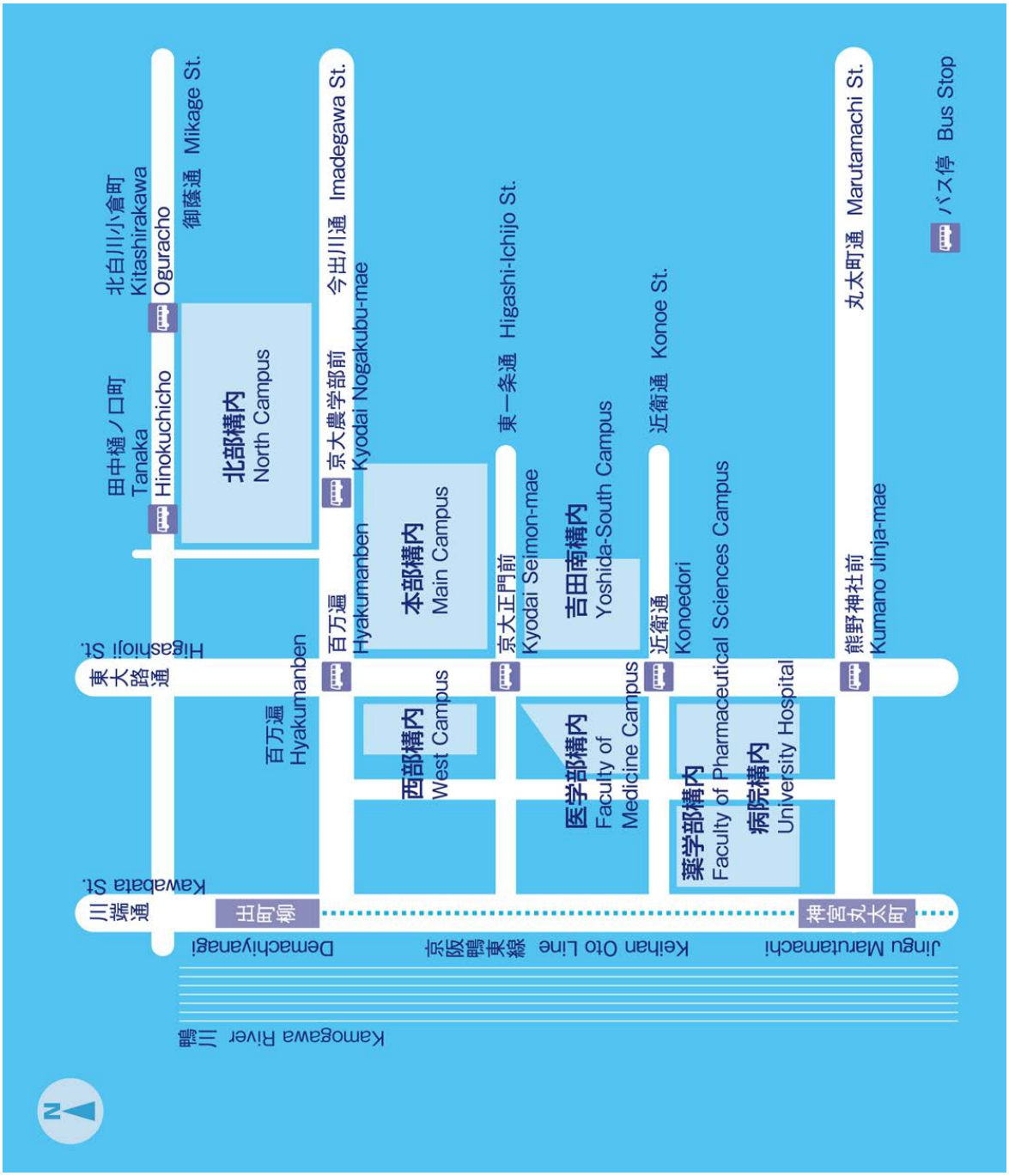
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Kitashirakawa
Oguracho
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田中樋ノ口町
Tanaka
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北部構内
North Campus
京大農学部前
今出川通 Imadegawa St.
Kyodai Nogakubu-mae
百万遍
Hyakumanben
本部構内
Main Campus
京大正門前
東一条通 Higashi-Ichijo St.
Kyodai Seimon-mae
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Yoshida-South Campus
近衛通 Konoe St.
Konoedori
丸太町通 Marutamachi St.
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Hyakumanben
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Program at a glance

Day 1 (October 16th, Sunday)

	Clock Tower Centennial Hall	International Conference Hall I	International Conference Hall II	International Conference Hall III	Conference Room III	Conference Room IV
13:00-14:30		**Tutorial 1** Non-Gaussian Machine Learning: From ICA to Unsupervised Deep Learning Prof. Aapo Hyvarinen		**Tutorial 2** The Use of Robotic Technology and Control Theory to Explore Brain Function and Dysfunction Prof. Stephen Scott		
14:30-16:00		**Tutorial 3** Deep Learning, Spiking Neural Networks and Evolving Spatio-Temporal Data Machines Prof. Nikola Kasabov		**Tutorial 4** Analysis Methods for Understanding Human Brain Activities Dr. Okito Yamashita		
16:00-16:30			Coffee Break			
16:30-18:30				Best Student Paper Awards Presentation		
18:30-20:30		Welcome Reception				

NOTICE: The conference venue, Kyoto University Clock Tower Centennial Hall, is not open until 9:00.

Day 2 (October 17th, Monday)

	Clock Tower Centennial Hall	International Conference Hall I	International Conference Hall II	International Conference Hall III	Conference Room III	Conference Room IV
9:20-9:30	**Opening Remark** General Chair Akira Hirose					
9:30-10:20	**Plenary 1** Deep CNN Neocognitron for Visual Pattern Recognition Prof. Kunihiko Fukushima					
10:20-10:40			Coffee Break			
10:40-12:20		**MonAM-1**: Deep and Reinforcement Learning	**MonAM-2**: Exhibition	**MonAM-3** Big Data Analysis	**MonAM-4**: Neural Data Analysis	**MonAM-5**: Robotics and Control
12:20-13:20		Lunch (@Cafeteria of Kyoto Univ Coop)				
13:20-15:00		**MonPM1-1**: Bio-Inspired / Energy-Efficient Information Processing: Theory, Systems, Devices 1	**MonPM1-2**: Exhibition	**MonPM1-3**: Whole Brain Architecture: Toward a Human Like General Purpose Artificial Intelligence 1	**MonPM1-4**: Neurodynamics 1	**MonPM1-5**: Bioinformatics
15:00-15:20			Coffee Break			
15:20-17:00		**MonPM2-1**: Bio-Inspired / Energy-Efficient Information Processing: Theory, Systems, Devices 2	**MonPM2-2**: Exhibition	**MonPM1-3**: Whole Brain Architecture: Toward a Human Like General Purpose Artificial Intelligence 2	**MonPM2-4**: Neurodynamics 2	**MonPM2-5**: Biomedical Engineering

Day 3 (October 18th, Tuesday)

	Clock Tower Centennial Hall	International Conference Hall I	International Conference Hall II	International Conference Hall III	Conference Room III	Conference Room IV
9:30-10:20	**Plenary 2** Recent Developments in Online Learning for Big Data Applications Prof. Irwin King					
10:20-10:40			Coffee Break			
10:40-12:20		**TueAM-1**: Data Mining and Cybersecurity Workshop 1 **Invited Talk:** Koji Nakao Cyber-security Information Sharing with Data Correlation	**TueAM-2**: Exhibition	**TueAM-3**: Neuromorphic Hardware	**TueAM-4**: Machine Learning 1	**TueAM-5**: Sensory Perception
12:20-13:20		Lunch (@Cafeteria of Kyoto Univ Coop)				
13:20-15:00		**TuePM1-1**: Data Mining and Cybersecurity Workshop 2 **Invited Talk:** Amir Hussain The Emerging Era of Cognitive Big Data Informatics: Some Case Studies and Future Directions	**TuePM1-2**: Exhibition	**TuePM1-3**: Pattern Recognition 1	**TuePM1-4**: Machine Learning 2	**TuePM1-5**: Social Networks
15:00-15:20			Coffee Break			
15:20-17:20		**TuePM2-1**: Data Mining and Cybersecurity Workshop 3	**TuePM2-2**: Exhibition	**TuePM2-3**: Pattern Recognition 2 **Invited Talk:** Masayuki Ohzeki Statistical Mechanics of Pre-Training and Fine Tuning in Deep Learning	**TuePM2-4**: Machine Learning 3	
17:20-19:00			**Poster 1**			

Day 4 (October 19th, Wednesday)

	Clock Tower Centennial Hall	International Conference Hall I	International Conference Hall II	International Conference Hall III	Conference Room III	Conference Room IV
9:30-10:20	**Plenary 3** DecNef: Tool for Revealing Brain-Mind Causal Relation Dr. Mitsuo Kawato					
10:20-10:40			Coffee Break			
10:40-12:20		**WedAM-1**: Brain-machine interface	**WedAM-2**: Exhibition	**WedAM-3**: Computer Vision 1	**WedAM-4**: Machine Learning 4	**WedAM-5**: Time Series Analysis
12:20-14:00		JNNS Meeting (13:00-14:00)	Lunch (@Cafeteria of Kyoto Univ Coop)			
14:00-15:40		**WedPM1-1**: Data-Driven Approach for Extracting Latent Features from Multi-Dimensional Data 1		**WedPM1-3**: Computer Vision 2	**WedPM1-4**: Machine Learning 5	**WedPM1-5**: Topological and Graph Based Clustering Methods 1 **Tutorial**: Rushed Kanawati, Nistor Grozavu Topological and Graph Based Clustering: Recent Algorithmic Advances
15:40-16:00			Coffee Break			
16:00-17:40		**WedPM2-1**: Data-Driven Approach for Extracting Latent Features from Multi-Dimensional Data 2	**WedPM2-2**: Exhibition	**WedPM2-3**: Computer Vision 3	**WedPM2-4**: Machine Learning 6	**WedPM2-5**: Topological and Graph Based Clustering Methods 2
17:40-19:20			**Poster 2**			

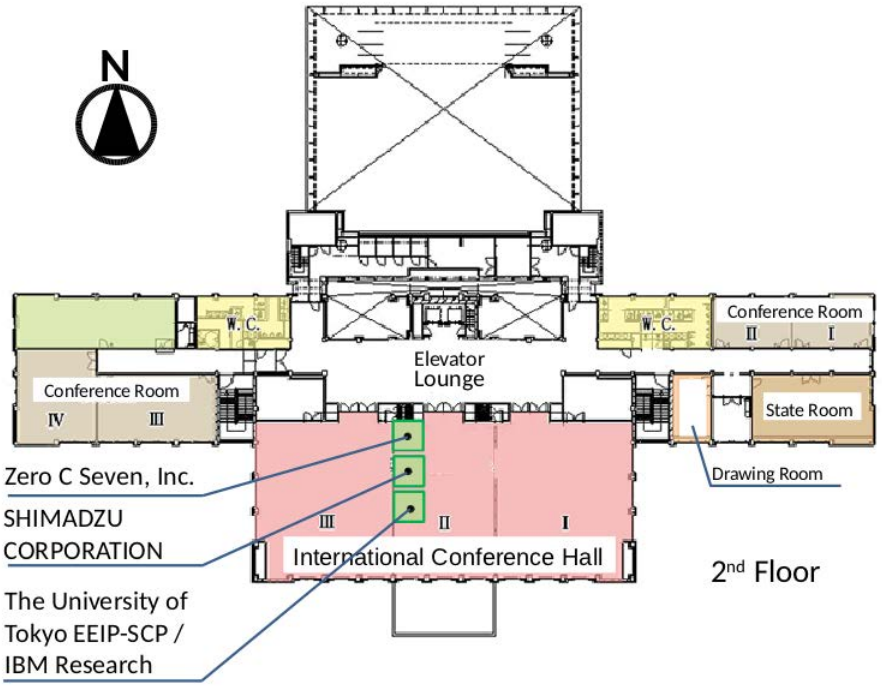
Day 5 (October 20th, Thursday)

	Clock Tower Centennial Hall	International Conference Hall I	International Conference Hall II	International Conference Hall III	Conference Room III	Conference Room IV
9:30-10:20	**Plenary 4** Neural Nets and The Connectome Prof. Sebastian Seung					
10:20-10:40		Coffee Break				
10:40-12:20		**ThuAM1-1**: Reinforcement learning	**ThuAM-2**: Applications	**ThuAM-3**: Computational Intelligence 1	**ThuAM-4**: Data Mining 1	**ThuAM-5**: Deep Neural Networks 1
12:20-13:20		Lunch (@Cafeteria of Kyoto Univ Coop)				
13:20-15:00		**ThuPM1-1**: Workshop on Novel Approaches of Systems Neuroscience to Sports and Rehabilitation 1 **Special Talk:** Yuji Yamamoto Understanding Complex Sports Behavior: Interpersonal Competition and Cooperation	**ThuPM1-2**: Machine Learning 7	**ThuPM1-3**: Computational Intelligence 2	**ThuPM1-4**: Data Mining 2	**ThuPM1-5**: Deep Neural Networks 2
15:00-15:20		Coffee Break				
15:20-17:00		**ThuPM2-1**: Workshop on Novel Approaches of Systems Neuroscience to Sports and Rehabilitation 2	**ThuPM2-2**: Computer Vision 4	**ThuPM2-3**: Computational Intelligence 3	**ThuPM2-4**: Data Mining 3	**ThuPM2-5**: Deep Neural Networks 3
Move to Kyoto Hotel Okura						
17:30-18:30	Tea Ceremony & Maiko Greetings (Kyoto Hotel Okura)					
18:30-21:30	Banquet & APNNS Regular Meeting of Members (Kyoto Hotel Okura)					

Day 6 (October 21th, Friday)

9:00-16:00	Technical Tour (optional) *Please ask the details at the registration desk.

Floor map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II I
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IV III
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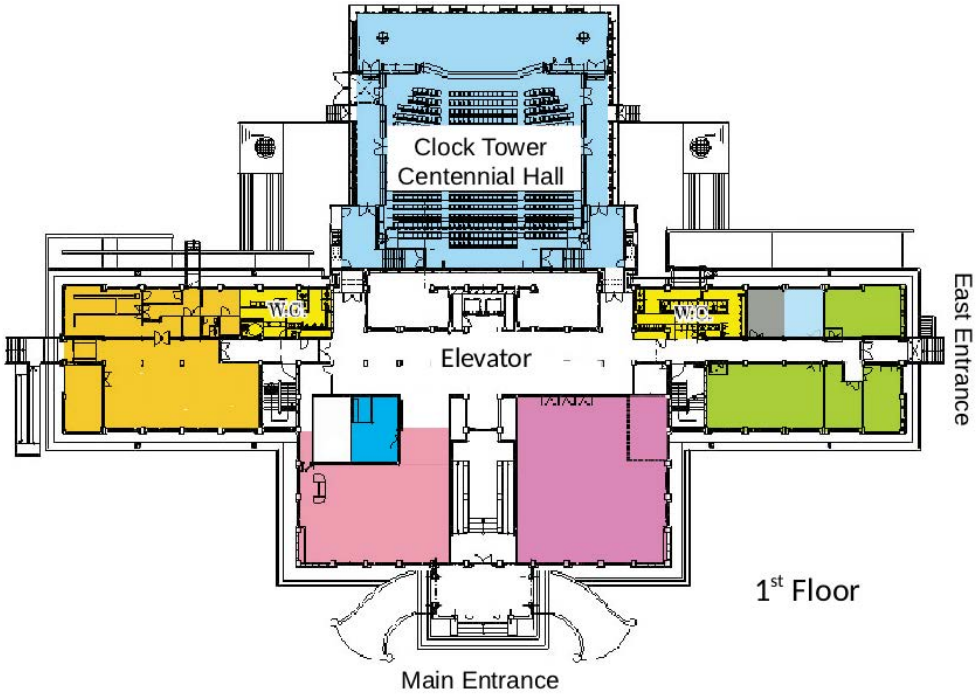
Tokyo EEIP-SCP /
IBM Research
III II I
International Conference Hall
2nd Floor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Centennial Hall
W.C.
W.C.
Elevator
East Entrance
1st Floor
Main Entrance

Tutorials (October 16, 2016)

Tutorial			International Conference Hall I
13:00	-	14:30	Tutorial 1: Non-Gaussian machine learning: From ICA to unsupervised deep learning Aapo Hyvärinen University of Helsinki
14:30	-	16:00	Tutorial 3: Deep Learning, Spiking Neural Networks and Evolving Spatio-Temporal Data Machines Nikola Kasabov, FIEEE, FRSNZ Knowledge Engineering and Discovery Research Institute (KEDRI), Auckland University of Technology
18:30	-	20:30	Welcome Reception

Tutorial			International Conference Hall III
13:00	-	14:30	Tutorial 2: The Use of Robotic Technology and Control Theory to Explore Brain Function and Dysfunction Stephen Scott GSK-CIHR Chair in Neuroscience, Centre for Neuroscience Studies, Department of Biomedical and Molecular Sciences, Queen ' s University
14:30	-	16:00	Tutorial 4: Analysis Methods for Understanding Human Brain Activities Okito Yamashita Neural Information Analysis Laboratories, ATR
16:30	-	18:30	Best Student Paper Awards Presentation

Technical Programs

October 17 (Monday)

Opening Remark Clock Tower Centennial Hall 9:20 – 9:30

Akira Hirose
General Chair of ICONIP2016 (University of Tokyo)

Plenary 1 Clock Tower Centennial Hall 9:30 – 10:20
chair: Akira Hirose

Deep CNN Neocognitron for Visual Pattern Recognition
Kunihiko Fukushima
Senior Research Scientist, Fuzzy Logic Systems Institute (Iizuka, Fukuoka, Japan)

MonAM-1 **Deep and Reinforcement Learning**
Chair: Kazushi Ikeda
Room: International Conference Hall I

10:40	-	11:00	Emotion Prediction from User-Generated Videos by Emotion Wheel Guided Deep Learning Che-Ting Ho[1], Yu-Hsun Lin[1], Ja-Ling Wu[1] [1]NTU
11:00	-	11:20	Deep Q-learning with Prioritized Sampling Jianwei Zhai[1] Quan Liu[1] Zongzhang Zhang[1] Shan Zhong[1] Haijun Zhu[1] Peng Zhang[1] Cijia Sun[1] [1]School of Computer Science & Technology, Soochow University
11:20	-	11:40	Deep Inverse Reinforcement Learning by Logistic Regression Eiji Uchibe[1] [1]ATR Computational Neuroscience Labs.
11:40	-	12:00	Parallel Learning for Combined Knowledge Acquisition Model Kohei Henmi[1], Motonobu Hattori[1] [1]University of Yamanashi
12:00	-	12:20	Emergence of Higher Exploration in Reinforcement Learning using a Chaotic Neural Network Yuki Goto[1], Katsunari Shibata[1] [1]Oita University

MonAM-3 **Big Data Analysis**
Chair: Farookh Hussain, Gohei Tanaka
Room: International Conference Hall III

10:40	-	11:00	Establishing Mechanism of Warning for River Dust Event based on an Artificial Neural Network Yen Hsun Chuang[1], Ho Wen Chen[1], Wei Yea Chen[1], Ya Chin Teng[1] [1]Tung Hai University
11:00	-	11:20	Harvesting multiple resources for Software as Service offers: a big data study Asma Alkalbani[1], Farookh Hussain[1], Ahmed Ghamry[2], Omar Hussain[2] [1]University of Technology Sydney [2]University of New South Wales Canberra (UNSW Canberra)
11:20	-	11:40	Cloud Monitoring Data Challenges: A Systematic Review Asif Gill[1], Sarhang Hevary[2] [1]University of Technology Sydney (UTS) [2]University of Technology, Sydney (UTS)
11:40	-	12:00	Locality-Sensitive Linear Bandit Model for Online Social Recommendation Tong Zhao[1], Irwin King[2] [1]Shenzhen Key Laboratory of Rich Media Big Data Analytics and Applications, Shenzhen Research Institute, The Chinese University of Hong Kong, Shenzhen, China [2]Department of Computer Science and Engineering, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong
12:00	-	12:20	An Online-Updating Approach on Task Recommendation in Crowdsourcing Systems Man-Ching Yuen[1], Irwin King[1], Kwong-Sak Leung[1] [1]The Chinese University of Hong Kong

MonAM-4 **Neural Data Analysis**
Chair: Juergen Fell, Junnosuke Teramae
Room: Conference Room III

10:40	-	11:00	Inferred duality of synaptic connectivity in local cortical circuit with receptive eld correlation Kohei Watanabe[1], Jun-nosuke Teramae[1], Naoki Wakamiya[1] [1]Graduate School of Information Science and Technology, Osaka University
11:00	-	11:20	Identifying gifted thinking activities through EEG microstate topology analysis Li Zhang[1], Mingna Cao[1], Bo Shi[1] [1]Bengbu Medical College
11:20	-	11:40	Representation of local figure-ground by a group of V4 cells Masaharu Hasuike[1], Yukako Yamane[2], HIroshi Tamura[2], Ko Sakai[1] [1]University of Tsukuba [2]Osaka University
11:40	-	12:00	Dynamic MEMD associated with Approximate Entropy in Patients' Consciousness Evaluation Gaochao Cui[1,2], Qibin Zhao[1,2], Toshihisa Tanaka[3], Jianting Cao[1,2], Andrzej Cichocki[2] [1]Saitama Institute of Technology [2]Brain Science Institute, RIKEN [3]Tokyo University

MonAM-5 **Robotics and Control**
Chair: Shuichi Kurogi, Sung-Bae Cho
Room: Conference Room IV

10:40	-	11:00	Neural Dynamic Programming for Event-Based Nonlinear Adaptive Robust Stabilization Ding Wang[1], Hongwen Ma[1], Derong Liu[2], Huidong Wang[3] [1]Institute of Automation, Chinese Academy of Sciences [2]University of Science and Technology Beijing [3]Shandong University of Finance and Economics
11:00	-	11:20	Entropy Maximization of Occupancy Grid Map for Selecting Good Registration of SLAM Algorithms Daishiro Akiyama[1], Kazuya Matsuo[1], Shuichi Kurogi[1] [1]Kyushu Institute of Technology
11:20	-	11:40	Analysis of an Intention-Response Model inspired by Brain Nervous System for Cognitive Robot Jae-Min Yu[1], Sung-Bae Cho[1] [1]Yonsei University
11:40	-	12:00	Dynamic Surface Sliding Mode Algorithm Based on Approximation for Three-dimensional Trajectory Tracking Control of an AUV Kai Zhang[1], Tieshan LI[1], Yuqi Wang[1], Zifu Li[2] [1]Dalian Maritime University [2]Jimei University

MonPM1-1 **Bio-Inspired / Energy-Efficient Information Processing: Theory, Systems, Devices 1**

Chair: Shigeru Nakagawa, Akira Hirose, Daiju Nakano
Room: International Conference Hall I

13:20	-	13:40	Exploiting Heterogeneous Units for Reservoir Computing with Simple Architecture Gouhei Tanaka[1], Ryosho Nakane[1], Toshiyuki Yamane[2], Daiju Nakano[2], Seiji Takeda[2], Shigeru Nakagawa[2], Akira Hirose[1] [1]The University of Tokyo [2]IBM Research - Tokyo
13:40	-	14:00	Graceful Degradation under Noise on Brain Inspired Robot Controllers Ricardo de Azambuja[1], Frederico Klein[1], Martin Stoelen[1], Samantha Adams[1], Angelo Cangelosi[1] [1]Plymouth University
14:00	-	14:20	Dynamics of reservoir computing at the edge of stability Toshiyuki Yamane[1], Seiji Takeda[1], Daiju Nakano[1], Gouhei Tanaka[2], Ryosho Nakane[2], Shigeru Nakagawa[1], Akira Hirose[2] [1]IBM Research - Tokyo [2]The University of Tokyo
14:20	-	14:40	Hybrid Gravitational Search Algorithm with Swarm Intelligence for Object Tracking Henry Fung Yeung[1], Guang Liu[1], Yuk Ying Chung[1], Eric Liu[1], Wei-Chang Yeh[2] [1]University of Sydney [2]National Tsing Hua University, Taiwan
14:40	-	15:00	Photonic Reservoir Computing Based on Laser Dynamics with External Feedback Seiji Takeda[1], Daiju Nakano[1], Toshiyuki Yamane[1], Gouhei Tanaka[2], Ryosho Nakane[2], Akira Hirose[2], Shigeru Nakagawa[1] [1]IBM Research - Tokyo [2]The University of Tokyo

MonPM1-3	**Whole Brain Architecture: Toward a Human Like General Purpose Artificial Intelligence 1**
Chair:	Takashi Omori, Hiroshi Yamakawa
Room:	International Conference Hall III

13:20	-	13:40	Whole brain architecture approach is a feasible way toward an Artificial General Intelligence Hiroshi Yamakawa[1], Masahiko Osawa[2], Yutaka Matsuo[3] [1]Dwango [2]Keio University [3]The University of Tokyo
13:40	-	14:00	Learning Visually Guided Risk-Aware Reaching on a Robot Controlled by a GPU Spiking Neural Network Terence Sanger[1] [1]USC
14:00	-	14:20	Regularization Methods for the Restricted Bayesian Network BESOM Yuuji Ichisugi[1], Takashi Sano[1] [1]AIST
14:20	-	14:40	Representation of Relations by Planes in Neural Network Language Model Takuma Ebisu[1], Ryutaro Ichise[2] [1]SOKENDAI [2]National Institute of Informatics
14:40	-	15:00	Modeling of emotion system as a value calculation system Takashi Omori[1], Masahiro Miyata[1] [1]Tamagawa University

MonPM1-4 **Neurodynamics 1**
Chair: Katsunari Shibata, Toshimichi Saito
Room: Conference Room III

13:20	-	13:40	Modeling Attention-Induced Reduction of Spike Synchrony in the Visual Cortex Nobuhiko Wagatsuma[1], Rudiger der Heydt[2], Ernst Niebur[2] [1]Tokyo Denki University [2]Johns Hopkins University
13:40	-	14:00	A Robust TOA Source Localization Algorithm based on LPNN Chi Sing Leung[1], Hao Wang[1], Ruibin Feng[1] [1]City University of Hong Kong
14:00	-	14:20	Reward-Based Learning of a Memory-Required Task based on the Internal Dynamics of a Chaotic Neural Network Toshitaka Matsuki[1], Katsunari Shibata[1] [1]Oita University
14:20	-	14:40	Roles of Gap Junctions in Organizing Traveling Waves in a Hippocampal CA3 Network Model Toshikazu Samura[1], Yutaka Sakai[2], Hatsuo Hayashi[3], Takeshi Aihara[2] [1]Yamaguchi University [2]Tamagawa University [3]Kyushu Institute of Technology
14:40	-	15:00	Towards Robustness to Fluctuated Perceptual Patterns by a Deterministic Predictive Coding Model in a Task of Imitative Synchronization with Human Movement Patterns Ahmadreza Ahmadi[1], Jun Tani[1] [1]KAIST

MonPM1-5			**Bioinformatics**
Chair:	Kitsuchart Pasupa, Madhu Chetty		
Room:	Conference Room IV		
13:20	-	13:40	Clustering-based Weighted Extreme Learning Machine for Classification in Drug Discovery Process Wasu Kudisthalert[1], Kitsuchart Pasupa[1] [1]Faculty of Information Technology, King Mongkut's Institute of Technology Ladkrabang
13:40	-	14:00	Metabolite Named Entity Recognition: A Hybrid Approach Wutthipong Kongburan[1], Praisan Padungweang[1], Worarat Krathu[1], Jonathan Chan[1] [1]School of Information Technology, King Mongkut's University of Technology Thonburi
14:00	-	14:20	Improving strategy for discovering interacting genetic variants in association studies Suneetha Uppu[1], Aneesh Krishna[1] [1]Curtin University
14:20	-	14:40	Improving Dependency Parsing on Clinical Text with Syntactic Clusters from Web Text Xiuming Qiao[1], Hailong Cao[1], Tiejun Zhao[1], Kehai Chen[1] [1]Harbin Institute of Technology
14:40	-	15:00	Exploiting Temporal Genetic Correlations for Enhancing Regulatory Network Optimization Ahammed Kizhakkethil Youseph[1], Madhu Chetty[2], Gour Karmakar[2] [1]Monash University, Australia [2]Federation University, Australia

MonPM2-1 **Bio-Inspired / Energy-Efficient Information Processing: Theory, Systems, Devices 2**

Chair: Shigeru Nakagawa, Akira Hirose, Daiju Nakano
Room: International Conference Hall I

15:20	-	15:40	FPGA Implementation of Autoencoders having Shared Synapse Architecture Akihiro Suzuki[1], Takashi Morie[1], Hakaru Tamukoh[1] [1]Kyushu Institute of Technology Graduate School of Life Science and Systems Engineering
15:40	-	16:00	Time-domain Weighted-sum Calculation for Ultimately Low Power VLSI Neural Networks Quan Wang[1], Hakaru Tamukoh[1], Takashi Morie[1] [1]Kyushu Institute of Technology
16:00	-	16:20	A CMOS Unit Circuit Using Subthreshold Operation of MOSFETs for Chaotic Boltzmann Machines Masatoshi Yamaguchi[1], Takashi Kato[1], Quan Wang[1], Hideyuki Suzuki[2], Hakaru Tamukoh[1], Takashi Morie[1] [1]Kyushu Institute of Technology [2]Osaka University
16:20	-	16:40	An attempt of speed-up of Neurocommunicator, an EEG-based communication aid. Ryohei Hasegawa[1] [1]AIST
16:40	-	17:00	Computational Performance of Echo State Networks with Dynamic Synapses Ryota Mori[1], Gouhei Tanaka[1], Ryosho Nakane[1], Akira Hirose[1], Kazuyuki Aihara[1] [1]The University of Tokyo

MonPM2-3 **Whole Brain Architecture: Toward a Human Like General Purpose Artificial Intelligence 2**

Chair: Takashi Omori, Hiroshi Yamakawa
Room: International Conference Hall III

15:20	-	15:40	The Whole Brain Architecture Initiative Naoya Arakawa[1], Hiroshi Yamakawa[2] [1]The Whole Brain Architecture Initiative [2]Dwango
15:40	-	16:00	Neural Network for Quantum Brain Dynamics: 4D $CP^1 + U(1)$ Gauge Theory on Lattice and its Phase Structure Shinya Sakane[1], Tetsuo Matsui[1] [1]Kindai University
16:00	-	16:20	BriCA: A Modular Software Platform for Whole Brain Architecture Kotone Itaya[1], Koichi Takahashi[2], Masayoshi Nakamura[3], Moriyoshi Koizumi[4], Naoya Arakawa[5], Masaru Tomita[1], Hiroshi Yamakawa[3] [1]Keio University [2]RIKEN QBiC [3]DWANGO Co. [4]Open Collector Inc. [5]The Whole Brain Architecture Initiative
16:20	-	16:40	An Implementation of Working Memory Using Stacked Half Restricted Boltzmann Machine: Toward to Restricted Boltzmann Machine-Based Cognitive Architecture Masahiko Osawa[1], Hiroshi Yamakawa[1], Michita Imai[1] [1]Keio University / Dwango AI Laboratory
16:40	-	17:00	A Game-Engine-Based Learning Environment Framework for Artificial General Intelligence - Toward Democratic AGI - Masayoshi Nakamura[1], Hiroshi Yamakawa[1] [1]DWANGO Co.

MonPM2-4 **Neurodynamics 2**
Chair: Katsunari Shibata, Toshimichi Saito
Room: Conference Room III

15:20	-	15:40	Image Segmentation using Graph Cuts based on Maximum-Flow Neural Network Masatoshi Sato[1], Hideharu Toda[2], Hisashi Aomori[2], Tsuyoshi Otake[3], Mamoru Tanaka[4] [1]Tokyo Metropolitan University [2]Chukyo University [3]Tamagawa University [4]Sophia University
15:40	-	16:00	Joint Routing and Bitrate Adjustment for DASH Video via neuro-dynamic programming in SDN Kunjie Zhu[1], Junchao Jiang[1], Bowen Yang[1], Weizhe Cai[1], Jian Yang[1] [1]University of Science and Technology of China
16:00	-	16:20	Stability of Periodic Orbits in Dynamic Binary Neural Networks with Ternary Connection Kazuma Makita[1], Ryuji Sato[1], Toshimichi Saito[1] [1]Hosei University
16:20	-	16:40	Evaluation of Chaotic Resonance by Lyapunov Exponent in Attractor-Merging Type Systems Sou Nobukawa[1], Haruhiko Nishimura[2], Teruya Yamanishi[1] [1]Fukui University of Technology [2]University of Hyogo

MonPM2-5			**Biomedical Engineering**
Chair:	Jianwu Li, Atsunori Kanemura		
Room:	Conference Room IV		
15:20	-	15:40	Sleep Stage Prediction Using Respiration and Body-Movement Based on Probabilistic Classifier Hirotaka Kaji[1], Hisashi Iizuka[1], Mitsuo Hayashi[2] [1]Toyota Motor Corp. [2]Hiroshima University
15:40	-	16:00	Removing Ring Artifacts in CBCT Images Using Smoothing based on Relative Total Variation Qirun Huo[1], Jianwu Li[1], Yao Lu[1], Ziye Yan[2] [1]Beijing Institute of Technology [2]China Resource Wandong Medical Equipment
16:00	-	16:20	Proposal of a human heartbeat detection/monitoring system employing chirp Z-transform and time-sequential neural prediction Ayse Bezer[1], Akira Hirose[1] [1]University of Tokyo
16:20	-	16:40	Fast Dual-Tree Wavelet Composite Splitting Algorithms for Compressed Sensing MRI Jianwu Li[1], Jinpeng Zhou[1], Qiang Tu[1], Javaria Ikram[1], Zhengchao Dong[2] [1]Beijing Institute of Technology [2]Columbia University
16:40	-	17:00	Implementation of a modular Growing When Required neural gas architecture for recognition of falls Frederico Belmonte Klein[1], Karla Stepanova[2], Angelo Cangelosi[1] [1]Plymouth University [2]FEL CTU in Prague

Plenary 1 (abstract)

Plenary 1	Clock Tower Centennial Hall

Deep CNN Neocognitron for Visual Pattern Recognition

Kunihiko Fukushima[1]
[1] Fuzzy Logic Systems Institute, Fukuoka, Japan

Abstract

Recently, deep convolutional neural networks (deep CNN) have become very popular in the field of visual pattern recognition. The neocognitron, which was first proposed by Fukushima (1979), is a network classified to this category. Its architecture was suggested by neurophysiological findings on the visual systems of mammals. It is a hierarchical multi-layered network. It acquires the ability to recognize visual patterns robustly through learning.
Although the neocognitron has a long history, improvements of the network are still continuing. This talk discusses the recent neocognitron focusing on differences from the conventional deep CNN. For training intermediate layers of the neocognitron, the learning rule called AiS (Add-if-Silent) is used. Under the AiS rule, a new cell is generated if all postsynaptic cells are silent in spite of non-silent presynaptic cells. The generated cell learns the activity of the presynaptic cells in one-shot. Once a cell is generated, its input connections do not change any more. Thus the training process is very simple and does not require time-consuming repetitive calculation. In the deepest layer, a method called Interpolating-Vector is used for classifying input patterns based on the features extracted in the intermediate layers.

Biography

Kunihiko Fukushima received a B.Eng. degree in electronics in 1958 and a PhD degree in electrical engineering in 1966 from Kyoto University, Japan. He was a professor at Osaka University from 1989 to 1999, at the University of Electro-Communications from 1999 to 2001, at Tokyo University of Technology from 2001 to 2006; and a visiting professor at Kansai University from 2006 to 2010. Prior to his Professorship, he was a Senior Research Scientist at the NHK Science and Technical Research Laboratories. He is now a Senior Research Scientist at Fuzzy Logic Systems Institute (part-time position), and usually works at his home in Tokyo. He received the Achievement Award and Excellent Paper Awards from IEICE, the Neural Networks Pioneer Award from IEEE, APNNA Outstanding Achievement Award, Excellent Paper Award from JNNS, INNS Helmholtz Award, and so on. He was the founding President of JNNS (the Japanese Neural Network Society) and was a founding member on the Board of Governors of INNS (the International Neural Network Society). He is a former President of APNNA (the Asia-Pacific Neural Network Assembly).

Monday AM (abstract)

MonAM-1 Deep and Reinforcement Learning

Emotion Prediction from User-Generated Videos by Emotion Wheel Guided Deep Learning

Che-Ting Ho[1], Yu-Hsun Lin[1], Ja-Ling Wu[1]
[1]NTU

Abstract
To build a robust system for predicting emotions from user-generated videos is a challenging problem due to the diverse contents and the high level abstraction of human emotions. Evidenced by the recent success of deep learning (e.g. Convolutional Neural Networks, CNN) in several visual competitions, CNN is expected to be a possible solution to conquer certain challenges in human cognitive processing, such as emotion prediction. The emotion wheel (a widely used emotion categorization in psychology) may provide a guidance on building basic cognitive structure for CNN feature learning. In this work, we try to predict emotions from user-generated videos with the aid of emotion wheel guided CNN feature extractors. Experimental results show that the emotion wheel guided and CNN learned features improved the average emotion prediction accuracy rate to 54.2%, which is better than that of the related state-of-the-art approaches.

Deep Q-learning with Prioritized Sampling

Jianwei Zhai[1], Quan Liu[1], Zongzhang Zhang[1], Shan Zhong[1], Haijun Zhu[1], Peng Zhang[1], Cijia Sun[1]
[1]School of Computer Science & Technology, Soochow University

Abstract
The combination of modern reinforcement learning and deep learning approaches brings significant breakthroughs to a variety of domains requiring both rich perception of high-dimensional sensory inputs and policy selection. A recent significant breakthrough in using deep neural networks as function approximators, termed Deep Q-Networks (DQN), proves to be very powerful for solving problems approaching real-world complexities such as Atari 2600 games. To remove temporal correlation between the observed transitions, DQN uses a sampling mechanism called experience reply which simply replays transitions at random from the memory buffer. However, such a mechanism does not exploit the importance of transitions in the memory buffer. In this paper, we use prioritized sampling into DQN as an alternative. Our experimental results demonstrate that DQN with prioritized sampling achieves a better performance, in terms of both average score and learning rate on four Atari 2600 games.

Deep Inverse Reinforcement Learning by Logistic Regression

Eiji Uchibe[1]
[1]ATR Computational Neuroscience Labs.

Abstract

This study proposes model-free deep inverse reinforcement learning to find nonlinear reward function structures. It is based on our previous method that exploits the fact that the log of the ratio between an optimal state transition and a baseline one is given by a part of reward and the difference of the value functions under linearly solvable Markov decision processes and reward and value functions are estimated by logistic regression. However, reward is assumed to be a linear function whose basis functions are prepared in advance. To overcome this limitation, we employ deep neural network frameworks to implement logistic regression. Simulation results show our method is comparable to model-based previous methods with less computing effort in the Objectworld benchmark. In addition, we show the optimal policy, which is trained with the shaping reward using the estimated reward and value functions, outperforms the policies that are used to collect data in the game of Reversi.

Parallel Learning for Combined Knowledge Acquisition Model

Kohei Henmi[1], Motonobu Hattori[1]
[1]University of Yamanashi

Abstract

In this paper, we propose a novel learning method for the combined knowledge acquisition model. The combined knowledge acquisition model is a model for knowledge acquisition in which an agent heuristically find new knowledge by integrating existing plural knowledge. In the conventional model, there are two separate phases for combined knowledge acquisition: (a) solving a task with existing knowledge by trial and error and (b) learning new knowledge based on the experience in solving the task. However, since these two phases are carried out serially, the efficiency of learning was poor. In this paper, in order to improve this problem, we propose a novel knowledge acquisition method which realizes two phases simultaneously. Computer simulation results show that the proposed method much improves the efficiency of learning new knowledge.

Emergence of Higher Exploration in Reinforcement Learning using a Chaotic Neural Network

Yuki Goto[1], Katsunari Shibata[1]
[1]Oita University

Abstract

Aiming for the emergence of higher functions such as "logical thinking", our group has proposed completely novel reinforcement learning where exploration is performed based onthe internal dynamics of a chaotic neural network. In this paper, in the learning of an obstacle avoidance task, it was examined that in the process of growing the dynamics through learning, the level of exploration changes from "lower" to "higher", in other words, from "motor level" to "more abstract level". It was shown that the agent learned to reach the goal while avoiding the obstacle and there is an area where the agent looks to pass through the right side or left side of the obstacle randomly. The result shows the possibility of the "higher exploration" though the agent sometimes collided with the obstacle and was trapped for a while as learning progressed.

MonAM-3 Big data analysis

Establishing Mechanism of Warning for River Dust Event based on an Artificial Neural Network

Yen Hsun Chuang[1], Ho Wen Chen[1], Wei Yea Chen[1], Ya Chin Teng[1]
[1]Tung Hai University

Abstract

PM10 is one of contributors to air pollution. One cause of increases in PM10 concentra-tion in ambient air is the dust of bare land from rivers in drought season. The Ta-an and Tachia river are this study area, and data on PM10 concentration, PM2.5 concen-tration and meteorological condition at air monitoring site are used to establish a model for predicting next PM10 concentration (PM10 (T+1)) based on an artificial neural network (ANN) and to establish a mechanism for warning about PM10 (T+1) concentration exceed 150 μg/m3 from rivers in drought season. The optimal archi-tecture of an ANN for predicting PM10 (T+1) concentration has six input factors in-clude PM10, PM2.5 and meteorological condition. The train and test R was 0.8392 and 0.7900. PM10 (T) was the most important factor in pre-dicting PM10 (T+1) by sensitivi-ty analysis. Finally, mechanism constraints were established for warning of high PM10 (T+1) concentrations in river basins.

Harvesting multiple resources for Software as Service offers: a big data study

Asma Alkalbani[1], Farookh Hussain[1], Ahmed Ghamry[2], Omar Hussain[2]
[1]University of Technology Sydney [2]University of New South Wales Canberra (UNSW Canberra)

Abstract

Currently, the World Wide Web (WWW) is the primary resource for cloud services information, including offers and providers. Cloud applications (Software as a Service), such as Google App, are one of the most popular and commonly used types of cloud services. Having access to a large amount of information on SaaS offers is critical for the potential cloud client to select and purchase an appropriate service. Web harvesting has become a primary tool for discovering knowledge from the Web source. This paper describes the design and development of Web scraper to collect information on SaaS offers from target Digital cloud services advertisement portals, namely www.getApp.com, and www.cloudreviews.com. The collected data were used to establish two datasets: a SaaS provider's dataset and a SaaS reviews/feedback dataset. Further, we applied sentiment analysis on the reviews dataset to establish a third dataset called the SaaS sentiment polarity dataset. The significance of this study is that the first work focuses on Web harvesting for cloud computing domain, and it also establishes the first SaaS services datasets. Furthermore, we present statistical data that can be helpful to determine the current status of SaaS services and the number of services offered on the Web. In our conclusion, we provide further insight into improving Web scraping for SaaS service information. Our datasets are available on-line through www.bluepagesdataset.com

Cloud Monitoring Data Challenges: A Systematic Review

Asif Gill[1], Sarhang Hevary[2]
[1]University of Technology Sydney (UTS) [2]University of Technology, Sydney (UTS)

Abstract

Organizations need to continuously monitor, source and process large amount of operational data for optimizing the cloud computing environment. The research problem is: what are cloud monitoring data challenges — in particular virtual CPU monitoring data? This paper adopts a Systematic Literature Review (SLR) approach to identify and report cloud monitoring data challenges. SLR approach was applied to initially identify a large set of 1861 papers. Finally, 24 of 1861 relevant papers were selected and reviewed to identify the five major challenges of cloud monitoring data: monitoring technology, virtualization technology, energy, availability and performance. The results of this review are expected to help researchers and practitioners to understand cloud computing data challenges and develop innovative techniques and strategies to deal with these challenges.

Locality-Sensitive Linear Bandit Model for Online Social Recommendation

Tong Zhao[1], Irwin King[2]
[1]Shenzhen Key Laboratory of Rich Media Big Data Analytics and Applications, Shenzhen Research Institute, The Chinese University of Hong Kong, Shenzhen, China [2]Department of Computer Science and Engineering, The Chinese University of Hong Kong, Shatin, N.T., Hong Kong

Abstract

Recommender systems provide personalized suggestions by learning users' preference based on their historical feedback. To alleviate the heavy relying on historical data, several online recommendation methods are recently proposed and have shown the effectiveness in solving data sparsity and cold start problems in recommender systems. However, existing online recommendation methods neglect the use of social connections among users. In this paper, we investigate how to leverage social connections to improve online recommendation performance. In particular, we formulate the online social recommendation task as a contextual bandit problem and propose a Locality-sensitive Linear Bandit (LS.Lin) method to solve it. We provide a theoretical analysis to the proposed LS.Lin method and then demonstrate its improved performance for online social recommendation in empirical studies compared with baseline methods.

An Online-Updating Approach on Task Recommendation in Crowdsourcing Systems

Man-Ching Yuen[1], Irwin King[1], Kwong-Sak Leung[1]
[1]The Chinese University of Hong Kong

Abstract

In crowdsourcing systems, tasks are distributed to networked people to complete such that a company's production cost can be greatly reduced. Task recommendation can help workers to find their right tasks faster as well as help requesters to receive good quality output quicker. With active learning, task recommendation can achieve certain accuracy with a very low cost. In our paper, we propose a generic online-updating method for learning a factor analysis model for crowdsourcing systems. In case of the worker (or task) having large profile, our algorithm retrains the whole feature vector of the worker (or task) and keeps all other entries in the matrix fixed. Besides, our algorithm runs batch update to further improve the performance. Experiment results show that our online-updating algorithm is accurate in approximating to a full retrain of ActivePMF on TaskRec model while the running time of online-updating algorithm is significantly lower than that of a full retrain of the model.

MonAM-4 Neural data analysis

Inferred duality of synaptic connectivity in local cortical circuit with receptive eld correlation

Kohei Watanabe[1], Jun-nosuke Teramae[1], Naoki Wakamiya[1]
[1]Graduate School of Information Science and Technology, Osaka University

Abstract
Synaptic connections in local cortical circuit are highly heterogeneous and non-random. A few strong synaptic connections often form "cluster" that is a tightly connected group of several neurons. Global structure of the clusters, however, has not been clarified yet. It is unclear whether clusters distribute independently and isolated in cortical network, or these clusters are a part of large-scale of global network structure. Here, we develop a network model based on recent experimental data of V1. In addition to reproducing previous result of highly skewed EPSPs, the model also allows us to study mutual relationship and global feature of clusters. We find that the network consists with two largely different sub-networks; a small-world network consists only of a few strong EPSPs and a random network consists of dense weak EPSPs. In other words, local cortical circuit shows a duality, and previously reported clusters are results of local observation of the global small-world network.

Identifying gifted thinking activities through EEG microstate topology analysis

Li Zhang[1], Mingna Cao[1], Bo Shi[1]
[1]Bengbu Medical College

Abstract
EEG microstate of the brain has been suggested to reflect functional significance of cognitive activity. In this paper, from math-gifted and non-gifted adolescents' EEG during a reasoning task, four classes of microstate configuration were extracted based on clustering analysis approach. Computations of multiple parameters were down for each class of EEG microstate. Between-groups statistical and discriminating analyses for these parameters discovered significant functional differences between math-gifted and non-gifted subjects in momentary microstates, involving mean duration and occurrence of EEG electric field configuration. Additionally, the topological differences between the two groups vary across classes and reflect functional disassociation of cognitive processing of the reasoning task. Our study suggests that the microstate classes can be used as the effective EEG features for identifying mental operations by individuals with typical cognitive ability differences.

Representation of local figure-ground by a group of V4 cells

Masaharu Hasuike[1], Yukako Yamane[2], Hiroshi Tamura[2], Ko Sakai[1]
[1]University of Tsukuba [2]Osaka University

Abstract

Figure-ground (FG) segregation is a crucial function of the intermediate-level vision. Physiological studies on monkey V2 have reported border-ownership (BO) selective cells that signal the direction of figure along a local border. However, local borders in natural images are often complicated and they often do not provide a clue for FG segregation. In the present study, we hypothesize that a population of V4 cells represents FG by means of surface rather than border. We investigated this hypothesis by the computational analysis of neural signals from multiple cells in monkey V4. Specifically, we applied Support Vector Machine as an ideal integrator to the cellular responses. Our results showed that the responses from several tens of cells are capable of determining correct local FG in a variety of natural image patches while single-cell responses hardly determine FG, suggesting a population coding of local FG by a small number of cells in V4.

Dynamic MEMD associated with Approximate Entropy in Patients' Consciousness Evaluation

Gaochao Cui[1,2], Qibin Zhao[1,2], Toshihisa Tanaka[3], Jianting Cao[1,2], Andrzej Cichocki[2]
[1]Saitama Institute of Technology [2]Brain Science Institute, RIKEN [3]Tokyo University

Abstract

Electroencephalography (EEG) based preliminary examination has been widely used in diagnosis of brain diseases. Based on previous studies, clinical brain death determination also can be actualized by analyzing EEG signal of patients. Dynamic Multivariate empirical mode decomposition (D-MEMD) and approximate entropy (ApEn) are two kinds of methods to analyze brain activity status of the patients in different perspectives for brain death determination. In our previous studies, D-MEMD and ApEn methods were always used severally and it cannot analyzing the patients' brain activity entirety. In this paper, we present a combine analysis method based on D-MEMD and ApEn methods to determine patients' brain activity level. Moreover, We will analysis three different status EEG data of subjects in normal awake, comatose patients and brain death. The analyzed results illustrate the effectiveness and reliability of the proposed methods.

MonAM-5 Robotics and control

Neural Dynamic Programming for Event-Based Nonlinear Adaptive Robust Stabilization

Ding Wang[1], Hongwen Ma[1], Derong Liu[2], Huidong Wang[3]
[1]Institute of Automation, Chinese Academy of Sciences [2]University of Science and Technology Beijing [3]Shandong University of Finance and Economics

Abstract
In this paper, we develop an event-based adaptive robust stabilization method for continuous-time nonlinear systems with uncertain terms via a self-learning technique called neural dynamic programming. Through system transformation, it is proven that the robustness of the uncertain system can be achieved by designing an event-triggered optimal controller with respect to the nominal system under a suitable triggering condition. Then, the idea of neural dynamic programming is adopted to perform the main controller design task by building and training a critic network. Finally, the effectiveness of the present adaptive robust control strategy is illustrated via a simulation example.

Entropy Maximization of Occupancy Grid Map for Selecting Good Registration of SLAM Algorithms

Daishiro Akiyama[1], Kazuya Matsuo[1], Shuichi Kurogi[1]
[1]Kyushu Institute of Technology

Abstract
This paper analyzes entropy of occupancy grid map (OGM) for evaluating registration performance of SLAM (simultaneous localization and mapping) algorithms. So far, there are a number of SLAM algorithms having been proposed, but we do not have general measure to evaluate the registration performance of point clouds obtained by LRF (laser range finder) for SLAM algorithms. This paper analyzes to show that good registration seems corresponding to large overlap of point clouds in OGM as well as large entropy, large uncertainty and low information of OGM. This analysis indicates a method of entropy maximization of OGM for selecting good registration of SLAM algorithms. By means of executing numerical experiments, we show the validity and the effectiveness of the entropy of OGM to evaluate the registration performance.

Analysis of an Intention-Response Model inspired by Brain Nervous System for Cognitive Robot

Jae-Min Yu[1], Sung-Bae Cho[1]
[1]Yonsei University

Abstract

A service robot requires natural and interactive interaction with users without explicit commands. It is still one of the difficult problems to generate robust reactions for the robot in the real environment with unreliable sensor data to satisfy user ' s requests. This paper presents an intention-response model based on mirror neuron and theory of mind, and analyzes the performance for a humanoid to show the usefulness. The model utilizes the modules of behavior selection networks to realize prompt response and goal-oriented characteristics of the mirror neuron, and performs reactions according to an action plan based on theory of mind. To cope with conflicting goals, behaviors of the sub-goal unit are generated using a hierarchical task network. Experiments with various scenarios reveal that appropriate reactions are generated according to external stimuli.

Dynamic Surface Sliding Mode Algorithm Based on Approximation for Three-dimensional Trajectory Tracking Control of an AUV

Kai Zhang[1], Tieshan LI[1], Yuqi Wang[1], Zifu Li[2]
[1]Dalian Maritime University [2]Jimei University

Abstract

In this paper, a novel dynamic surface sliding mode control method is proposed for three-dimensional trajectory tracking control of autonomous underwater vehicle (AUV) in the presence of model errors. To enhance the robustness, the sliding mode control approach is modified by employing dynamic surface control(DSC). The radial basis function neural network(RBFNN) approximation technique is used for approximating model errors, furthermore the norm of the ideal weighting vector in neural network system is considered as the estimation parameter, such that only one parameter is adjusted. The proposed controller guarantees uniform ultimate boundedness (UUB) of all the signals in the closed-loop system via Lya-punov stability analysis, while the tracking errors converge to a small neighbor-hood of the desired trajectory. Finally, simulation studies are given to illustrate the performance of the proposed algorithm.

Monday PM1 (abstract)

MonPM1-1 Bio-Inspired / Energy-Efficient Information Processing: Theory, Systems, Devices 1

Exploiting Heterogeneous Units for Reservoir Computing with Simple Architecture

Gouhei Tanaka[1], Ryosho Nakane[1], Toshiyuki Yamane[2], Daiju Nakano[2], Seiji Takeda[2], Shigeru Nakagawa[2], Akira Hirose[1]
[1]The University of Tokyo [2]IBM Research - Tokyo

Abstract
Reservoir computing is a computational framework suited for sequential data processing, consisting of a reservoir part and a readout part. Not only theoretical and numerical studies on reservoir computing but also its implementation with physical devices have attracted much attention. In most studies, the reservoir part is constructed with identical units. However, a variability of physical units is inevitable, particularly when implemented with nano/micro devices. Here we numerically examine the effect of variability of reservoir units on computational performance. We show that the heterogeneity in reservoir units can be beneficial in reducing the prediction error in the reservoir computing system with a simple cycle reservoir.

Graceful Degradation under Noise on Brain Inspired Robot Controllers

Ricardo de Azambuja[1], Frederico Klein[1], Martin Stoelen[1], Samantha Adams[1], Angelo Cangelosi[1]
[1]Plymouth University

Abstract
How can we build robot controllers that are able to work under harsh conditions, but without experiencing catastrophic failures? As seen on the recent Fukushima's nuclear disaster, standard robots break down when exposed to high radiation environments. Here we present the results from two arrangements of Spiking Neural Networks, based on the Liquid State Machine (LSM) framework, that were able to gracefully degrade under the effects of a noisy current injected directly into each simulated neuron. These noisy currents could be seen, in a simplified way, as the consequences of exposition to non-destructive radiation. The results show that not only can the systems withstand noise, but one of the configurations, the Modular Parallel LSM, actually improved its results, in a certain range, when the noise levels were increased. Also, the robot controllers implemented in this work are suitable to run on a modern, power efficient neuromorphic hardware such as SpiNNaker.

Dynamics of reservoir computing at the edge of stability

Toshiyuki Yamane[1], Seiji Takeda[1], Daiju Nakano[1], Gouhei Tanaka[2], Ryosho Nakane[2], Shigeru Nakagawa[1], Akira Hirose[2]
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Abstract

We investigate reservoir computing systems whose dynamics are at critical bifurcation points based on center manifold theorem. We take echo state networks as an example and show that the center manifold defines mapping of the input dynamics to higher dimensional space. We also show that the mapping by center manifolds can contribute to recognition of attractors of input dynamics. The implications for realization of reservoir computing as real physical systems are also discussed.

Hybrid Gravitational Search Algorithm with Swarm Intelligence for Object Tracking

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Abstract

This paper proposes a new approach to object tracking using the Hybrid Gravitational Search Algorithm (HGSA). HGSA introduces the Gravitational Search Algorithm (GSA) to the field of object tracking by incorporating Particle Swarm Optimization (PSO) using a novel weight function that elegantly combines GSA ' s gravitational update component with the cognitive and social components of PSO. The hybridized algorithm acquires PSO ' s exploitation of past information and fast convergence property while retaining GSA ' s capability in fully utilizing all current information. The proposed framework is compared against standard natural phenomena based algorithms and Particle Filter. Experiment results show that HGSA largely reduces convergence to local optimum and significantly out-performed the standard PSO algorithm, the standard GSA and Particle Filter in terms of tracking accuracy and stability under occlusion and non-linear movement in a large search space.

Photonic Reservoir Computing Based on Laser Dynamics with External Feedback

Seiji Takeda[1], Daiju Nakano[1], Toshiyuki Yamane[1], Gouhei Tanaka[2], Ryosho Nakane[2], Akira Hirose[2], Shigeru Nakagawa[1]
[1]IBM Research - Tokyo [2]The University of Tokyo

Abstract

Reservoir computing is a novel paradigm of neural network, offering advantages in low learning cost and ease of implementation as hardware. In this paper we propose a concept of reservoir computing consisting of a semiconductor laser subject to external feedback by a mirror, where input signal is supplied as modulation pattern of mirror reflectivity. In that system, non-linear interaction between optical field and electrons are enhanced in complex manner under substantial external feedback, leading to achieve highly nonlinear projection of input electric signal to output optical field intensity. It is exhibited that the system can most efficiently classify waveforms of sequential input data when operating around laser oscillation ' s effective threshold.

MonPM1-3 Whole Brain Architecture: Toward a Human Like General Purpose Artificial Intelligence 1

Whole brain architecture approach is a feasible way toward an Artificial General Intelligence

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Abstract

In recent years, a breakthrough has been made in infant level AI due to the acquisition of representation, which was realized by deep learning. By this, the construction of AI that specializes in a specific task that does not require a high-level understanding of language is becoming a possibility. The primary remaining issue for the realization of human-level AI is the realization of general intelligence capable of solving flexible problems by combining highly reusable knowledge. Therefore, this research paper explores the possibility of approaching artificial general intelligence with such abilities based on mesoscopic connectome.

Learning Visually Guided Risk-Aware Reaching on a Robot Controlled by a GPU Spiking Neural Network

Terence Sanger[1]
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Abstract

Risk-aware control is a new type of robust nonlinear stochastic controller in which state variables are represented by time-varying probability densities and the desired trajectory is replaced by a cost function that specifies both the goals of movement and the potential risks associated with deviations. Efficient implementation is possible using the theory of Stochastic Dynamic Operators (SDO), because for most physical systems the SDO operators are near-diagonal and can thus be implemented using distributed computation. I show such an implementation using 4.3million spiking neurons simulated in real-time on a GPU. I demonstrate successful control of a commercial desktop robot for a visually-guided reaching task, and I show that the operators can be learned during repetitive practice using a recursive learning rule.

Regularization Methods for the Restricted Bayesian Network BESOM

Yuuji Ichisugi[1], Takashi Sano[1]
[1]AIST

Abstract

We describe a method of regularization for the restricted Bayesian network BESOM, which possesses a network structure similar to that of Deep Learning. Two types of penalties are introduced to avoid overfitting and local minimum problems. The win-rate penalty ensures that each value in the nodes is used evenly; the lateral-inhibition penalty ensures that the nodes in the same layer are independent. Bayesian networks with these prior distributions can be converted into equivalent Bayesian networks without prior distributions, then the EM algorithm becomes easy to be executed.

Representation of Relations by Planes in Neural Network Language Model

Takuma Ebisu[1], Ryutaro Ichise[2]
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Abstract

Whole brain architecture (WBA) which uses neural networks to imitate a human brain is attracting increased attention as a promising way to achieve artificial general intelligence, and distributed vector representations of words is becoming recognized as the best way to connect neural networks and knowledge. Distributed representations of words have played a wide range of roles in natural language processing, and they have become increasingly important because of their ability to capture a large amount of syntactic and lexical meanings or relationships. Relation vectors are used to represent relations between words, but this approach has some problems; some relations cannot be easily defined, for example, sibling relations, parent-child relations, and many-to-one relations. To deal with these problems, we have created a novel way of representing relations: we represent relations by planes instead of by vectors, and this increases by more than 10% the accuracy of predicting the relation.

Modeling of emotion system as a value calculation system

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Abstract

Emotion is a very popular but not well-known phenomenon of animals. Human emotion / feeling is more complex including the emotion features and the intelligent features. Though there are many researches on emotion / feeling, its computational role on self-maintenance is not known well. But it must be important because most of animals look to have similar emotion and there must be a reason for its similarity. Therefore, in this paper, we discuss on a possible component of emotion system, compare their computational model, and propose a possible hypothesis that the emotion is a system of value calculation for a decision making. For a discussion, we show a possible computational model of feeling system in brain.

MonPM1-4 Neurodynamics 1

Modeling Attention-Induced Reduction of Spike Synchrony in the Visual Cortex

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Abstract

The mean firing rate of a border-ownership selective (BOS) neuron encodes where a foreground figure relative to its classical receptive field. Physiological experiments have indicated that top-down attention increases firing rates and decreases spike synchrony between them. To elucidate mechanisms of attention modulation on rates and synchrony of BOS neurons, we developed a spiking neuron network model: BOS neurons receive synaptic input which reflects visual input. The synaptic input strength is modulated multiplicatively by the activity of Grouping neurons whose activity represents the object's location and mediates top-down attentional projection to BOS neurons. Model simulations agree with experimental findings, showing that attention to an object increases the rates of BOS neurons representing it while decreasing spike synchrony between pairs of such neurons. Our results suggest that top-down attention multiplicatively emphasizes synaptic current due to bottom-up visual inputs.

A Robust TOA Source Localization Algorithm based on LPNN

Chi Sing Leung[1], Hao Wang[1], Ruibin Feng[1]
[1]City University of Hong Kong

Abstract

One of the traditional models for finding the location of a mobile source is the time-of-arrival (TOA). It usually assumes that the measurement noise follow the Gaussian distribution. However, in practical, outliers are difficult to be avoided. This paper proposes an l_1-norm based objective function for estimating the position of a mobile source. Afterwards, we utilize the Lagrange programming neural network (LPNN) framework for the position estimation. As the framework requires that its objective function and constraints should be twice differentiable, we introduce an approximation for the l_1-norm term in our LPNN formulation. From the simulation result, our proposed algorithm has very good robustness against outliers.

Reward-Based Learning of a Memory-Required Task based on the Internal Dynamics of a Chaotic Neural Network

Toshitaka Matsuki[1], Katsunari Shibata[1]
[1]Oita University

Abstract

We have expected that dynamic higher functions such as ”thinking” emerge in the framework of reinforcement learning(RL) using a chaotic Neural Network(NN). In this frame, the chaotic internal dynamics is used also for exploration and that eliminates the necessity of giving external exploration noises. A special RL method for this framework has been proposed in which ”traces” were introduced. On the other hand, reservoir computing has shown its excellent ability in learning dynamic patterns. Hoerzer et al. showed that the learning can be done by giving rewards and exploration noises instead of explicit teacher signals. In this paper, aiming to introduce the learning ability into our new RL framework, it was shown that the memory-required task in the work of Hoerzer et al. could be learned without giving exploration noises by utilizing the chaotic internal dynamics while the exploration level was adjusted flexibly and autonomously. The task could be learned also using ”traces”.

Roles of Gap Junctions in Organizing Traveling Waves in a Hippocampal CA3 Network Model

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Abstract

Directional traveling waves are organized in a hippocampal CA3 recurrent network model composed of biophysical pyramidal cells and inhibitory interneurons with gap junctions. The network spontaneously organizes neuronal activities traveling in a particular direction and the organized traveling waves are modified by repetitive local inputs. We found that the distributions of inter-spike intervals (ISIs) of pyramidal cells and interneurons are involved with spontaneous traveling waves that can be modified by local stimulation. Similar ISI distributions emerge in a network that has no gap junctions, but strong mutual connections between pyramidal cells and interneurons. These results suggest that interaction between interneurons through gap junctions contributes to enhancing the inhibition of pyramidal cells for organizing traveling waves.

Towards Robustness to Fluctuated Perceptual Patterns by a Deterministic Predictive Coding Model in a Task of Imitative Synchronization with Human Movement Patterns

Ahmadreza Ahmadi[1], Jun Tani[1]
[1]KAIST

Abstract

The current paper presents how performance of a particular deterministic dynamical neural network model in predictive coding scheme differ when it is trained for a set of prototypical movement patterns using their modulated teaching samples from when it is trained using unmodulated teaching samples. Multiple timescale neural network (MTRNN) trained with or without modulated patterns was applied in a simple numerical experiment for a task of imitative synchronization by inferencing the internal states by the error regression, and the results suggest that the scheme of training with modulated patterns can outperform the scheme of training without them. In our second experiment, our network was tested with naturally fluctuated movement patterns in an imitative interaction between a robot and different human subjects, and the results showed that a network trained with fluctuated patterns could achieve generalization in learning, and mutual imitation by synchronization was obtained.

MonPM1-5 Bioinformatics

Clustering-based Weighted Extreme Learning Machine for Classification in Drug Discovery Process

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Abstract

Extreme Learning Machine (ELM) is a universal approximation method that is extremely fast and easy to implement, but the weights of the model are normally randomly selected so they can lead to poor prediction performance. In this work, we applied Weighted Similarity Extreme Learning Machine in combination with Jaccard/Tanimoto (WELM-JT) and cluster analysis (namely, k-means clustering and Support Vector Clustering) on similarity and distance measures (i.e., Jaccard/Tanimoto and Euclidean). The proposed method was experimented on one of the most challenging datasets named Maximum Unbiased Validation (MUV) dataset with 4 different types of fingerprints. The experimental results show that WELM-JT in combination with k-means-ED gave the best performance. It retrieved the highest number of active molecules and used the lowest number of nodes. Meanwhile, WELM-JT with k-means-JT and ECFP 6 encoding proved to be a robust contender for most of the activity classes.

Metabolite Named Entity Recognition: A Hybrid Approach

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Abstract

Since labor intensive and time consuming issue, manual curation in metabolic information extraction currently was replaced by text mining (TM). While TM in metabolic domain has been attempted previously, it is still challenging due to variety of specific terms and their meanings in different contexts. Named Entity Recognition (NER) generally used to identify interested keyword (protein and metabolite terms) in sentence, this preliminary task therefore highly influences the performance of metabolic TM framework. Conditional Random Fields (CRFs) NER has been actively used during a last decade, because it explicitly outperforms other approaches. However, an efficient CRFs-based NER depends purely on a quality of corpus which is a nontrivial task to produce. This paper introduced a hybrid solution which combines CRFs-based NER, dictionary usage, and complementary modules (constructed from existing corpus) in order to improve the performance of metabolic NER and another similar domain.

Improving strategy for discovering interacting genetic variants in association studies

Suneetha Uppu[1], Aneesh Krishna[1]
[1]Curtin University

Abstract

Revealing the underlying complex architecture of human diseases has received considerable attention since the exploration of genotype-phenotype relationships in genetic epidemiology. Identification of these relationships becomes more challenging due to multiple factors acting together or independently. A deep neural network was trained in the previous work to identify two-locus interacting single nucleotide polymorphisms (SNPs) related to a complex disease. However, the performance of the proposed method in the higher-order interactions was unknown. The objective of this study is to validate the model for the higher-order interactions in high-dimensional data. The proposed method is further extended for unsupervised learning. A number of experiments were performed on the simulated datasets under same scenarios as well as a real dataset to show the performance of the extended model. On an average, the results illustrate improved performance over the previous methods.

Improving Dependency Parsing on Clinical Text with Syntactic Clusters from Web Text

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Abstract

Treebanks for clinical text are not enough for supervised dependency parsing no matter in their scale or diversity, leading to still unsatisfactory performance. Many unlabeled text from web can make up for the scarceness of treebanks in some extent. In this paper, we propose to gain syntactic knowledge from web text as syntactic cluster features to improve dependency parsing on clinical text. We parse the web text and compute the distributed representation of each words base on their contexts in dependency trees. Then we cluster words according to their distributed representation, and use these syntactic cluster features to solve the data sparseness problem. Experiments on Genia show that syntactic cluster features improve the LAS (Labled Attachment Score) of dependency parser on clinical text by 1.62%. And when we use syntactic clusters combining with brown clusters, the performance gains by 1.93

Exploiting Temporal Genetic Correlations for Enhancing Regulatory Network Optimization

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Abstract

Inferring gene regulatory networks (GRN) from microarray gene expression data is a highly challenging problem in computational and systems biology. To make GRN reconstruction process more accurate and faster, in this paper, we develop a technique to identify the gene having maximum in-degree in the network using the temporal correlation of gene expression profiles. The in-degree of the identified gene is estimated applying evolutionary optimization algorithm on a decoupled S-system GRN model. The value of in-degree thus obtained is set as the maximum in-degree for inference of the regulations in other genes. The simulations are carried out on in silico networks of small and medium sizes.The results show that both the prediction accuracy in terms of well known performance metrics and the computational time of the optimization process have been improved when compared with the traditional S-system model based inference.

Monday PM2 (abstract)

MonPM2-1 Bio-Inspired / Energy-Efficient Information Processing: Theory, Systems, Devices 2

FPGA Implementation of Autoencoders having Shared Synapse Architecture

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Abstract
Implementation of Deep neural networks (DNNs) into embedded systems is required to realize artificial intelligence on robots and automobiles. A field-programmable gate array (FPGA) is a suitable device for embedded systems because of its low power consumption, high speed processing, and reconfigurability. Autoencoders (AEs) are key parts of DNNs and comprise an input, a hidden, and an output layers. We propose a novel hardware implementation of AEs having a shared synapse architecture. In the proposed architecture, the value of each weight is shared in two interlayers between input-hidden layer and hidden-output layer. This architecture saves the limited resources of an FPGA, allowing a reduction of the synapse modules by half. Experimental results show that the proposed design can reconstruct input data and be stacked. Compared with the related works, the proposed design is a register transfer level description, synthesizable, and estimated to decrease total processing time.

Time-domain Weighted-sum Calculation for Ultimately Low Power VLSI Neural Networks

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Abstract
Time-domain weighted-sum operation based on a spiking neuron model is discussed and evaluated from a VLSI implementation point of view. This calculation model is useful for extremely low-power operation because transition states in resistance and capacitance (RC) circuits can be used. Weighted summation is achieved with energy dissipation on the order of 1 fJ using the current CMOS VLSI technology if 1 G ohm order resistance can be used, where the number of inputs can be more than a hundred. This amount of energy is several orders of magnitude lower than that in conventional digital processors. In this paper, we show the software simulation results that verify the proposed calculation method for a 500-input neuron in a three-layer perceptron for digit character recognition.

A CMOS Unit Circuit Using Subthreshold Operation of MOSFETs for Chaotic Boltzmann Machines

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Abstract

Boltzmann machines are a useful model for deep neural networks in artificial intelligence, but in their software or hardware implementation, they require random number generation for stochastic operation, which consumes considerable computational resources and power. Chaotic Boltzmann machines (CBMs) have been proposed as a model using chaotic dynamics instead of stochastic operation. They require no random number generation, and are suitable for analog VLSI implementation. In this paper, we describe software simulation results for CBM operation, and propose a CMOS circuit of CBMs using the subthreshold operation of MOSFETs.

An attempt of speed-up of Neurocommunicator, an EEG-based communication aid.

Ryohei Hasegawa[1]
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Abstract

We have been developing the “Neurocommunicator”, an EEG-based communication aid for people with severe motor disabilities. This system analyzes an event-related potential (ERP) to the sequentially flashed pictograms to indicate a desired message, and predicts the user ’ s choice in the brain. To speed-up of this decoding process, we introduced a special algorithm, the Virtual Decision Function (VDF), which was originally designed to reflect the continuous progress of binary decisions on a single trial basis of neuronal activities in the primate brain. We applied the VDF to the EEG signals, and succeeded in faster decoding of the target.

Computational Performance of Echo State Networks with Dynamic Synapses

Ryota Mori[1], Gouhei Tanaka[1], Ryosho Nakane[1], Akira Hirose[1], Kazuyuki Aihara[1]
[1]The University of Tokyo

Abstract

The echo state network is a framework for temporal data processing, such as recognition, identification, classification and prediction. The echo state network generates spatiotemporal dynamics reflecting the history of an input sequence in the dynamical reservoir and constructs mapping from the input sequence to the output one in the readout. In the conventional dynamical reservoir consisting of sparsely connected neuron units, more neurons are required to create more time delay. In this study, we introduce the dynamic synapses into the dynamical reservoir for controlling the nonlinearity and the time constant. We apply the echo state network with dynamic synapses to several benchmark tasks. The results show that the dynamic synapses are effective for improving the performance in time series prediction tasks.

MonPM2-3 Whole Brain Architecture: Toward a Human Like General Purpose Artificial Intelligence 2

The Whole Brain Architecture Initiative

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Abstract

The Whole Brain Architecture Initiative is a non-profit organization (NPO) founded in Japan in August 2015, whose purpose is to support research activities aiming for realizing artificial intelligence with human-like cognitive capabilities by studying the entire architecture of the brain. It performs educational activities such as holding seminars and hackathons and compiling educational materials, as well as R&D activities such as developing software platforms to support research in artificial intelligence and facilitating communication among research communities.

Neural Network for Quantum Brain Dynamics: 4D $CP^1 + U(1)$ Gauge Theory on Lattice and its Phase Structure

Shinya Sakane[1], Tetsuo Matsui[1]
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Abstract

We consider a system of two-level quantum quasi-spins and gauge bosons put on a 3+ $1D$ lattice. As a model of neural network of the brain functions, these spins describe neurons quantum-mechanically, and the gauge bosons describes weights of synaptic connections. It is a generalization of the Hopfield model to a quantum network with dynamical synaptic weights. At the microscopic level, this system becomes a model of quantum brain dynamics proposed by Umezawa et al., where spins and gauge field describe water molecules and photons, respectively. We calculate the phase diagram of this system under quantum and thermal fluctuations, and find thatthere are three phases; confinement, Coulomb, and Higgs phases. Each phase is classified according to the ability to learn patterns and recall them. By comparing the phase diagram with that of classical networks, we discuss the effect of quantum fluctuations and thermal fluctuations (noises in signal propagations) on the brain functions.

BriCA: A Modular Software Platform for Whole Brain Architecture

Kotone Itaya[1], Koichi Takahashi[2], Masayoshi Nakamura[3], Moriyoshi Koizumi[4], Naoya Arakawa[5], Masaru Tomita[1], Hiroshi Yamakawa[3]
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Abstract

Brain-inspired Computing Architecture (BriCA) is a generic software platform for modular composition of machine learning algorithms. It can combine and schedule an arbitrary number of machine learning components in a brain-inspired fashion to construct higher level structures such as cognitive architectures. We would like to report and discuss the core concepts of BriCA version 1 and prospects toward future development.

An Implementation of Working Memory Using Stacked Half Restricted Boltzmann Machine: Toward to Restricted Boltzmann Machine-Based Cognitive Architecture

Masahiko Osawa[1], Hiroshi Yamakawa[1], Michita Imai[1]
[1]Keio University / Dwango AI Laboratory

Abstract

Cognition, judgment, action, and expression acquisition have been widely treated in studies on recently developed deep learning. However, although each study has been specialised for specific tasks and goals, cognitive architecture that integrates many different functions remains necessary for the realisation of artificial general intelligence. To that end, a cognitive architecture fully described with restricted Boltzmann machines (RBMs) in a unified way are promising, and we have begun to implement various cognitive functions with an RBM base. In this paper, we propose new stacked half RBMs (SHRBMs) made from layered half RBMs (HRBMs) that handle working memory. We show that an ability to solve maze problems that requires working memory improves drastically when SHRBMs in the agent ' s judgment area are used instead of HRBMs or other RBM-based models.

A Game-Engine-Based Learning Environment Framework for Artificial General Intelligence - Toward Democratic AGI -

Masayoshi Nakamura[1], Hiroshi Yamakawa[1]
[1]DWANGO Co.

Abstract

Artificial General Intelligence (AGI) refers to machine intelligence that can effectively conduct variety of human tasks. Therefore AGI research requires multivariate and realistic learning environments. In recent years, game engines capable of constructing highly realistic 3D virtual worlds have also become available at low cost. In accordance with these changes, we developed the "Life in Silico" (LIS) framework, which provides virtual agents with learning algorithms and their learning environments with game engine. This should in turn allow for easier and more flexible AGI research. Furthermore, non-experts will be able to play with the framework, which would enable them to research as their hobby. If AGI research becomes popular in this manner, we may see a sudden acceleration towards the "Democratization of AGI"

MonPM2-4 Neurodynamics 2

Image Segmentation using Graph Cuts based on Maximum-Flow Neural Network

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Abstract
Graph Cuts (GC) has became useful methods for the image segmentation. In GC, the segmentation process is performed using the min-cut algorithm. For GC, the most typical min-cut algorithm is the B-K algorithm. While the B-K algorithm is very efficient, it is still far from real-time processing. In addition, the B-K algorithm gives only the single min-cut even if the graph has multiple min-cuts. Therefore, the conventional GC has a possibility that a better min-cut is frequently overlooked. In this research, we propose a new image segmentation technique using GC based on the maximum-flow neural network (MF-NN). The MF-NN is our proposed min-cut algorithm based on a nonlinear resistive circuit analysis. In our method, image segmentation problems can be solved as the circuits analysis. In addition, the MF-NN has an unique feature that multiple min-cuts can be find easily. That is, it can be expected that our proposed method can obtain more accurate results than the conventional GC.

Joint Routing and Bitrate Adjustment for DASH Video via neuro-dynamic programming in SDN

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Abstract

This paper considers the joint routing and bitrate adjustment optimization for DASH (Dynamic Adaptive Streaming over HTTP) video service using neuro-dynamic programming (NDP) in software-defined networking (SDN). We design an open optimization architecture based on OpenFlow based SDN. Following this architecture, we formulate the joint routing and bitrate adjustment problem as a Markov Decision Process (MDP) for maximizing the average reward. In order to solve the curses of dimensionality, we employ neuro-dynamic programming method to conceive an online learning framework and develop a NDP based joint routing and bitrate adjustment algorithm for DASH video service. At last, an emulation platform based on POX and Mininet is constructed to verify the performance of the proposed algorithm. The experimental results indicate our algorithm has more excellent performance compared with OSPF based algorithm.

Stability of Periodic Orbits in Dynamic Binary Neural Networks with Ternary Connection

Kazuma Makita[1], Ryuji Sato[1], Toshimichi Saito[1]
[1]Hosei University

Abstract

This paper studies dynamic binary neural networks that can generate various periodic orbits. The networks is characterized by signum activation function and ternary connection parameters. In order to analyze the dynamics, we present two simple feature quantities that characterize plentifulness of transient phenomena and superstability of the periodic orbits. Calculating the feature quantities for a class of networks, we investigate transient and superstability of the periodic orbits.

Evaluation of Chaotic Resonance by Lyapunov Exponent in Attractor-Merging Type Systems

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[1]Fukui University of Technology [2]University of Hyogo

Abstract

Fluctuating activities in the deterministic chaos cause a phenomenon that is similar to stochastic resonance (SR) whereby the presence of noise helps a non-linear system to amplify a weak (under-barrier) signal. In this phenomenon, called chaotic resonance (CR), the system responds to the weak input signal by the effect of intrinsic chaotic activities under the condition where no additive noise exists. Recently, we have revealed that the signal response of the CR in the spiking neuron model has an unimodal maximum with respect to the degree of stability for chaotic orbits quantified by maximum Lyapunov exponent. In response to this situation, in this study, focusing on CR in the systems with chaos-chaos intermittency, we examine the signal response in a cubic map and a chaotic neural network embedded two symmetric patterns by cross correlation and Lyapunov exponent (or maximum Lyapunov exponent).

MonPM2-5 Biomedical engineering

Sleep Stage Prediction Using Respiration and Body-Movement Based on Probabilistic Classifier

Hirotaka Kaji[1], Hisashi Iizuka[1], Mitsuo Hayashi[2]
[1]Toyota Motor Corp. [2]Hiroshima University

Abstract

In this paper, a sleep stage prediction method using respiration and body-movement based on probabilistic classifier is proposed. A pressure sensor is employed to capture respiratory signal. We propose to use least square probabilistic classifier (LSPC), a computationally effective probabilistic classifier, for four-class sleep stage classification (wakefulness, rapid-eye movement sleep, light sleep, deep sleep). Thanks to output of posterior probability of each class by LSPC, we can directly handle the confidence of predicted sleep stages. In addition, we introduce a method to handle class imbalance problem which arises in sleep data collection. The experimental results demonstrate the effectiveness of sleep stage prediction by LSPC.

Removing Ring Artifacts in CBCT Images Using Smoothing based on Relative Total Variation

Qirun Huo[1], Jianwu Li[1], Yao Lu[1], Ziye Yan[2]
[1]Beijing Institute of Technology [2]China Resource Wandong Medical Equipment

Abstract

Removing ring artifacts in Cone Beam Computed Tomography (CBCT) images without impairing the image quality is critical for the application of CBCT. In this paper, we propose a novel method for the removal of ring artifacts in CBCT Images using an image smoothing based on relative total variation (RTV). After transforming the CBCT image into polar coordinates, we introduce a single-direction smoothing to separate the small scale textures, which include the artifacts, from the image structures. Then the artifact template is generated by median value extraction. Finally, the artifact template is transformed back into Cartesian coordinates and is subtracted from the original CBCT image. Experiments on different CBCT images show that the proposed method can obtain satisfactory results.

Proposal of a human heartbeat detection/monitoring system employing chirp Z-transform and time-sequential neural prediction

Ayse Bezer[1], Akira Hirose[2]
[1]University of Tokyo

Abstract

Heartbeat signal detection and/or monitoring is very important in the rescue of human beings existing under debris after disasters such as earthquakes as well as in the monitoring of patients in hospital. In this paper, we propose a human heartbeat detection/monitoring system employing chirp Z-transform and a time-sequential prediction neural network. The system is an adaptive radar using 2.5 GHz continuous microwave. The CZT realizes high resolution peak search in the frequency domain. We use a neural network to track adaptively the heartbeat signal which often has frequency fluctuation. The network learns the time-sequential peak frequency online in parallel to the detection and tracking. Even when the heartbeat frequency drifts, the network finds and tracks the heartbeat. Experiments demonstrate that the proposed system has high effectiveness in distinction between person-exist and person-non-exist observations, resulting in successful detection of persons.

Fast Dual-Tree Wavelet Composite Splitting Algorithms for Compressed Sensing MRI

Jianwu Li[1], Jinpeng Zhou[1], Qiang Tu[1], Javaria Ikram[1], Zhengchao Dong[2]
[1]Beijing Institute of Technology [2]Columbia University

Abstract

We presented new reconstruction algorithms for compressed sensing magnetic resonance imaging (CS-MRI) based on the combination of the fast composite splitting algorithm (FCSA) and complex dual-tree wavelet transform (DT-CWT) and on the combination of FCSA and double density dual-tree wavelet transform (DDDT-DWT), respectively. We applied the bivariate thresholding to these two combinations. The proposed methods not only inherit the effectiveness and fast convergence of FCSA but also improve the sparse representation of both point-like and curve-like features. Experimental results validate the effectiveness and efficiency of the proposed methods.

Implementation of a modular Growing When Required neural gas architecture for recognition of falls

Frederico Belmonte Klein[1], Karla Stepanova[2], Angelo Cangelosi[1]
[1]Plymouth University [2]FEL CTU in Prague

Abstract

In this paper we aim for the replication of a state of the art architecture for recognition of human actions using skeleton poses obtained from a depth sensor. We review the usefulness of accurate human action recognition in the field of robotic elderly care, focusing on fall detection. We attempt fall recognition using a chained Growing When Required neural gas classifier that is fed only skeleton joints data. We test this architecture against Recurrent SOMs (RSOMs) to classify the TST Fall detection database ver. 2, a specialised dataset for fall sequences. We also introduce a simplified mathematical model of falls for easier and faster bench-testing of classification algorithms for fall detection. The outcome of classifying falls from our mathematical model was successful with an accuracy of $97.12 \pm 1.65\%$ and from the TST Fall detection database ver. 2 with an accuracy of 90.2 ± 2.68 % when a filter was added.

October 18 (Tuesday)

Plenary 2 Clock Tower Centennial Hall 9:30 – 10:20
chair: Kenji Doya

Recent Developments in Online Learning for Big Data Applications
Irwin King
Department of Computer Science & Engineering. The Chinese University of Hong Kong

TueAM-1 **Data Mining and Cybersecurity Workshop 1**
Chair: Tao Ban, Paul Pang, Kaizhu Huang
Room: International Conference Hall I

10:20 - 11:00
Invited talk
Cyber-security Information Sharing with Data Correlation
Koji Nakao[1,2]
[1]Distinguished Researcher, Cybersecurity Research Institute National Institute of Information and Communications Technology,
[2]Information Security advisor, KDDI

11:00 - 11:20
Botnet Detection Using Graphical Lasso with Graph Density
Chansu Han[1] Kento Kono[1] Shoma Tanaka[1] Masanori Kawakita[1] Jun'ichi Takeuchi[1]
[1]Graduate School of ISEE, Kyushu University

11:20 - 11:40
The Usability of Metadata for Android Application Analysis
Takeshi Takahashi[1], Tao Ban[1], Chin-Wei Tien[2], Chih-Hung Lin[2], Daisuke Inoue[1], Koji Nakao[1]
[1]National Institute of Information and Communications Technology, [2]Institute for Information Industry

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11:40 - 12:00
Preserving Privacy of Agents in Reinforcement Learning for Distributed Cognitive Radio Networks
Geong Sen Poh[1], Kok-Lim Alvin Yau[2]
[1]MIMOS Berhad [2]Sunway University

TueAM-3 **Neuromorphic Hardware**
Chair: Mutsumi Kimura, Toshimichi Saito
Room: International Conference Hall III

10:40	-	11:00	Simplification of Processing Elements in Cellular Neural Networks - Working Confirmation using Circuit Simulation - Mutsumi Kimura[1], Nao Nakamura[1], Tomoharu Yokoyama[1], Tokiyoshi Matsuda[1], Tomoya Kameda[2], Yasuhiko Nakashima[2] [1]Ryukoku University [2]Nara Institite of Science and Technology
11:00	-	11:20	Pattern and frequency generation using an opto-electronic reservoir computer with output feedback Piotr Antonik[1], Michiel Hermans[1], Marc Haelterman[1], Serge Massar[1] [1]Université Libre de Bruxelles
11:20	-	11:40	A retino-morphic hardware system simulating the graded and action potentials in retinal neuronal layers Yuki Hayashida[1], Yuka Kudo[1], Ryoya Ishida[1], Hirotsugu Okuno[2], Tetsuya Yagi[1] [1]Osaka University [2]Osaka Institute of Technology
11:40	-	12:00	Stability Analysis of Periodic Orbits in Digital Spiking Neurons Tomoki Hamaguchi[1], Kei Yamaoka[1], Toshimichi Saito[1] [1]Hosei University
12:00	-	12:20	Letter Reprodution Simulator for Hardware Design of Cellular Neural Network using Thin-Film Synapses - Crosspoint-type Synapses and Simulation Algorithm - Tomoya Kameda[1] [1]Nara Institite of Science and Technology

TueAM-4 **Machine Learning 1**
Chair: Daniel Berrar, Kazuyuki Hara
Room: Conference Room III

10:40	-	11:00	Non-parametric e-mixture of density functions Hideitsu Hino[1], Ken Takano[2], Shotaro Akaho[3], Noboru Murata[2] [1]University of Tsukuba [2]Waseda University [3]AIST
11:00	-	11:20	An Entropy Estimator Based on Polynomial Regression with Poisson Error Structure Hideitsu Hino[1], Shotaro Akaho[2], Noboru Murata[3] [1]University of Tsukuba [2]AIST [3]Waseda University
11:20	-	11:40	A problem in model selection of LASSO and introduction of scaling Katsuyuki Hagiwara[1] [1]Mie University
11:40	-	12:00	A Theoretical Analysis of Semi-Supervised Learning Takashi Fujii[1], Hidetaka Ito[1], Seiji Miyoshi[1] [1]Kansai University
12:00	-	12:20	Evolutionary multi-task learning for modular training of feed-forward neural networks Rohitash Chandra[1] Abhishek Gupta[1] Yew Soon Ong[1] ChiKeong Goh[1] [1]Rolls Royce @NTU Corporate Lab, Nanyang Technological University, Nanyang View, Singapore

TueAM-2

TueAM-4 **Sensory Perception**

Chair: Kazuhiro Sakamoto, Yoshiki Kashimori

Room: Conference Room IV

10:40	-	11:00	An analysis of current source density profiles activated by local stimulation in the mouse auditory cortex in vitro Daiki Yamamura[1], Ayaka Sano[1], Takashi Tateno[1] [1]Hokkaido University
11:00	-	11:20	Differential Effect of Two Types of Anesthesia on Sound-driven Oscillations in the Rat Primary Auditory Cortex Hisayuki Osanai[1] Takashi Tateno[1] [1]Hokkaido University
11:20	-	11:40	Developing an Implantable Micro Magnetic Stimulation System to Induce Neural Activity in vivo Shunsuke Minusa[1], Takashi Tateno[1] [1]Hokkaido University
11:40	-	12:00	"Figure" Salience as a Meta-Rule for Rule Dynamics in Visual Perception Kazuhiro Sakamoto[1] [1]Tohoku Medical and Pharmaceutical University
12:00	-	12:20	A neural network model for retaining object information required in a categorization task Yuki Abe[1] Kazuhisa Fujita[2] Yoshiki Kashimori[1] [1]University of Electro-Communications [2]Tsuyama National College of Technology

TuePM1-1 **Data Mining and Cybersecurity Workshop 2**
Chair: Tao Ban, Paul Pang,Kaizhu Huang
Room: International Conference Hall I

13:00	-	13:40	Invited talk The emerging era of Cognitive Big Data Informatics: Some Case Studies and future Directions Amir Hussain[1,2] [1]Director, Cognitive Big Data Informatics (CogBID) Laboratory, [2]Division of Computing Science and Mathematics, University of Stirling, Stirling FK9 4LA, UK
13:40	-	14:00	winner presentation
14:00	-	14:20	Campus Wireless LAN Usage Analysis and Its Applications Kensuke Miyashita[1], Yuki Maruno[1] [1]Kyoto Women's University
14:20	-	14:40	MDL Criterion for NMF with Application to Botnet Detection Shoma Tanaka[1], Yuki Kawamura[2], Masanori Kawakita[1], Noboru Murata[3], Jun'ichi Takeuchi[1] [1]Graduate School of ISEE Kyushu University [2]Nihon Unisys, Ltd. [3]Waseda University

TuePM1-3 **Pattern Recognition 1**
Chair: Tong Zhiqiang
Room: International Conference Hall III

13:20	-	13:40	Weighted Discriminant Analysis and Kernel Ridge Regression Metric Learning for Face Verification Siew-Chin Chong[1], Andrew Jin Teoh[2], Thian-Song Ong[1] [1]Multimedia University [2]Yonsei University
13:40	-	14:00	An Incremental One Class Learning Framework for Large Scale Data Qilin Deng[1] Yi Yang[1] Furao Shen[1] Chaomin Luo[2] Jinxi Zhao[1] [1]Department of Computer Science and Technology, Nanjing University [2]Department of Electrical and Computer Engineering, University of Detroit Mercy
14:00	-	14:20	Gesture Spotting by Using Vector Distance of Self-Organizing Map Yuta Ichikawa[1], Shuji Tashiro[1], Hidetaka Ito[1], Hiroomi Hikawa[1] [1]Kansai University
14:20	-	14:40	Cross-Database Facial Expression Recognition via Unsupervised Domain Adaptive Dictionary Learning Keyu Yan[1], Wenming Zheng[1], Zhen Cui[1], Yuan Zong[1] [1]Southeast University
14:40	-	15:00	Adaptive Multi-View Semi-Supervised Nonnegative Matrix Factorization Jing Wang[1], Xiao Wang[2], Feng Tian[1], Chang Hong Liu[1], Hongchuan Yu[1], Yanbei Liu[3] [1]Bournemouth University [2]Tsinghua University [3]Tianjin University

TuePM1-4 **Machine Learning 2**
Chair: Hiroaki Sasaki, Seiji Miyoshi
Room: Conference Room III

13:20	-	13:40	On the Noise Resilience of Ranking Measures Daniel Berrar[1] [1]Shibaura Institute of Technology
13:40	-	14:00	BPSpike II : A new backpropagation learning algorithm for spiking neural networks Satoshi Matsuda[1] [1]Nihon University
14:00	-	14:20	Group dropout inspired by ensemble learning Kazuyuki Hara[1] Daisuke Saitoh[2] Tasuku Kondo[2] Satoshi Suzuki[3] Hayaru Shouno[3] [1]College of Industrial Technology, Nihon University, [2]Graduate School of Industrial Technology, Nihon Univeristy [3]Graduate School of Informatics and Engineering, The University of Electro-Communications
14:20	-	14:40	Audio Generation From Scene Considering Its Emotion Aspect Gwenaelle Cunha Sergio[1], Minho Lee[1] [1]Kyungpook National University
14:40	-	15:00	Semi Supervised Autoencoder Anupriya Gogna[1] Angshul Majumdar[1] [1]Indraprasatha Institute of Information Technology-Delhi

TuePM1-5			**Social Networks**
Chair:	Ma Huifang, Marcos Quiles		
Room:	Conference Room IV		
13:20	-	13:40	Influence Spread Evaluation and Propagation Rebuilding Qianwen Zhang[1], Cheng-Chao Huang[1], Jinkui Xie[1] [1]East China Normal University
13:40	-	14:00	A Tag Probability Correlation-based Microblog Recommendation Method Zhang Di[1], Ma Huifang[1] [1]Northwest Normal University
14:00	-	14:20	A New Model and Heuristic for Infection Minimization by Cutting Relationships Rafael Santiago[1], Wellington Zunino[1], Fernando Concatto[1], Luís Lamb[2] [1]Universidade do Vale do Itajaí [2]Federal University of Rio Grande do Sul
14:20	-	14:40	Sentiment and Behavior Analysis of one Controversial American Individual on Twitter J. Eliakin M. de Oliveira[1], Moshe Cotacallapa[1], Wilson Seron[2], Rafael Santos[1], Marcos Quiles[2] [1]INPE [2]UNIFESP

TuePM2-1 **Data Mining and Cybersecurity Workshop 3**
Chair: Tao Ban, Paul Pang, Kaizhu Huang
Room: International Conference Hall I

15:20	-	15:40	A Brief Review of Spin-glass Applications in Unsupervised and Semi-supervised Learning Lei Zhu[1], Kazushi Ikeda[2], Paul Pang[1], Ruibin Zhang[1], Abdolhossein Sarrafzadeh[1] [1]Unitec Institute of Technology, New Zealand [2]Nara Institute of Science and Technology
15:40	-	16:00	Learning Latent Features with Infinite Non-negative Binary Matrix Tri-factorization Xi Yang[1] Kaizhu Huang[1] Rui Zhang[1] Amir Hussain[2] [1]Xi'an Jiaotong-Liverpool University [2]University of Stirling
16:00	-	16:20	A Novel Manifold Regularized Online Semi-Supervised Learning Algorithm Shuguang Ding[1], Xuanyang Xi[2], Zhiyong Liu[2], Hong Qiao[2], Bo Zhang[3] [1]Institute of Applied Mathematics, AMSS, Chinese Academy of Sciences [2]State Key Lab of Management and Control for Complex Systems, Institute of Automation, Chinese Academy of Sciences [3]LSEC and Institute of Applied Mathematics, AMSS, Chinese Academy of Sciences
16:20	-	16:40	Learning from Few Samples with Memory Network Shufei Zhang[1], Kaizhu Huang[1] [1]Xi'an Jiaotong-Liverpool Univ.
16:40	-	17:00	Generalized Compatible Function Approximation for Policy Gradient Search Yiming Peng[1], Gang Chen[1], Mengjie Zhang[1], Paul Pang[2] [1]Victoria University of Wellington [2]Unitec Institute of Technology, New Zealand
17:00	-	17:20	A Combo Object Model for Maritime Boat Ramps Traffic Monitoring Paul pang[1] [1]Unitec Institute of Technology, New Zealand

TuePM2-3 Pattern Recognition 2
Chair: Hiroomi Hikawa, Tong Zhiqiang
Room: International Conference Hall III

15:20	-	15:40	Robust Soft Semi-Supervised Discriminant Projection for Feature Learning Xiaoyu Wang[1], Zhao Zhang[1], Yan Zhang[1] [1]Soochow University
15:40	-	16:00	A Hybrid Pooling Method for Convolutional Neural Networks Tong Zhiqiang[1] Kazuyuki Aihara[1] Gouhei Tanaka[1] [1]The University of Tokyo
16:00	-	16:20	Multi-nation and multi-norm License plates detection in real traffic surveillance environment using Deep Learning Amira Naimi[1] Yousri Kessentini[1] Mohamed Hammami[1] [1]MIRACL
16:20	-	16:40	A study on cluster size sensitivity of fuzzy c-means algorithm variants Laszlo Szilagyi[1], Sandor Miklos Szilagyi[2], Calin Enachescu[2] [1]Sapientia University of Transylvania, Tirgu Mures, Romania [2]Petru Maior University
16:40	-	17:20	Invited talk Statistical mechanics of pre-training and fine tuning in deep learning Masayuki Ohzeki[1] [1]Graduate School of Informatics, Kyoto University.

TuePM2-4 Machine Learning 3
Chair: Hideitsu Hino, Seiji Miyoshi
Room: Conference Room III

15:20	-	15:40	Sampling-based Gradient Regularization for Capturing Long-Term Dependencies in Recurrent Neural Networks Artem Chernodub[1], Dimitri Nowicki[1] [1]Institute of MMS of NAS of Ukraine
15:40	-	16:00	FACE HALLUCINATION USING CORRELATIVE RESIDUE COMPENSATION IN A MODIFIED FEATURE SPACE Javaria Ikram[1], Yao Lu[1], Jianwu Li[1], Hui Nie[1] [1]Beijing Institute of Technology
16:00	-	16:20	Modal Regression via Direct Log-Density Derivative Estimation Hiroaki Sasaki[1], Yurina Ono[2], Masashi Sugiyama[2] [1]Nara Institute of Science and Technology [2]The University of Tokyo
16:20	-	16:40	Simplicial Nonnegative Matrix Tri-Factorization: Fast Guaranteed Parallel Algorithm Duy Khuong Nguyen[1], Dinh Quoc Tran[2], Tu Bao Ho[3] [1]University of Engineering and Technology: VNU [2]The University of North Carolina at Chapel Hill [3]JAIST
16:40	-	17:00	Active Consensus-Based Semi-Supervised Growing Neural Gas Vinicius Maximo[1], Mariá Nascimento[1], Fabricio Breve[2], Marcos Quiles[1] [1]UNIFESP [2]UNESP

Poster1-1 : Applications
Room International Conference Hall II

Data Analysis of Correlation Between Project Popularity and Code Change Frequency
Dabeeruddin Syed[1], Jadran Sessa[1], Andreas Henschel[1], Davor Svetinovic[1]
[1]Masdar Institute of Science and Technology

Hidden space neighbourhood component analysis for cancer classification
Li Zhang[1], Xiaojuan Huang[1], Bangjun Wang[1], Fanzhang Li[1], Zhao Zhang[1]
[1]Soochow University

Prediction of Bank Telemarketing with Co-training of Mixture-of-Experts and MLP
Jae-Min Yu[1], Sung-Bae Cho[1]
[1]Yonsei University

Prioritising Security Tests on Large-Scale and Distributed Software Development Projects by Using Self-Organised Maps
Marcos Alvares[1], Fernando Lima Neto[2], Tshilidzi Marwala[1]
[1]University of Johannesburg [2]University of Pernambuco

Android Malware Detection Method Based on Function Call Graphs
Yuxin Ding[1], Siyi Zhu[1], Xiaoling Xia[1]
[1]Harbin Institute of Technology Shenzhen Graduate School

Proposal of singular-unit restoration by focusing on the spatial continuity of topographical statistics in spectral domain
Kazuhide Ichikawa[1], Akira Hirose[1]
[1]The University of Tokyo

Poster1-2 : Computational & Cognitive Neurosciences
Room International Conference Hall II

The Impact of Adaptive Regularization of the Demand Predictor on A Multistage Supply Chain Simulation
Fumiaki Saitoh[1]
[1]Aoyama Gakuin University

The effect of reward information on perceptual decision making
Devu Mahesan[1], Manisha Chawla[1], Krishna P Miyapuram[1]
[1]Indian Institute of Technology, Gandhinagar, India

Doubting What to Eat: A Computational Model for Food Choice Using Different Valuing Perspectives
Altaf Hussain Abro[1], Jan Treur[1]
[1]VU University, Amsterdam, Netherlands

A Novel Graph Regularized Sparse Linear Discriminant Analysis Model for EEG Emotion Recognition
Yang Li[1], Wenming Zheng[1], Zhen Cui[1], Xiaoyan Zhou[2]
[1]Southeast University [2]Nanjing University of Information Science & Technology

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Information maximization in a feedforward network replicates the stimulus preference of the medial geniculate and the auditory cortex
Takuma Tanaka[1]
[1]Shiga University

A simple visual model accounts for drift illusion and reveals illusory patterns
Daiki Nakamura[1], Shunji Satoh[1]
[1]The University of Electro-Communications

An Internal Model of the Human Hand Affects Recognition of Graspable Tools
Masazumi Katayama[1], Yusuke Akimaru[1]
[1]Department of Human and Artificial Intelligent Systems, Graduate School of Engineering, University of Fukui

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Perceptual Representation of Material Quality — Adaptation to BRDF-morphing Images —
Kouki Kudou[1], Ko Sakai[1]
[1]University of Tsukuba

Rhinal-hippocampal information flow reverses between memory encoding and retrieval

Juergen Fell[1], Tobias Wagner[1], Bernhard Staresina[2], Charan Ranganath[3], Christian Elger[1], Nikolai Axmacher[4]
[1]Dept. of Epileptology, Univ. of Bonn, Germany [2]Dept. of Psychology, Univ. of Birmingham, UK [3]Center for Neuroscience and Dept. of Psychology, Univ. of California, Davis, USA [4]Dept. of Psychology, Ruhr-University Bochum, Germany

GPU-Accelerated Simulations of an Electric Stimulus and Neural Activities in Electrolocation

Kazuhisa Fujita[1], Yoshiki Kashimori[2]
[1]Tsuyama National College of Technology [2]Univ. of Electro-Communications

Analysis of Similarity and Differences in Brain Activities between Perception and Production of Facial Expressions Using EEG Data and the NeuCube Spiking Neural Network Architecture

Hideaki Kawano[1], Akinori Seo[1], Zohreh Gholami Doborjeh[2], Nikola Kasabov[2], Maryam Gholami Doborjeh[2]
[1]Kyushu Institute of Technology [2]Auckland University of Technology

Self and Non-self Discrimination Mechanism Based on Predictive Learning with Estimation of Uncertainty

Ryoichi Nakajo[1], Maasa Takahashi[1], Shingo Murata[1], Hiroaki Arie[1], Tetsuya Ogata[1]
[1]Waseda University

A Framework for Ontology Based Management of Neural Network as a Service

Erich Schikuta[1], Abdelkader Magdy[1], A. Baith Mohamed[2]
[1]University of Vienna [2]Arab Academy for Science and Technology & Maritime Transport, Egypt

Poster1-3 : Theory & Algorithms
Room International Conference Hall II

Modeling the propensity score with statistical learning
Kenshi Uchihashi[1], Atsunori Kanemura[1]
[1]National Institute of Advanced Industrial Science and Technology (AIST)

Analysis of the DNN-kWTA Network Model with Drifts in the Offset Voltages of Threshold Logic Units
Chi Sing Leung[1], Ruibin Feng[1], John Sum[2]
[1]City University of Hong Kong [2]National Chung Hsing University

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Efficient Numerical Simulation of Neuron Models with Spatial Structure on Graphics Processing Units
Tsukasa Tsuyuki[1], Yuki Yamamoto[2], Tadashi Yamazaki[1]
[1]The University of Electro-Communications [2]Tokyo Medical and Dental University

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A Scalable Patch-Based Approach for RGB-D Face Recognition
Nesrine GRATI[1], Achraf Ben-Hamadou[2], Mohamed Hammami[1]
[1]Miracl Laboratory Sfax-Tunisia [2]Valeo

Gaussian Processes based fusion of multiple data sources for automatic identification of geological boundaries in mining
Katherine Silversides[1], Arman Melkumyan[1]
[1]The University of Sydney

Speaker Detection in Audio Stream via Probabilistic Prediction Using Generalized GEBI
Koki Sakata[1], Shota Sakashita[1], Kazuya Matsuo[1], Shuichi Kurogi[1]
[1]Kyushu Institute of Technology

Probabilistic Prediction for Text-Prompted Speaker Verification Capable of Accepting Spoken Words with the Same Meaning but Different Pronunciations
Shota Sakashita[1], Satoshi Takeguchi[1], Kazuya Matsuo[1], Shuichi Kurogi[1]
[1]Kyushu Institute of Technology

Segment-Level Probabilistic Sequence Kernel based Support Vector Machines for Classification of Varying Length Patterns of Speech
Shikha Gupta[1], Veena Thenkanidiyoor[2], Dileep A.D[1]
[1]IIT Mandi, H.P India [2]Department of CSE, National Institute of Technology Goa, Ponda, Goa, India

Attention Estimation for Input Switch in Scalable Multi-Display Environments
Xingyuan Bu[1], Mingtao Pei[1], Yunde Jia[1]
[1]Beijing Institute of Technology

Deep Dictionary Learning vs Deep Belief Network vs Stacked Autoencoder: An Empirical Analysis
Vanika Singhal[1], Anupriya Gogna[1], Angshul Majumdar[1]
[1]IIIT Delhi

Bi-directional LSTM Recurrent Neural Network for Chinese Word Segmentation
Yushi Yao[1], Zheng Huang[1]
[1]Shanghai Jiaotong University

Alternating optimization method based on nonnegative matrix factorizations for deep neural networks
Tetsuya Sakurai[1], Akira Imakura[1], Yuto Inoue[1], Yasunori Futamura[1]
[1]University of Tsukuba

Fissionable Deep Neural Network
DongXu Tan[1], JunMin Wu[2], HuanXin Zheng[3], Yan Yin[3], YaXin Liu[1]
[1]School of Software Engineering of USTC [2]Suzhou Institute for Advanced Study of USTC [3]Department of Computer Science and Technology of USTC

A Structural Learning Method of Restricted Boltzmann Machine by Neuron Generation and Annihilation Algorithm
Shin Kamada[1], Takumi Ichimura[2]
[1]Graduate School of Information Sciences, Hiroshima City University, Japan [2]Faculty of Management and Information Systems, Prefectural University of Hiroshima, Japan

Semi-supervised Learning for Convolutional Neural Networks using Mild Supervisory Signals
Takashi Shinozaki[1]
[1]NICT CiNet

On the Singularity in Deep Neural Networks
Tohru Nitta[1]
[1]National Institute of Advanced Industrial Science and Technology

A Deep Neural Network Architecture Using Dimensionality Reduction with Sparse Matrices
Wataru Matsumoto[1], Manabu Hagiwara[2], Petros Boufounos[3], Kunihiko Fukushima[1,4], Toshisada Mariyama[1], Zhao Xiongxin[1]
[1]Mitsubishi Electric Corporation, Information Technology R&D Center, Kanagawa, Japan [2]Chiba University, Chiba, Japan [3]Mitsubishi Electric Research Laboratories, Cambridge, MA, USA [4]Fuzzy Logic System Institute, Fukuoka, Japan.

Noisy Softplus: A Biology Inspired Activation Function
Qian Liu[1], Steve Furber[1]
[1]University of Manchester

Compressing Word Embeddings
Martin Andrews[1]
[1]Red Cat Labs

Plenary 2 (abstract)

Plenary 2 Clock Tower Centennial Hall

Recent Developments in Online Learning for Big Data Applications

Irwin King[1]
[1] Department of Computer Science & Engineering
The Chinese University of Hong Kong

Abstract

As data generated from sciences, business, governments, etc. are reaching petabyte or even exabyte at an alarming rate, theories, models, and applications in online learning is becoming important in machine learning to process a large amount of streaming data effectively and efficiently. Recently, a number of online learning algorithms have been proposed to tackle the issues of ultra-dimension and high imbalance among the data. In this talk, we focus on new developments of online learning technologies in both theory and applications. Important topics including online boosting, online learning for sparse learning models, and distributed online algorithms, etc. will be discussed. Moreover, some of our recent works such as online learning for multi-task feature selection, imbalanced data, online dictionary learning, etc., will also be presented to demonstrate how online learning approaches can effectively handle streaming big data.

Biography

Irwin King is the Associate Dean (Education) of the Engineering Faculty and Professor in the Department of Computer Science and Engineering, The Chinese University of Hong Kong. He is also the Director of Rich Media and Big Data Key Laboratory at the Shenzhen Research Institute. His research interests include machine learning, social computing, Big Data, data mining, and multimedia information processing. In these research areas, he has over 225 technical publications in journals and conferences.
Prof. King is the Book Series Editor for Social Media and Social Computing with Taylor and Francis (CRC Press). He is also an Associate Editor of the Neural Network Journal and ACM Transactions on Knowledge Discovery from Data (ACM TKDD). Currently, he is a member of the Board of Governors of INNS and a Vice-President and Governing Board Member of APNNA. He also serves INNS as the Vice-President for Membership in the Board of Governors. Moreover, he is the General Chair of WSDM2011, General Co-Chair of RecSys2013, ACML2015, and in various capacities in a number of top conferences such as WWW, NIPS, ICML, IJCAI, AAAI, etc.

Prof. King is Associate Dean (Education), Faculty of Engineering and Professor at the Department of Computer Science and Engineering, The Chinese University of Hong Kong. He is also Director of the Shenzhen Key Laboratory of Rich Media and Big Data. He received his B.Sc. degree in Engineering and Applied Science from California Institute of Technology, Pasadena and his M.Sc. and Ph.D. degree in Computer Science from the University of Southern California, Los Angeles. He was on leave to AT&T Labs Research on special projects and also taught courses at UC Berkeley on Social Computing and Data Mining. Recently, Prof. King has been an evangelist in the use of education technologies in eLearning for the betterment of teaching and learning.

Tuesday AM (abstract)

TueAM-1 Data Mining and Cybersecurity Workshop 1

Invited talk

Cyber-security Information Sharing with Data Correlation

Koji Nakao[1,2]
[1]Distinguished Researcher, Cybersecurity Research Institute National Institute of Information and Communications Technology,
[2]Information Security advisor, KDDI

Abstract

With the rapid development and proliferation of the Internet, cyber-attacks are increasingly and continually emerging and evolving nowadays. Malware – a generic term for computer viruses, worms, trojan horses, spywares, adwares, and bots – is a particularly lethal security threat. To cope with this security threat appropriately, NICT has conducted "darknet analysis" by NICTER (Network Security Incident Analysis System) and "malware analysis" by use of advanced honeypot technology. Through such research activities, "Cyber-security Information" such as suspicious source IP addresses, C2 server addresses can be collected. This talk will provide Cyber-security information sharing schemes discussed in Japan with the idea of data correlation. Before sharing the cyber-security information among stakeholders, de-identification techniques should be appropriately considered. Finally, this talk will also provide a touchpoint of International Standardizations in this context.

Botnet Detection Using Graphical Lasso with Graph Density

Chansu Han[1] Kento Kono[1] Shoma Tanaka[1] Masanori Kawakita[1] Jun'ichi Takeuchi[1]
[1]Graduate School of ISEE, Kyushu University

Abstract

A botnet detection method using the graphical lasso is studied. Hamasaki et al. proposed a botnet detection method based on graphical lasso applied on darknet traffic, which captures change points of outputs of graphical lasso caused by a botnet activity. In their method, they estimate cooperative relationship of bots using graphical lasso. If the regularization coefficient of graphical lasso is appropriately tuned, it can remove false cooperative relationships to some extent. Though they represent the cooperative relationships of bots as a graph, they didn't use its graphical properties. We propose a new method of botnet detection based on 'graph density', for which we introduce a new method to set the regularization coefficient automatically. The effectiveness of the proposed method is illustrated by experiments on darknet data.

The Usability of Metadata for Android Application Analysis

Takeshi Takahashi[1], Tao Ban[1], Chin-Wei Tien[2], Chih-Hung Lin[2], Daisuke Inoue[1], Koji Nakao[1]
[1]National Institute of Information and Communications Technology, [2]Institute for Information Industry

Abstract

The number of security incidents faced by Android users is growing, along with the surge in malware targeting Android terminals. Such malware arrives at the Android terminals in the form of Android Packages (APKs). Assorted techniques for protecting Android users from such malware have been reported, but most of them focus on the APK files themselves. Different from these approaches, we use metadata, such as web information obtained from the online APK markets, to improve the accuracy of malware identification. In this paper, we introduce malware detection schemes using metadata, which includes categories and descriptions of APKs. We introduce two types of schemes: statistical scheme and support vector machine-based scheme. Finally, we analyze and discuss the performance and usability of the schemes, and confirm the usability of web information for the purpose of identifying malware.

Preserving Privacy of Agents in Reinforcement Learning for Distributed Cognitive Radio Networks

Geong Sen Poh[1], Kok-Lim Alvin Yau[2]
[1]MIMOS Berhad [2]Sunway University

Abstract

Reinforcement learning (RL) is one of the artificial intelligence approaches that has been deployed effectively to improve performance of distributed cognitive radio networks (DCRNs). However, in existing proposals that involve multi-agents, perceptions of the agents are shared in plain in order to calculate optimal actions. This raises privacy concern where an agent learns private information (e.g. Q-values) of the others, which can then be used to infer, for instance, the actions of these other agents. In this paper, we provide a preliminary investigation and a privacy-preserving protocol on multi-agent RL in DCRNs. The proposed protocol provides RL computations without revealing agents' private information. We also discuss the security and performance of the protocol.

TueAM-3 Neuromorphic hardware

Simplification of Processing Elements in Cellular Neural Networks - Working Confirmation using Circuit Simulation -

Mutsumi Kimura[1], Nao Nakamura[1], Tomoharu Yokoyama[1], Tokiyoshi Matsuda[1], Tomoya Kameda[2], Yasuhiko Nakashima[2]
[1]Ryukoku University [2]Nara Institite of Science and Technology

Abstract
Simplification of processing elements is greatly desired in cellular neural networks to realize ultra-large scale integration. First, we propose reducing a neuron to two-inverter two-switch circuit, two-inverter one-switch circuit, or two-inverter circuit. Next, we propose reducing a synapse only to one variable resistor or one variable capacitor. Finally, we confirm the correct workings of the cellular neural networks using circuit simulation. These results will be one of the theoretical bases to apply cellular neural networks to brain-type integrated circuits.

Pattern and frequency generation using an opto-electronic reservoir computer with output feedback

Piotr Antonik[1], Michiel Hermans[1], Marc Haelterman[1], Serge Massar[1]
[1]Université Libre de Bruxelles

Abstract
Reservoir Computing is a bio-inspired computing paradigm for processing time dependent signals. The performance of its analogue implementations matches other digital algorithms on a series of benchmark tasks. Their potential can be further increased by feeding the output signal back into the reservoir, which would allow to apply the algorithm to time series generation. This requires, in principle, implementing a sufficiently fast readout layer for real-time output computation. Here we achieve this with a digital output layer driven by an FPGA chip. We demonstrate the first opto-electronic reservoir computer with output feedback and test it on two examples of time series generation tasks: pattern and frequency generation. The good results we obtain open new possible applications for analogue Reservoir Computing.

A retino-morphic hardware system simulating the graded and action potentials in retinal neuronal layers

Yuki Hayashida[1], Yuka Kudo[1], Ryoya Ishida[1], Hirotsugu Okuno[2], Tetsuya Yagi[1]
[1]Osaka University [2]Osaka Institute of Technology

Abstract

We recently developed a retino-morphic hardware system operating at a frame interval of 5 msec, that was short enough for simulating the graded voltage responses of neurons in the retinal circuit in a quasi-continuous manner. In the present, we made a further progress, by implementing the Izhikevich model so that spatial spike distributions in a ganglion-cell layer can be simulated with millisecond-order timing precision. This system is useful for examining the retinal spike encoding of natural visual scenes.

Stability Analysis of Periodic Orbits in Digital Spiking Neurons

Tomoki Hamaguchi[1], Kei Yamaoka[1], Toshimichi Saito[1]
[1]Hosei University

Abstract

This paper considers stability of various periodic spike-trains from digital spiking neuron constructed by two coupled shift registers. The dynamics is integrated into a digital spike map defined on a set of points. In order to analyze the stability, we introduce two simple feature quantities that characterize plentifulness and superstability of the periodic spike-trains. Using the feature quantities, stability of typical examples is investigated.

Letter Reprodution Simulator for Hardware Design of Cellular Neural Network using Thin-Film Synapses - Crosspoint-type Synapses and Simulation Algorithm -

Tomoya Kameda[1]
[1]Nara Institite of Science and Technology

Abstract

Recently, neural networks have been developed for variable purposes including image and voice recognitions. However, those based on software require much calculation and energy. Therefore, we are developing hardware of a cellular neural network (CNN) that features low power, high-density integration, and high functionality. In this study, we developed a CNN simulator for character reproduction. Here, each neuron is connected to only neighboring neurons by synapses, where the learning is executed by changing the connection strengths. Particularly, we assumed to use a-IGZO films as synapses and utilize a phenomenon that the conductance changes when an electric current flows. We modeled this phenomenon and implemented it into the simulator to determine the network architecture and device parameters. This time, we confirmed that this hardware can learn two characters and estimated the time necessary for the learning based on the characteristic change model of the a-IGZO film.

TueAM-4 Machine learning 1

Non-parametric e-mixture of density functions

Hideitsu Hino[1], Ken Takano[2], Shotaro Akaho[3], Noboru Murata[2]
[1]University of Tsukuba [2]Waseda University [3]AIST

Abstract
Mixture modeling is one of the simplest ways to represent complicated probability density functions, and to integrate information from different sources. There are two typical mixtures in the context of information geometry, the m- and e-mixtures. This paper proposes a novel framework of non-parametric e-mixture modeling by using a simple estimation algorithm based on geometrical insights into the characteristics of the e-mixture. An experimental result supports the proposed framework.

An Entropy Estimator Based on Polynomial Regression with Poisson Error Structure

Hideitsu Hino[1], Shotaro Akaho[2], Noboru Murata[3]
[1]University of Tsukuba [2]AIST [3]Waseda University

Abstract
A method for estimating Shannon differential entropy is proposed based on the second order expansion of the probability mass around the inspection point with respect to the distance from the point. Polynomial regression with Poisson error structure is utilized to estimate the values of density function. The density estimates at every given data points are averaged to obtain entropy estimators. The proposed estimator is shown to perform well through numerical experiments for various probability distributions.

A problem in model selection of LASSO and introduction of scaling

Katsuyuki Hagiwara[1]
[1]Mie University

Abstract

In this article, we considered to assign a single scaling parameter to LASSO estimators for investigating and improving a problem of excessive shrinkage at a sparse representation. This problem is important because it directly affects a quality of model selection in LASSO. Through a theoretical risk analysis and a simple numerical experiment, we found that a prediction risk for LASSO tends to be high at a sparse representation and be minimized at a relatively large model while it was improved by the introduction of an estimate of the optimal scaling value. Actually, by applying an estimate of the risk as a model selection criterion, we found that LASSO with scaling tends to obtain a model with low risk and high sparsity compared to LASSO without scaling.

A Theoretical Analysis of Semi-Supervised Learning

Takashi Fujii[1], Hidetaka Ito[1], Seiji Miyoshi[1]
[1]Kansai University

Abstract

We analyze the dynamical behaviors of semi-supervised learning in the framework of on-line learning by using the statistical-mechanical method. A student uses several correlated input vectors in each update. The student is given a desired output for only one input vector out of these correlated input vectors. In this model, we derive simultaneous differential equations with deterministic forms that describe the dynamical behaviors of order parameters using the self-averaging property in the thermodynamic limit. We treat the Hebbian and Perceptron learning rules. As a result, it is shown that using unlabeled data is effective in the early stages for both of the two learning rules. In addition, we show that the two learning rules have qualitatively different dynamical behaviors. Furthermore, we propose a new algorithm that improves the generalization performance by switching the number of input vectors used in an update as the time step proceeds.

Evolutionary multi-task learning for modular training of feedforward neural networks

Rohitash Chandra[1] Abhishek Gupta[1] Yew Soon Ong[1] ChiKeong Goh[1]
[1]Rolls Royce @NTU Corporate Lab, Nanyang Technological University, Nanyang View, Singapore

Abstract

Multi-task learning enables learning algorithms to harness shared knowledge from several tasks in order to provide better performance. In the past, neuro-evolution has shown promising performance for a number of real-world applications. Recently, evolutionary multi-tasking has been proposed for optimisation problems. In this paper, we present a multi-task learning for neural networks that evolves modular network topologies. In the proposed method, each task is defined by a specific network topology defined with a different number of hidden neurons. The method produces a modular network that could be effective even if some of the neurons and connections are removed from selected trained modules in the network. We demonstrate the effectiveness of the method using feedforward networks to learn selected n-bit parity problems of varying levels of difficulty.

TueAM-5 Sensory perception

An analysis of current source density profiles activated by local stimulation in the mouse auditory cortex in vitro

Daiki Yamamura[1], Ayaka Sano[1], Takashi Tateno[1]
[1]Hokkaido University

Abstract

To examine microcircuit properties of the mouse auditory cortex (AC) in vitro, we extracellularly recorded spatiotemporal laminar profiles driven by short electric microstimulation on a planar multielectrode array (MEA) substrate. The recorded local field potentials (LFPs) were subsequently evaluated using current source density (CSD) analysis to identify sources and sinks. Current sinks are thought to be an indicator of net synaptic current in a small volume of cortex surrounding the recording site. Thus, CSD analysis combined with MEAs enabled us to compare mean synaptic activity in response to current stimuli on a layer-by-layer basis. Here, we used senescence-accelerated mice (SAM), some strains of which show age-related hearing loss, to examine char-acteristic spatiotemporal CSD patterns stimulated by electrodes in specific cor-tical layers. Thus, the CSD patterns were classified into several clusters based on the stimulation sites in the cortical layers.

Differential Effect of Two Types of Anesthesia on Sound-driven Oscillations in the Rat Primary Auditory Cortex

Hisayuki Osanai[1] Takashi Tateno[1]
[1]Hokkaido University

Abstract

Neural oscillations are closely associated with brain function. However, the extent to which different anesthetic agents exert unique effects on such oscillations is unclear. A mixture of three anesthetics (medetomidine, midazolam, and butorphanol) was recently developed as an alternative to ketamine, which has potential addictive effects. Yet, little is known about the effects of this combination of anesthetics on neural oscillations. In this study, we used multi-channel electrophysiological recording and flavoprotein endogenous imaging to compare sound-driven oscillations in primary auditory cortical neurons after administration of these two types of anesthetics. We observed differences in high gamma activities (over 120 Hz) across cortical layers between these two anesthetics but found no differences in activities including lower frequency components (¡ 120 Hz). Our results provide new information about how specific anesthetics influence sound-driven neural oscillations.

Developing an Implantable Micro Magnetic Stimulation System to Induce Neural Activity in vivo

Shunsuke Minusa[1], Takashi Tateno[1],
[1]Hokkaido University

Abstract

Although electromagnetic stimulation is widely used in neurological studies and clinical appli-cations, conventional methods have several limitations. Recent studies have reported that mi-cro magnetic stimulation (μMS), which can directly activate neural tissue and cells via sub-millimeter solenoids, has the possibility to overcome such limitations. However, the develop-ment and application of μMS using implantable sub-millimeter solenoids has not yet been re-ported. Here, we proposed a new implantable μMS system and evaluated its validity. In par-ticular, using flavoprotein fluorescence imaging, we evaluated if the stimuli delivered by our system were large enough to activate the mouse auditory cortex in vivo. The results indicated that our system successfully activated neural tissue, and the activity propagation was observed on the brain surface. Thus, this study is the first step to applying μMS implantable devices in investigating basic neuroscience and clinical application tools.

"Figure" Salience as a Meta-Rule for Rule Dynamics in Visual Perception

Kazuhiro Sakamoto[1]
[1]Tohoku Medical and Pharmaceutical University

Abstract

The brain faces many ill-posed problems whose solutions cannot be achieved solely on the basis of external conditions. To solve such problems, certain constraints or rules are required. Using a fixed set of rules, however, is not necessarily advantageous in ever-changing environments. Here, I revisit two of our previous psychophysical experiments. One pertains to visual depth perception based on spatial frequency cues, and the other involves apparent group motion. Results from these experiments demonstrate that perceptual rules change dynamically depending on the experimental conditions. They also suggest the existence of a meta-rule governing the dynamics of perceptual rules, which I refer to as a meta-rule of ”figure” salience.

A neural network model for retaining object information required in a categorization task

Yuki Abe[1] Kazuhisa Fujita[2] Yoshiki Kashimori[1]
[1]University of Electro-Communications [2]Tsuyama National College of Technology

Abstract

Categorization is our ability to generalize properties of object, and clearly fundamental cognitive capacity. A delay matching-to-categorization task requires working memory of category information, shaped by the interaction between prefrontal cortex (PFC) and inferior temporal (IT) cortex. In the present study, we present the neural mechanism by which working memory is shaped and retained in PFC and how top-down signals from PFC to IT affect the categorization ability.

Tuesday PM1 (abstract)

TuePM1-1 Data Mining and Cybersecurity Workshop 2

Invited talk

The emerging era of Cognitive Big Data Informatics: Some Case Studies and future Directions

Amir Hussain[1,2]
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[2]Division of Computing Science and Mathematics, University of Stirling, Stirling FK9 4LA, UK

Abstract

Cognitive Big Data informatics is a rapidly developing discipline, bringing together neurobiology, cognitive psychology, Big Data and artificial intelligence. Recent work at Stirling University has explored the application of cognitively-inspired multi-modal Big Data informatics to solving challenging real world applications. Two case studies are introduced in this talk. Firstly, on-going research into cognitively-inspired multi-modal speech perception has led to the development of a novel context-aware fuzzy-logic based audio-visual speech processing system. The proposed framework exploits cognitively inspired use of both audio and visual (including lip-tracking) information, with potential applications in next-generation multi-modal hearing aids and listening device technology. The second case study focusses on open-domain sentiment analysis of natural language text using sentic computing: a novel multi-disciplinary paradigm, based on the semantic, latent and implicit meaning of natural language concepts, which implicitly exploits the psychologically inspired notion of dual (unconscious and conscious) processing. Ongoing extensions of this work include a cognitively-inspired emotion recognition system based on multimodal input, including text, audio and facial information, which is shown to significantly outperform state-of-the-art uni-modal and bi-modal systems. We present a brief summary of these exciting multi-disciplinary research areas, and outline possible parallels, links and some future research directions and challenges.

Campus Wireless LAN Usage Analysis and Its Applications

Kensuke Miyashita[1], Yuki Maruno[1]
[1]Kyoto Women's University

Abstract

Wireless LAN (WLAN) service has been provided in many companies, universities, hotels, coffee shops and even on the street, which supports the growing number of users with mobile devices. Kyoto Women ' s University has offered WLAN service with many access points in centralized control style since 2011, which allows mobile users to access the network at any location covered by its access points while on campus. It is useful for evacuation planning to figure out when and where people gather, and therefore, it is worth understanding the trends of WLAN usage in each organization at all times. In this paper, we analyzed the trends of WLAN usage in the university and described some applications.

MDL Criterion for NMF with Application to Botnet Detection

Shoma Tanaka[1], Yuki Kawamura[2], Masanori Kawakita[1], Noboru Murata[3], Jun'ichi Takeuchi[1]
[1]Graduate School of ISEE Kyushu University [2]Nihon Unisys, Ltd. [3]Waseda University

Abstract

A method for botnet detection from traffic data of the Internet by the Non-negative Matrix Factorization (NMF) was proposed by (Yamauchi et al. 2012). This method assumes that traffic data is composed by several types of communications, and estimates the number of types in the data by the minimum description length (MDL) criterion. However, consideration on the MDL criterion was not sufficient and validity has not been guaranteed. In this paper, we refine the MDL criterion for NMF and report results of experiments for the new MDL criterion on synthetic and real data.

TuePM1-3 Pattern recognition 1

Weighted Discriminant Analysis and Kernel Ridge Regression Metric Learning for Face Verification

Siew-Chin Chong[1], Andrew Jin Teoh[2], Thian-Song Ong[1]
[1]Multimedia University [2]Yonsei University

Abstract
In this paper, a new formulation of metric learning is introduced by assimilating the kernel ridge regression (KRR) and weighted side-information linear discriminant analysis (WSILD) to enjoy the best of both worlds for unconstrained face verification task. To be specific, we formulate a doublet constrained metric learning problem by means of a second degree polynomial kernel function. The said metric learning problem can be solved analytically for Mahalanobis distance metric due to simplistic nature of KRR in which we named KRRML. In addition, the WSILD further enhances the learned Mahalanobis distance metric by leveraging the between-class and within-class scatter matrix of doublets. We evaluate the proposed method with Labeled Faces in the Wild database, a large benchmark dataset for unconstrained face verification. The promising result attests the feasibility and robustness of the proposed method.

An Incremental One Class Learning Framework for Large Scale Data

Qilin Deng[1] Yi Yang[1] Furao Shen[1] Chaomin Luo[2] Jinxi Zhao[1]
[1]Department of Computer Science and Technology, Nanjing University [2]Department of Electrical and Computer Engineering, University of Detroit Mercy

Abstract
In this paper, we propose a novel one class learning method for the large scale data. In the context of one class learning, the proposed method could automatically learn the appropriate number of prototypes needed to represent the original target examples, and acquire the essential topology structure of target distribution. Then based on the learned topology structure, a neighbors analysis technique is utilized to separate the target examples from outlier examples. Experimental results show that our method can accommodate the large scale data environment, and achieve comparable or preferable performance than other contemporary methods on both artificial and real word data sets.

Gesture Spotting by Using Vector Distance of Self-Organizing Map

Yuta Ichikawa[1], Shuji Tashiro[1], Hidetaka Ito[1], Hiroomi Hikawa[1]
[1]Kansai University

Abstract

This paper proposes a dynamic hand gesture recognition algorithm with a function of gesture spotting. The algorithm consists of two self-organizing maps (SOMs) and a Hebb learning network. Feature vectors are extracted from input images, and these are fed to one of the SOMs and a vector that represents the sequence of postures in the given frame is generated. Using this vector, gesture classification is performed using another SOM. In the SOM, the vector distance between the input vector and the winner neuron's weight vector is used for the gesture spotting. The following Hebb network identifies the gesture class. The experimental results show that the system recognizes eight gestures with the accuracy of 95.8%.

Cross-Database Facial Expression Recognition via Unsupervised Domain Adaptive Dictionary Learning

Keyu Yan[1], Wenming Zheng[1], Zhen Cui[1], Yuan Zong[1]
[1]Southeast University

Abstract

We propose a novel method called unsupervised domain adaptive dictionary learning (UDADL) to deal with the unsupervised case that all samples in target database are completely unlabeled. In UDADL, to obtain more robust representations of facial expressions and to reduce the time complexity in training and testing phases, we introduce a dual dictionary pair consisting of a synthesis one and an analysis one to mutually bridge the samples and their codes. Meanwhile, to relieve the distribution disparity of source and target samples, we further integrate the learning of unlabeled testing data into UDADL to adaptively adjust the misaligned distribution in an embedded space, where geometric structures of both domains are also encourage to be preserved. The UDADL model can be solved by an iterate optimization strategy with each sub-optimization in a closed analytic form.

Adaptive Multi-View Semi-Supervised Nonnegative Matrix Factorization

Jing Wang[1], Xiao Wang[2], Feng Tian[1], Chang Hong Liu[1], Hongchuan Yu[1], Yanbei Liu[3]

[1]Bournemouth University [2]Tsinghua University [3]Tianjin University

Abstract

Multi-view clustering, which explores complementary information between multiple distinct feature sets, has received considerable attention. For accurate clustering, all data with the same label should be clustered together regardless of their multiple views. However, this is not guaranteed in existing approaches. To address this issue, we propose Adaptive Multi-View Semi-Supervised Nonnegative Matrix Factorization (AMVNMF), which uses label information as hard constraints to ensure data with same label are clustered together, so that the discriminating power of new representations are enhanced. Besides, AMVNMF provides a viable solution to learn the weight of each view adaptively with only a single parameter. Using L2,1-norm, AMVNMF is also robust to noises and outliers. We further develop an efficient iterative algorithm for solving the optimization problem. Experiments carried out on five well-known datasets have demonstrated the effectiveness of AMVNMF.

TuePM1-4 Machine learning 2

On the Noise Resilience of Ranking Measures

Daniel Berrar[1]
[1]Shibaura Institute of Technology

Abstract
Performance measures play a pivotal role in the evaluation and selection of machine learning models for a wide range of applications. Using both synthetic and real-world data sets, we investigated the resilience to noise of various ranking measures. Our experiments revealed that the area under the ROC curve (AUC) and a related measure, the truncated average Kolmogorov-Smirnov statistic (taKS), can reliably discriminate between models with truly different performance under various types and levels of noise. With increasing class skew, however, the H-measure and estimators of the area under the precision-recall curve become preferable measures. Because of its simple graphical interpretation and robustness, the lower trapezoid estimator of the area under the precision-recall curve is recommended for highly imbalanced data sets.

BPSpike II : A new backpropagation learning algorithm for spiking neural networks

Satoshi Matsuda[1]
[1]Nihon University

Abstract
Using gradient descent, we propose a new backpropagation learning algorithm for spiking neural networks with multi-layers, multi-synapses between neurons, and multi-spiking neurons. It adjusts synaptic weights, delays, and time constants, and neurons' thresholds in output and hidden layers. It guarantees convergence to minimum error point, and unlike SpikeProp and its extensions, does not need a one-to-one correspondence between actual and desired spikes in advance. So, it is stably and widely applicable to practical problems.

Group dropout inspired by ensemble learning

Kazuyuki Hara[1] Daisuke Saitoh[2] Tasuku Kondo[2] Satoshi Suzuki[3] Hayaru Shouno[3]
[1]College of Industrial Technology, Nihon University, [2]Graduate School of Industrial Technology, Nihon Univeristy [3]Graduate School of Informatics and Engineering, The University of Electro-Communications

Abstract

Deep learning is a state-of-the-art learning method that is used in fields such as visual object recognition and speech recognition. This learning uses a large number of layers and a huge number of units and connections, so overfitting occurs. Dropout learning is a kind of regularizer that neglects some inputs and hidden units in the learning process with a probability p; then, the neglected inputs and hidden units are combined with the learned network to express the final output. We compared dropout learning and ensemble learning from three viewpoints and found that dropout learning can be regarded as ensemble learning that divides the student network into two groups of hidden units. From this insight, we explored novel dropout learning that divides the student network into more than two groups of hidden units to enhance the benefit of ensemble learning.

Audio Generation From Scene Considering Its Emotion Aspect

Gwenaelle Cunha Sergio[1], Minho Lee[1]
[1]Kyungpook National University

Abstract

Scenes can convey emotion like music. If that ' s so, it might be possible that, given an image, one can generate music with similar emotional reaction from users. The challenge lies in how to do that. In this paper, we use the Hue, Saturation and Lightness features from a number of image samples extracted from videos excerpts and the tempo, loudness and rhythm from a number of audio samples also extracted from the same video excerpts to train a group of neural networks, including Recurrent Neural Network and Neuro-Fuzzy Network, and obtain the desired audio signal to evoke a similar emotional response to a listener. This work could prove to be an important contribution to the field of Human-Computer Interaction because it can improve the interaction between computers and humans. Experimental results show that this model effectively produces an audio that matches the video evoking a similar emotion from the viewer.

Semi Supervised Autoencoder

Anupriya Gogna[1] Angshul Majumdar[1]
[1]Indraprasatha Institute of Information Technology-Delhi

Abstract

Autoencoders are self-supervised learning tools, but are unsupervised in the sense that class information is not required for training; but almost invariably they are used for supervised classification tasks. We propose to learn the autoencoder for a semi-supervised paradigm, i.e. with both labeled and unlabeled samples available. Given labeled and unlabeled data, our proposed autoencoder automatically adjusts — for unlabeled data it acts as a standard autoencoder (unsupervised) and for labeled data it additionally learns a linear classifier. We use our proposed semi-supervised autoencoder to (greedily) construct a stacked architecture. We demonstrate the efficacy our design in terms of both accuracy and run time requirements for the case of image classification. Our model is able to provide high classification accuracy with even simple classification schemes as compared to existing models for deep architectures

TuePM1-5 Social networks

Influence Spread Evaluation and Propagation Rebuilding

Qianwen Zhang[1], Cheng-Chao Huang[1], Jinkui Xie[1]
[1]East China Normal University

Abstract
In social networks, studies about influence maximization mainly focus on the algorithm of finding seed nodes, but ignore the intrinsic properties of influence propagation. In this paper, we consider the relationship between seed sets & influence spread. For static propagation, we reasonably abstract the relationship between the size of the seed set and the influence spread in influence maximization problem as a logarithmic function. We also provide experiments on large collaboration networks, showing the rationality and the accuracy of the proposed function. For dynamic influence propagation, we rebuild it as a continuous linear dynamical system called 3DS, which is based on Newton ' s law of cooling. Furthermore, we give an efficient method to compute the influence spread function of time without much loss of accuracy. Its efficiency is demonstrated by complexity analysis.

A Tag Probability Correlation-based Microblog Recommendation Method

Zhang Di[1], Ma Huifang[1]
[1]Northwest Normal University

Abstract
In order to improve users' experience it is necessary to recommend valuable and interesting content for users. A tag probability correlation based microblog recommendation method (TPCMR) is presented via analyzing microblog features and the deficiencies of existing microblog recommendation algorithm. Firstly, our method takes advantage of the probability correlation between tags to construct the tag similarity matrix. Then the weight of the tag for each user is enhanced based on the relevance weighting scheme and the user tag matrix can be constructed. The matrix is updated using the tag similarity matrix, which contains both the user interest information and the relationship between tags and tags. Experimental results show that the algorithm is effective in microblog recommendation.

A New Model and Heuristic for Infection Minimization by Cutting Relationships

Rafael Santiago[1], Wellington Zunino[1], Fernando Concatto[1], Luís Lamb[2]
[1]Universidade do Vale do Itajaí [2]Federal University of Rio Grande do Sul

Abstract

Models of infection spreading have been used and applied to economic, health, and social contexts. Seeing them as an optimization problem, the spreading can be maximized or minimized. This paper presents a novel optimization problem for infection spreading control applied to networks. It uses as a parameter the number of relations (edges) that must be cut, and the optimal solution is the set of edges that must be cut to ensure the minimal infection over time. The problem uses the states of SEIS nodes, which is based on the SEIR and SIS models. We refer to the problem as Min-SEIS-Cluster. The model also considers that the infections occurred over different probabilities in different clusters of individuals (nodes). We also report a heuristic to solve Min-SEIS-Cluster. The analysis of the obtained results allows one to observe that there exists a positive correlation between the proportion of removed edges and relative increase of mitigation effectiveness.

Sentiment and Behavior Analysis of one Controversial American Individual on Twitter

João Oliveira[1], Moshe Cotacallapa[1], Wilson Seron[2], Rafael Santos[1], Marcos Quiles[2]
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Abstract

Social media is a convenient tool for expressing ideas and a powerful means for opinion formation. In this paper, we apply sentiment analysis and machine learning techniques to study a controversial American individual on Twitter., aiming to grasp temporal patterns of opinion changes and the geographical distribution of sentiments (positive, neutral or negative), in the American territory. Specifically, we choose the American TV presenter and candidate for the Republican party nomination, Donald J. Trump. The results acquired aim to elucidate some interesting points about the data, such as: what is the distribution of users considering a match between their sentiment and their relevance? Which clusters can we get from the temporal data of each state? How is the distribution of sentiments, before and after, the first two Republican party debates?

Tuesday PM2 (abstract)

TuePM2-1 Data Mining and Cybersecurity Workshop 3

A Brief Review of Spin-glass Applications in Unsupervised and Semi-supervised Learning

Lei Zhu[1], Kazushi Ikeda[2], Paul Pang[1], Ruibin Zhang[1], Abdolhossein Sarrafzadeh[1]
[1]Unitec Institute of Technology, New Zealand [2]Nara Institute of Science and Technology

Abstract
Spin-glass theory developed in statistical mechanics has found its usage in various information science problems. In this study, we focus on the application of spin-glass models in unsupervised and semi-supervised learning. Several key papers in this field are reviewed, to answer the question that why and how spin-glass is adopted. The question can be answered from two aspects. Firstly, adopting spin-glass models enables the vast knowledge base developed in statistical mechanics to be used, such as the self-organizing grains at the superparamagnetic phase has a natural connection to clustering. Secondly, spin-glass model can serve as a bridge for model development, i.e., one can map existing model into spin-glass manner, facilitate it with new features and finally map it back.

Learning Latent Features with Infinite Non-negative Binary Matrix Tri-factorization

Xi Yang[1] Kaizhu Huang[1] Rui Zhang[1] Amir Hussain[2]
[1]Xi'an Jiaotong-Liverpool University. [2]University of Stirling

Abstract
In this paper, we propose a new Bayesian model called infinite non-negative binary matrix tri-factorizations model (iNBMT), capable of learning automatically the latent binary features as well as feature number based on Indian Buffet Process (IBP). iNBMT engages a tri-factorization process that decomposes a nonnegative matrix into the product of 3 components including 2 binary and 1 non-negative real matrix. Compared with bi-factorization, the tri-factorization can better reveal the latent structures among samples and features. Specifically, we impose an IBP prior on the 2 infinite binary matrices while a truncated Gaussian is assumed on the weight matrix. We develop an efficient modified maximization-expectation algorithm, with the iteration complexity 1 order lower than another recently-proposed model. We conduct a series of experiments. Results demonstrate that our proposed model significantly outperforms the other comparison algorithms in both synthetic and real data.

A Novel Manifold Regularized Online Semi-Supervised Learning Algorithm

Shuguang Ding[1], Xuanyang Xi[2], Zhiyong Liu[2], Hong Qiao[2], Bo Zhang[3]
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Abstract

In this paper, we propose a novel manifold regularized online semi-supervised learning model in an Reproducing Kernel Hilbert Space (RKHS). The proposed algorithm, named Model-Based Online Manifold Regularization (MOMR), is derived by solving a constrained optimization problem, which is different from the stochastic gradient algorithm used for solving the online version of the primal problem of Laplacian support vector machine (LapSVM). Taking advantage of the convex property of the proposed model, an exact solution can be obtained iteratively by solving its Lagrange dual problem. Furthermore, a buffering strategy is introduced to improve the computational efficiency of the algorithm. Finally, the proposed algorithm is experimentally shown to have a comparable performance to the standard batch manifold regularization algorithm.

Learning from Few Samples with Memory Network

Shufei Zhang[1], Kaizhu Huang[1]
[1]Xi'an Jiaotong-Liverpool Univ.

Abstract

Neural Networks (NN) have achieved great success in pattern recognition and machine learning. However, the success of NNs usually relies on a sufficiently large number of samples. When fed with limited data, NN's performance may be degraded significantly. In this paper, we introduce a novel neural network called Memory Network, which can learn better from limited data. Taking advantages of the memory from previous samples, the new model could achieve remarkable performance improvement on limited data. We demonstrate the memory network in Multi-Layer Perceptron (MLP). However, it keeps straightforward to extend our idea to other neural networks, e.g., Convolutional Neural Networks (CNN). We detail the network structure, present the training algorithm, and conduct a series of experiments to validate the proposed framework. Experimental results show that our model outperforms the traditional NN and other competitive algorithms in two real data sets.

Generalized Compatible Function Approximation for Policy Gradient Search

Yiming Peng[1], Gang Chen[1], Mengjie Zhang[1], Paul Pang[2]
[1]Victoria University of Wellington [2]Unitec Institute of Technology, New Zealand

Abstract

Reinforcement learning aims at solving stochastic sequential decision making problems through direct trial-and-error interactions with the learning environment. In this paper, we will develop generalized compatible features to approximate value functions for reliable Reinforcement Learning. Further guided by an Actor-Critic Reinforcement Learning paradigm, we will also develop a generalized updating rule for policy gradient search in order to constantly improve learning performance. Our new updating rule has been examined on several benchmark learning problems. The experimental results on two problems will be reported specifically in this paper. Our results show that, under suitable generalization of the updating rule, the learning performance and reliability can be noticeably improved.

A Combo Object Model for Maritime Boat Ramps Traffic Monitoring

Paul pang[1]
[1]Unitec Institute of Technology, New Zealand

Abstract

Conventional tracking methods are incapable of tracking boats towed by vehicles on boat ramps because the relative geometry of these combined objects changes as they move up and down the ramp. In the context of maritime boat ramp surveillance, fishing trailer boat is the object of interest for monitoring the amount of recreational fishing activities over the time. Instead of tracking trailer boat as a single object, this paper proposes a novel boat-vehicle combo object model, by which each boat is tracked as a combination of a trailered boat and a towing vehicle, and the relationship between these two components is modelled in multi-feature space and traced across consecutive frames. Experimental results show that the proposed combo modelling tracks the object of interest accurately and reliably in real-world boat traffic videos.

TuePM2-3 Pattern recognition 2

Robust Soft Semi-Supervised Discriminant Projection for Feature Learning

Xiaoyu Wang[1] Zhao Zhang[1] Yan Zhang[1]
[1]Soochow University

Abstract

Image feature extraction and noise/outlier processing has received more and more attention. In this paper, we first take the full use of labeled and unlabeled samples, which leads to a semi-supervised model. Based on the soft label, we combine unlabeled samples with their predicted labels so that all the samples have their own soft labels. Our ratio based model maximizes the soft between-class scatter, as well as minimizes the soft within-class scatter plus a neighborhood preserving item, so that our approach can explicitly extract discriminant and locality preserving features. Further, to make the result be more robust to outliers, all the distance metrics are configured as L1-norm instead of L2-norm. An effective iterative method is taken to solve the optimal function. Finally, we conduct simulation experiments on CASIA-HWDB1.1 and MNIST handwriting digits datasets. The results verified the effectiveness of our approach compared with other related methods.

A Hybrid Pooling Method for Convolutional Neural Networks

Tong Zhiqiang[1] Kazuyuki Aihara[1] Gouhei Tanaka[1]
[1]The University of Tokyo

Abstract

The convolutional neural network (CNN) is an effective machine learning model which has been successfully used in the computer vision tasks such as image recognition and object detection. The pooling step is an important process in the CNN to decrease the dimensionality of the input image data and keep the transformation invariance for preventing the overfitting problem. There are two major pooling methods, i.e. the max pooling and the average pooling. Their performances depend on the data and the features to be extracted. In this study, we propose a hybrid system of the two pooling methods to improve the feature extraction performance. We randomly choose one of them for each pooling zone with a fixed probability. We show that the hybrid pooling method (HPM) enhances the generalization ability of the CNNs in numerical experiments with the handwritten digit images.

Multi-nation and multi-norm License plates detection in real traffic surveillance environment using Deep Learning

Amira Naimi[1] Yousri Kessentini[1] Mohamed Hammami[1]
[1]MIRACL

Abstract

This paper aims to highlight the problems of license plate detection in real traffic surveillance environment. We notice that existing systems require strong assumptions on license plate norm and environment. We propose a novel solution based on deep learning using self-taught features to localize multi-nation and multi-norm license plates under real road conditions such poor illumination, complex background and several positions. Our method is insensitive to illumination (day, night, sunrise, sunset,...), translation and poses. Despite the low resolution of images collected from real road surveillance environment, a series of experiments shows interesting results and the fastest time processing comparing with traditional algorithms.

A study on cluster size sensitivity of fuzzy c-means algorithm variants

Laszlo Szilagyi[1], Sandor Miklos Szilagyi[2], Calin Enachescu[2]
[1]Sapientia University of Transylvania, Tirgu Mures, Romania [2]Petru Maior University

Abstract

Detecting clusters of different sizes represents a serious difficulty for all c-means clustering models. This study investigates the set of various modified fuzzy c-means clustering algorithms within the bounds of the probabilistic constraint, from the point of view of their sensitivity to cluster sizes. Two numerical frameworks are constructed, one of them addressing clusters of different cardinalities but relatively similar diameter, while the other manipulating with both cluster cardinality and diameter. The numerical evaluations have shown the existence of algorithms that can effectively handle both cases. However, these are difficult to automatically adjust to the input data through their parameters.

Invited talk

Statistical mechanics of pre-training and fine tuning in deep learning

Masayuki Ohzeki[1]
[1]Graduate School of Informatics, Kyoto University

Abstract

Lack of analytical study on the architecture of deep learning hampers understanding of its origin of the outstanding performance. A recent study has formulated a theoretical basis for the relationship between the recursive manipulation of variational renormalization groups and the multi-layer neural network in deep learning [2]. Indeed, it is confirmed that the renormalization group indeed can mitigate the computational cost in the learning without any significant degradation [3]. The statistical mechanical approach is a rare successful approach to pave a way to the nature of the deep learning. We present a statistical-mechanical analysis on a part of architecture in the deep learning. We first elucidate some of the essential components of deep learning —pre-training by unsupervised learning and fine tuning by supervised learning. We formulate the extraction of features from the training data as a margin criterion in a high-dimensional feature-vector space. The self-organized classifier is then supplied with small amounts of labelled data, as in deep learning. For simplicity, we employ a simple single-layer perceptron model, rather than directly analyzing a multi-layer neural network. The surprising performance of the deep learning does not necessarily come from deep neural network, but rather stem from the potential of the neural network itself. We find a nontrivial phase transition that is dependent on the number of unlabelled data in the generalization error of the resultant classifier. The resultant phenomena exhibits the efficacy of the unsupervised learning in deep learning. Increasing the number of unlabelled data again leads to an improvement in the generalization error. A gradual increase in the number of labelled data allows us to escape from a metastable solution in multiple solutions. In this sense, fine tuning by supervised learning is necessary to achieve the lower-error state and mitigate the difficulties in reaching the desired solution. We should emphasize that the emergence of the metastable state does not come from the multi-layer neural networks, but from the combination of unsupervised and supervised learning. The analysis is performed by the replica method, which is a sophisticated tool in statistical mechanics. We validate our result in the manner of deep learning, using a simple iterative algorithm to learn the weight vector on the basis of belief propagation.

Reference:

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[2] P. Mehta and D. J. Schwab: arXiv:1410.3831.
[3] K. Tanaka, S. Kataoka, M. Yasuda, and M. Ohzeki: Journal of the Physical Society of Japan 84, 045001 (2015)

TuePM2-4 Machine learning 3

Sampling-based Gradient Regularization for Capturing Long-Term Dependencies in Recurrent Neural Networks

Artem Chernodub[1], Dimitri Nowicki[1]
[1]Institute of MMS of NAS of Ukraine

Abstract

Vanishing (and exploding) gradients effect is a common problem for recurrent neural networks which use backpropagation method for calculation of derivatives. We construct an analytical framework to estimate a contribution of each training example to the norm of the long-term components of the target functions gradient and use it to hold the norm of the gradients in the suitable range. Using this subroutine we can construct mini-batches for the stochastic gradient descent (SGD) training that leads to high performance and accuracy of the trained network even for very complex tasks. To check our framework experimentally we use some special synthetic benchmarks for testing RNNs on ability to capture long-term dependencies. Our network can detect links between events in the (temporal) sequence at the range 100 and longer.

FACE HALLUCINATION USING CORRELATIVE RESIDUE COMPENSATION IN A MODIFIED FEATURE SPACE

Javaria Ikram[1], Yao Lu[1], Jianwu Li[1], Hui Nie[1]
[1]Beijing Institute of Technology

Abstract

Local linear embedding (LLE) is a promising manifold learning method in the field of machine learning. Number of face hallucination (FH) methods have been proposed due to its neighborhood preserving nature. However, the projection of low resolution (LR) image to high resolution (HR) is "one-to-multiple" mapping; therefore manifold assumption does not hold well. To solve the above inconsistency problem we proposed a new approach. First, an intermediate HR patch is constructed based on the non linear relationship between LR and HR patches, which is established using partial least square (PLS) method. Secondly, we incorporate the correlative residue compensation to the intermediate HR results by using only the HR residue manifold. We use the same combination coefficient as for the intermediate hallucination of the first phase. Extensive experiments show that the proposed method outperforms some state-of-the-art methods in both reconstruction error and visual quality.

Modal Regression via Direct Log-Density Derivative Estimation

Hiroaki Sasaki[1], Yurina Ono[2], Masashi Sugiyama[2]
[1]Nara Institute of Science and Technology [2]The University of Tokyo

Abstract

Regression is aimed at estimating the conditional expectation of output given input, which is suitable for analyzing functional relation between input and output. On the other hand, when the conditional density with multiple modes is analyzed, *modal regression* comes in handy. *Partial mean shift* (PMS) is a promising method of modal regression, which updates data points toward conditional modes by gradient ascent. In the implementation, PMS first obtains an estimate of the joint density by kernel density estimation and then computes its derivative for gradient ascent. However, this two-step approach can be unreliable because a good density estimator does not necessarily mean a good density derivative estimator. In this paper, we propose a novel method for modal regression based on *direct* estimation of the log-density derivative without density estimation. Experiments show the superiority of our direct method over PMS.

Simplicial Nonnegative Matrix Tri-Factorization: Fast Guaranteed Parallel Algorithm

Duy Khuong Nguyen[1], Dinh Quoc Tran[2], Tu Bao Ho[3]
[1]University of Engineering and Technology: VNU [2]The University of North Carolina at Chapel Hill [3]JAIST

Abstract

Nonnegative matrix factorization (NMF) is a linear powerful dimension reduction and has various important applications. However, existing models remain the limitations in the terms of interpretability, guaranteed convergence, computational complexity, and sparse representation. In this paper, we propose to add simplicial constraints to the classical NMF model and to reformulate it into a new model called simplicial nonnegative matrix tri-factorization to have more concise interpretability via these values of factor matrices. Then, we propose an effective algorithm based on a combination of three-block alternating direction and Frank-Wolfe's scheme to attain linear convergence, low iteration complexity, and easily controlled sparsity. The experiments indicate that the proposed model and algorithm outperform the NMF model and its state-of-the-art algorithms.

Active Consensus-Based Semi-Supervised Growing Neural Gas

Vinicius Maximo[1], Mariá Nascimento[1], Fabricio Breve[2], Marcos Quiles[1]
[1]UNIFESP [2]UNESP

Abstract

In this paper, we propose a new active semi-supervised growing neural gas (GNG) model, named Active Consensus-Based Semi-Supervised GNG, or ACSSGNG. This model extends the former CSSGNG model by introducing an active mechanism for querying more representative samples in comparison to a random, or passive, selection. Moreover, as a semi-supervised model, the ACSSGNG takes both labelled and unlabelled samples in the training procedure. In comparison to other adaptations of the GNG to semi-supervised classification, the ACSSGNG does not assign a single scalar label value to each neuron. Instead, a vector containing the representativeness level of each class is associated with each neuron. Here, this information is used to select which sample the specialist might label instead of using a random selection of samples. Computer experiments show that our model can deliver, on average, better classification results than state-of-art semi-supervised algorithms, including the CSSGNG.

Poster Session 1 (abstract)

Poster1-1 Applications

Data Analysis of Correlation Between Project Popularity and Code Change Frequency

Dabeeruddin Syed[1], Jadran Sessa[1], Andreas Henschel[1], Davor Svetinovic[1]
[1]Masdar Institute of Science and Technology

Abstract
Github is a source code management platform with social networking features that help increase the popularity of a project. The features of the GitHub like watch, star, fork and pull requests help make a project popular among the developers, in addition to enabling them to work on the code together. In this work, we study the relation between the project popularity and the continual code changes made to a GitHub project. The correlation is found by using the metrics such as the number of watchers, pull requests, and the number of commits. We correlate the time series of code change frequency with the time series of project popularity. As a result, we have found that projects with at least 1500 watchers each month have a strong positive correlation between the project popularity and frequency of code changes. We have also found that the number of pull requests is 73.2% more important to the popularity of a project than the number of watchers.

Hidden space neighbourhood component analysis for cancer classification

Li Zhang[1], Xiaojuan Huang[1], Bangjun Wang[1], Fanzhang Li[1], Zhao Zhang[1]
[1]Soochow University

Abstract
Neighbourhood component analysis (NCA) is a method for learning a distance metric which can maximize the classification performance of the K nearest neighbour (KNN) classifier. However, NCA suffers from the small size sample problem that the number of samples is much less than the number of features. To remedy this, this paper proposes a hidden space neighbourhood components analysis (HSNCA), which is a nonlinear extension of NCA. HSNCA first maps the data in the original space into a feature space by a set of nonlinear mapping functions, and then performs NCA in the feature space. Notably, the number of samples is equal to the number of features in the feature space. Thus, HSNCA can avoid the small size sample problem. Experimental results on DNA array datasets show that HSNCA is feasibility and efficiency

Prediction of Bank Telemarketing with Co-training of Mixture-of-Experts and MLP

Jae-Min Yu[1], Sung-Bae Cho[1]
[1]Yonsei University

Abstract

Utilization of financial data becomes one of the important issues for user adaptive marketing on the bank service. The marketing is conducted based on personal information with various facts that affect a success (clients agree to accept financial instrument). Personal information can be collected continuously anytime if clients want to agree to use own information in case of opening an account in bank, but labeling all the data needs to pay a high cost. In this paper, focusing on this characteristics of financial data, we present a global-local co-training (GLCT) algorithm to utilize labeled and unlabeled data to construct better prediction model. We performed experiments using real-world data from Portuguese bank. Experiments show that GLCT performs well regardless of the ratio of initial labeled data. Through the series of iterating experiments, we obtained better results on various aspects.

Prioritising Security Tests on Large-Scale and Distributed Software Development Projects by Using Self-Organised Maps

Marcos Alvares[1], Fernando Lima Neto[2], Tshilidzi Marwala[1]
[1]University of Johannesburg [2]University of Pernambuco

Abstract

Large-scale and distributed software development initiatives demand a systematic testing process in order to prevent failures. Significant amount of resources are usually allocated on testing. Like any development and designing task, testing activities have to be prioritised in order to efficiently validate the produced code. By using source code complexity measurement, Computational Intelligence and Image Processing techniques, this research presents a new approach to prioritise testing efforts on large-scale and distributed software projects. The proposed technique was validated by automatically highlighting sensitive code within the Linux device drivers source code base. Our algorithm was able to classify 3,077 from 35,091 procedures as critical code to be tested. We argue that the approach is general enough to prioritise test tasks of most critical large-scale and distributed developed software such as: Operating Systems, Enterprise Resource Planning and Content Management systems.

Android Malware Detection Method Based on Function Call Graphs

Yuxin Ding[1], Siyi Zhu[1], Xiaoling Xia[1]
[1]Harbin Institute of Technology Shenzhen Graduate School

Abstract

With the rapid development of mobile Internet, mobile devices have been widely used in people's daily life, which has made mobile platforms a prime target for malware attack. In this paper we study on Android malware detection method. We propose the method how to extract the structural features of android application from its function call graph, and then use the structure features to build classifier to classify malware. The experiment results show that structural features can effectively improve the performance of malware detection methods.

Proposal of singular-unit restoration by focusing on the spatial continuity of topographical statistics in spectral domain

Kazuhide Ichikawa[1], Akira Hirose[1]
[1]The University of Tokyo

Abstract

An interferogram which interferometric synthetic aperture radar (InSAR) acquires includes singular points (SPs), which cause an unwrapping error. It is very important to remove the SP. We propose a filtering technique in order to eliminate the distortion around a SP. In this proposed filter, a complex-valued neural network (CVNN) learns the continuous changes of topographical statistics in the spectral domain. CVNN predicts the spectrum around a singular unit (SU), i.e., the four pixels constituting a SP, to restore the SU. The proposed method is so effective in the removal of the distortion at the SU that it allows us to generate a highly accurate digital elevation model (DEM).

Poster1-2 Computational & Cognitive Neurosciences

The Impact of Adaptive Regularization of the Demand Predictor on A Multistage Supply Chain Simulation

Fumiaki Saitoh[1]
[1]Aoyama Gakuin University

Abstract

The supply chain is difficult to control, which is representative of the bullwhip effect. Its behavior under the influence of the bullwhip effect is complex, and the cost and risk are increased. This study provides an application of online learning that is effective in large-scale data processing in a supply chain simulation. Because quality of solutions and agility are required in the management of the supply chain, we have adopted adaptive regularization learning. This is excellent from the viewpoint of speed and generalization of convergence and can be expected to stabilize supply chain behavior. In addition, because it is an online learning algorithm for evaluation of the bullwhip effect by computer simulation, it is easily applied to large-scale data from the viewpoint of the amount of calculation and memory size. The effectiveness of our approach was confirmed.

The effect of reward information on perceptual decision making

Devu Mahesan[1], Manisha Chawla[1], Krishna P Miyapuram[1]
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Abstract

Decision making can be treated as a two-step process involving sensory information and valuation of various options. However, the integration of value and sensory information at a neural level is still unclear.We used electroencephalography (EEG) to investigate the effect of reward information on perceptual decision making using two- alternative discriminating task. The reward information was signalled before the appearance of the stimuli. Our findings suggest that economic value acts as a top-down influence early in the decision epoch possibly shifting the evaluation criteria to a more favourable outcome.

Doubting What to Eat: A Computational Model for Food Choice Using Different Valuing Perspectives

Altaf Hussain Abro[1], Jan Treur[1]
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Abstract

Making food choices often depends on various factors. For example, a person may have a habit to eat a particular kind of food, or may select a type of food based on the expected level of satisfaction, or may have certain goals (e.g., weight loss) to be achieved. Do to these different factors the decision process may be complex. Moreover, part of the complexity is that the process is adaptive in that all the time patterns or habits can be formed. To assist humans in achieving a healthy lifestyle, computational tools used as smart applications may be helpful. In this paper a computational model for this decision process is presented that takes into account a number of aspects on which a decision can be based, for example, a temptation triggered by the food itself, a desire for food triggered by being hungry, valuing by the expected basic satisfaction feeling, and valuing by the expected goal satisfaction feeling. results show that this model is capable of learning of making food choices.

A Novel Graph Regularized Sparse Linear Discriminant Analysis Model for EEG Emotion Recognition

Yang Li[1], Wenming Zheng[1], Zhen Cui[1], Xiaoyan Zhou[2]
[1]Southeast University [2]Nanjing University of Information Science & Technology

Abstract

In this paper, a novel regression model, called graph regularized sparse linear discriminant analysis (GraphSLDA), is proposed to deal with EEG emotion recognition problem. GraphSLDA extends the conventional linear discriminant analysis (LDA) method by imposing a graph regularization and a sparse regularization on the transform matrix of LDA, such that it is able to simultaneously cope with sparse transform matrix learning while preserve the intrinsic manifold of the data samples. To cope with the EEG emotion recognition, we extract a set of frequency based EEG features to training the GraphSLDA model and also use it as EEG emotion classifier for testing EEG signals, in which we divide the raw EEG signals into five frequency bands, i.e.,δ, θ, α, β, and γ. To evaluate the proposed GraphSLDA model, we conduct experiments on the SEED database. The experimental results show that the proposed algorithm GraphSLDA is superior to the classic baselines.

Information maximization in a feedforward network replicates the stimulus preference of the medial geniculate and the auditory cortex

Takuma Tanaka[1]
[1]Shiga University

Abstract

Central auditory neurons exhibit a preference for complex features, such as frequency modulation and pitch. This study shows that the stimulus preference for these features can be replicated by a network model trained to maximize information transmission from input to output. The network contains three layers: input, first-output, and second-output. The first-output-layer neurons exhibit auditory-nerve neuron-like preferences, and the second-output-layer neurons exhibit a stimulus preference similar to that of cochlear nucleus, medial geniculate, and auditory cortical neurons. The features detected by the second-output-layer neurons reflect the statistical properties of the sounds used as input.

A simple visual model accounts for drift illusion and reveals illusory patterns

Daiki Nakamura[1], Shunji Satoh[1]
[1]The University of Electro-Communications

Abstract

Computational models of vision should not only be able to reproduce experimentally obtained results; such models should also be able to predict the input—output properties of vision. We assess whether a simple computational model of neurons in the Middle Temporal (MT) visual area proposed by the authors can account for illusory perception of "rotating drift patterns," by which humans perceive illusory rotation (clockwise or counterclockwise) depending on the background luminance. Moreover, to predict whether a pattern causes visual illusion or not, we generate an enormous set of possible visual patterns as inputs to the MT model: 8^8 =16,777,216 possible input patterns. Numerical quantities of model outputs by computer simulation for 8^8 inputs were used to estimate human illusory perception. Using psychophysical experiments, we show that the model prediction is consistent with human perception.

An Internal Model of the Human Hand Affects Recognition of Graspable Tools

Masazumi Katayama[1], Yusuke Akimaru[1]
[1]Department of Human and Artificial Intelligent Systems, Graduate School of Engineering, University of Fukui

Abstract

In this study, we validated a plausibility of a hypothesis that in the human brain an internal simulation of grasping contributes to tool recognition. Such an internal simulation must be performed by utilizing internal models of the human hand. An internal model corresponding to a geometrically transformed hand shape was retrained by an experimental paradigm we built. The retrained internal model of the dominant hand affected cognitive judgments of object size of tools used by the dominant hand and however did not influence these of tools used by the non-dominant hand. While, those results in the training condition of the non-dominant hand showed the reverse tendency of the former results. The above results indicate the plausibility of the hypothesis.

Perceptual Representation of Material Quality — Adaptation to BRDF-morphing Images —

Kouki Kudou[1], Ko Sakai[1]
[1]University of Tsukuba

Abstract

Perception of the material quality of a surface depends on its reflectance properties. Recent physiological studies reported the neural selectivity to glossy surfaces in the Inferior Temporal cortical areas. In the present study, we examine the hypothesis that basis neurons are selective to typical materials, and that the combinations of their responses are representative of a variety of natural materials. To assess the hypotheses, we performed a psychological experiment based on adaptation. If adaptation to a specific material is observed, the presence of neurons that are selective to the specific material is predicted. We performed adaptation tests with six typical material qualities including gloss, matte, metal and wood. We observed the adaptation to certain materials but not to some other materials. This result indicates the presence of basis neurons that are selective to materials, which is fundamentally important for understanding cortical representation of surface materials.

GPU-Accelerated Simulations of an Electric Stimulus and Neural Activities in Electrolocation

Kazuhisa Fujita[1], Yoshiki Kashimori[2]
[1]Tsuyama National College of Technology [2]Univ. of Electro-Communications

Abstract

To understand mechanism of information processing by a neural network, it is important to well know a sensory stimulus. However, it is hard to examine details of a real stimulus received by an animal. Furthermore, it is too hard to simultaneously measure a received stimulus and neural activities of a neural system. We have studied the electrosensory system of an electric fish in electrolocation. It is also difficult to measure the electric stimulus received by an electric fish in the real environment and neural activities evoked by the electric stimulus. To address this issue, we have applied computational simulation. We developed the simulation software accelerated by a GPU to calculate various electric stimuli and neural activities of the electrosensory system using a GPU. This paper describes comparison of computation time between CPUs and a GPU in calculation of the electric field and the neural activities.

Analysis of Similarity and Differences in Brain Activities between Perception and Production of Facial Expressions Using EEG Data and the NeuCube Spiking Neural Network Architecture

Hideaki Kawano[1], Akinori Seo[1], Zohreh Gholami Doborjeh[2], Nikola Kasabov[2], Maryam Gholami Doborjeh[2]
[1]Kyushu Institute of Technology [2]Auckland University of Technology

Abstract

This paper is a feasibility study of using the NeuCube spiking neural network (SNN) architecture for modeling EEG brain data related to perceiving versus mimicking facial expressions. It is demonstrated that the proposed model can be used to study the similarity and differences between corresponding brain activities as complex spatio-temporal patterns. Two SNN models are created for each of the 7 basic emotions for a group of Japanese subjects, one when subjects are perceiving an emotional face and another, when the same subjects are mimicking this emotion. The evolved connectivity in the two models are then subtracted to study the differences. The study, being based on the well-known mirror neuron concept in the brain, is the first to analyze and visualize similarity and differences as evolved spatio-temporal patterns in a brain-like SNN model.

Self and Non-self Discrimination Mechanism Based on Predictive Learning with Estimation of Uncertainty

Ryoichi Nakajo[1], Maasa Takahashi[1], Shingo Murata[1], Hiroaki Arie[1], Tetsuya Ogata[1]
[1]Waseda University

Abstract

In this paper,we propose a model that can explain the mechanism of self and non-self discrimination. Infants gradually develop their abilities for self—other cognition through interaction with the environment. Predictive learning has been widely used to explain the mechanism of infants ' development. We hypothesized that infants ' cognitive abilities are developed through predictive learning and the uncertainty estimation of their sensory-motor inputs. We chose a stochastic continuous time recurrent neural network, which is a dynamical neural network model, to predict uncertainties as variances. From the perspective of cognitive developmental robotics, a predictive learning experiment with a robot was performed. The results indicate that training made the robot predict the regions related to its body more easily. We confirmed that self and non-self cognitive abilities might be acquired through predictive learning with uncertainty estimation.

A Framework for Ontology Based Management of Neural Network as a Service

Erich Schikuta[1], Abdelkader Magdy[1], A. Baith Mohamed[2]
[1]University of Vienna [2]Arab Academy for Science and Technology & Maritime Transport, Egypt

Abstract

Neural networks proved extremely feasible for problems which are hard to solve by conventional computational algorithms due to excessive computational demand, as NP-hard problems, or even lack of a deterministic solution approach. In this paper we present a management framework for neural network objects based on ontology knowledge for the cloud-based neural network simulator N2Sky, which delivers neural network resources as a service on a world-wide basis. Core of this framework is the Neural Network Query Engine, N2Query, which allows users to specify their problem statements in form of natural language queries. It delivers a list of ranked N2Sky resources in return, providing solutions to these problems. The search algorithm applies a mapping process between a domain specific problem ontology and solution ontology.

Rhinal-hippocampal information flow reverses between memory encoding and retrieval

Juergen Fell[1], Tobias Wagner[1], Bernhard Staresina[2], Charan Ranganath[3], Christian Elger[1], Nikolai Axmacher[4]
[1]Dept. of Epileptology, Univ. of Bonn, Germany [2]Dept. of Psychology, Univ. of Birmingham, UK [3]Center for Neuroscience and Dept. of Psychology, Univ. of California, Davis, USA [4]Dept. of Psychology, Ruhr-University Bochum, Germany

Abstract
The medial temporal lobe is crucial for the encoding and retrieval of episodic long-term memories. It is widely assumed that memory encoding is associated with information transfer from sensory regions via the rhinal cortex into the hippocampus. Retrieval of information should then be associated with transfer in the reverse direction. However, experimental evidence for this mechanism is still lacking. Here, we show in human intracranial EEG data during two independent recognition memory paradigms that rhinal-hippocampal information flow significantly changes its directionality from encoding to retrieval. Using a novel phase-based method to analyze directional coupling of oscillations, coupling values were more positive (i.e., from rhinal cortex to the hippocampus) during encoding as compared to retrieval. These effects were observed in the delta (1-3 Hz) range where rhinal-hippocampal post-stimulus phase synchronization increased most robustly across both experiments.

Poster1-3 Theory & Algorithms

Modeling the propensity score with statistical learning

Kenshi Uchihashi[1], Atsunori Kanemura[1]
[1]National Institute of Advanced Industrial Science and Technology (AIST)

Abstract
The progress of the ICT technology has produced data-sources that continuously generate datasets with different features and possibly with partial missing values. Such heterogeneity can be mended by integrating several processing blocks, but a unified method to extract conclusions from such heterogeneous datasets would bring consistent results with lower complexity. This paper proposes a flexible propensity score estimation method based on statistical learning for classification, and compared its performance against classical generalized linear methods.

Analysis of the DNN-kWTA Network Model with Drifts in the Offset Voltages of Threshold Logic Units

Chi Sing Leung[1], Ruibin Feng[1], John Sum[2]
[1]City University of Hong Kong [2]National Chung Hsing University

Abstract
The structure of the dual neural network-based (DNN) k-winner-take-all (kWTA) model is much simpler than that of other kWTA models. Its convergence time and capability under the perfect condition were reported. However, in the circuit implementation, the threshold levels of the threshold logic units (TLUs) in the DNN-kWTA model may have some drifts. This paper analyzes the DNN-kWTA model under the imperfect condition, where there are some drifts in the threshold level. We show that given that the inputs are uniformly distributed in the range of [0,1], the probability that the DNN-kWTA model gives the correct output is greater than or equal to $(1-2\Delta)^n$, where Δ is the maximum drift level. Besides, we derive the formulas for the average convergent time and the variance of the convergent time under the drift situation.

Efficient Numerical Simulation of Neuron Models with Spatial Structure on Graphics Processing Units

Tsukasa Tsuyuki[1], Yuki Yamamoto[2], Tadashi Yamazaki[1]
[1]The University of Electro-Communications [2]Tokyo Medical and Dental University

Abstract

Computer simulation of multi-compartment neuron models is difficult, because writing the computer program is tedious but complicated, and it requires sophisticated numerical methods to solve partial differential equations (PDEs) that describe the current flow in a neuron robustly. For this reason, dedicated simulation software such as NEURON and GENESIS have been used widely. However, these simulators do not support hardware acceleration using graphics processing units (GPUs). In this study, we implemented a conjugate gradient (CG) method to solve linear equations efficiently on a GPU in our own software. CG methods are known much faster and more efficient than the Gaussian elimination, when the matrix is huge and sparse. As a result, our software succeeded to carry out a simulation of Purkinje cells developed by De Schutter and Bower (1994) on a GPU. The GPU (Tesla K40c) version realized 3 times faster computation than that a single-threaded CPU version for 15 Purkinje cells.

A Scalable Patch-Based Approach for RGB-D Face Recognition

Nesrine GRATI[1], Achraf Ben-Hamadou[2], Mohamed Hammami[1]
[1]Miracl Laboratory Sfax-Tunisia [2]Valeo

Abstract

This paper presents a novel approach for face recognition using low cost RGB-D cameras under challenging conditions. In particular, the proposed approach is based on salient points to extract local patches independently to the face pose. The classification is performed using a scalable sparse representation classification by an adaptive and dynamic dictionaries selection. The experimental results proved that the proposed algorithm achieves significant accuracy on three different RGB-D databases and competes with known approaches in the literature.

Gaussian Processes based fusion of multiple data sources for automatic identification of geological boundaries in mining

Katherine Silversides[1], Arman Melkumyan[1]
[1]The University of Sydney

Abstract

Mining stratified ore deposits such as Banded Iron Formation (BIF) hosted iron ore deposits requires detailed knowledge of the location of orebody boundaries. In one Marra Mamba style deposit, the alluvial to bedded boundary only creates distinctive signatures when both the magnetic susceptibility logs and the downhole chemical assays are considered. Identifying where the ore to BIF boundary occurs with the NS3-NS4 stratigraphic boundary requires both natural gamma logs and chemical assays. These data sources have different downhole resolutions. This paper proposes a Gaussian Processes based method of probabilistically processing geophysical logs and chemical assays together. This method improves the classification of the alluvial to bedded boundary and allows the identification of concurring stratigraphic and mineralization boundaries. The results will help to automatically produce more accurate and objective geological models, significantly reducing the need for manual effort.

Speaker Detection in Audio Stream via Probabilistic Prediction Using Generalized GEBI

Koki Sakata[1], Shota Sakashita[1], Kazuya Matsuo[1], Shuichi Kurogi[1]
[1]Kyushu Institute of Technology

Abstract

This paper presents a method of speaker detection using probabilistic prediction for avoiding the tuning of thresholds to detect a speaker in an audio stream. We introduce g-GEBI (generalized GEBI) as a generalization of BI (Bayesian Inference) and GEBI (Gibbs-distribution-based Extended BI) to execute iterative detection of a speaker in audio stream uttered by more than one speaker. Then, we show a method of probabilistic prediction in multiclass classification to classify the results of speaker detection. By means of numerical experiments using recorded real speech data, we examine the properties and the effectiveness of the present method. Especially, we show that g-GEBI and g-BI (generalized BI) are more effective than the conventional BI and GEBI in incremental speaker detection task.

Probabilistic Prediction for Text-Prompted Speaker Verification Capable of Accepting Spoken Words with the Same Meaning but Different Pronunciations

Shota Sakashita[1], Satoshi Takeguchi[1], Kazuya Matsuo[1], Shuichi Kurogi[1]
[1]Kyushu Institute of Technology

Abstract

So far, we have presented a method of probabilistic prediction using GEBI (Gibbs-distribution based Bayesian inference) for flexible text-prompted speaker verification. For more flexible and practical verification, this paper presents a method of verification capable of accepting spoken words with the same meaning but different pronunciations. For example, Japanese language has different pronunciations for a digit, such as /yon/ and /shi/ for 4, /nana/ and /shichi/ for 7, which are usually uttered via unintentional selection, and then it is a practical problem in speech verification of words involving digits, such as ID numbers. With several assumptions, we present a modification of GEBI for dealing with such words. By means of numerical experiments using recorded real speech data, we examine the properties of the present method and show the validity and the effectiveness.

Segment-Level Probabilistic Sequence Kernel based Support Vector Machines for Classification of Varying Length Patterns of Speech

Shikha Gupta[1], Veena Thenkanidiyoor[2], Dileep A.D[1]
[1]IIT Mandi, H.P India [2]Department of CSE, National Institute of Technology Goa, Ponda, Goa, India

Abstract

In this work we propose the segment-level probabilistic sequence kernel (SLPSK) as dynamic kernel to be used in support vector machine (SVM) for classification of varying length patterns of long duration speech represented as sets of feature vectors. SLPSK is built upon a set of Gaussian basis functions, where half of the basis functions contain class specific information while the other half implicates the common characteristics of all the speech utterances of all classes. The proposed kernel is computed between the pair of examples, by partitioning the speech signal into fixed number of segments and then matching the corresponding segments. We study the performance of the SVM-based classifiers using the proposed SLPSK using different pooling technique for speech emotion recognition and speaker identification and compare with that of the SVM-based classifiers using other kernels for varying length patterns.

Attention Estimation for Input Switch in Scalable Multi-Display Environments

Xingyuan Bu[1], Mingtao Pei[1], Yunde Jia[1]
[1]Beijing Institute of Technology

Abstract

Multi-Display Environments (MDEs) have become commonplace in office desks for editing and displaying different tasks, such as coding, searching, reading, and video-communicating. In this paper, we present a method of automatic switch for routing one input (including mouse/keyboard, touch pad, joystick, etc.) to different displays in scalable MDEs based on the user attention estimation. We set up an MDE in our office desk, in which each display is equipped with a webcam to capture the user's face video for detecting if the user is looking at the display. We use Convolutional Neural Networks (CNNs) to learn the attention model from face videos with various poses, illuminations, and occlusions for achieving a high performance of attention estimation. Qualitative and quantitative experiments demonstrate the effectiveness and potential of the proposed approach. The results of the user study also shows that the participants deemed that the system is wonderful, useful, and friendly.

Deep Dictionary Learning vs Deep Belief Network vs Stacked Autoencoder: An Empirical Analysis

Vanika Singhal[1], Anupriya Gogna[1], Angshul Majumdar[1]
[1]IIIT Delhi

Abstract

A recent work introduced the concept of deep dictionary learning. The first lev-el is a dictionary learning stage where the inputs are the training data and the outputs are the dictionary and learned coefficients. In subsequent levels of deep dictionary learning, the learned coefficients from the previous level acts as in-puts. This is an unsupervised representation learning technique. In this work we empirically compare and contrast with similar deep representation learning techniques — deep belief network and stacked autoencoder. We delve into two aspects; the first one is the robustness of the learning tool in the presence of noise and the second one is the robustness with respect to variations in the number of training samples. The experiments have been carried out on several benchmark datasets. We find that the deep dictionary learning method is the most robust.

Bi-directional LSTM Recurrent Neural Network for Chinese Word Segmentation

Yushi Yao[1], Zheng Huang[1]
[1]Shanghai Jiaotong University

Abstract

Recurrent neural network(RNN) has been broadly applied to natural language process(NLP) problems. This kind of neural network is designed for modeling sequential data and has been testified to be quite efficient in sequential tagging tasks. In this paper, we propose to use bi-directional RNN with long short-term memory(LSTM) units for Chinese word segmentation, which is a crucial task for modeling Chinese sentences and articles. Classical methods focus on designing and combining hand-craft features from context, whereas bi-directional LSTM network(BLSTM) does not need any prior knowledge or pre-designing, and is expert in creating hierarchical feature representation of contextual information from both directions. Experiment result shows that our approach gets state-of-the-art performance in word segmentation on both traditional Chinese datasets and simplified Chinese datasets.

Alternating optimization method based on nonnegative matrix factorizations for deep neural networks

Tetsuya Sakurai[1], Akira Imakura[1], Yuto Inoue[1], Yasunori Futamura[1]
[1]University of Tsukuba

Abstract

The backpropagation algorithm for calculating gradients has been widely used in computation of weights for deep neural networks (DNNs). This method requires derivatives of objective functions and has some difficulties finding appropriate parameters such as learning rate. In this paper, we propose a novel approach for computing weight matrices of fully-connected DNNs by using two types of semi-nonnegative matrix factorizations (semi-NMFs). In this method, optimization processes are performed by calculating weight matrices alternately, and backpropagation (BP) is not used. We also present a method to calculate stacked autoencoder using a NMF. The output results of the autoencoder are used as pre-training data for DNNs. The experimental results show that our method using three types of NMFs attains similar error rates to the conventional DNNs with BP.

Fissionable Deep Neural Network

DongXu Tan[1], JunMin Wu[2], HuanXin Zheng[3], Yan Yin[3], YaXin Liu[1]
[1]School of Software Engineering of USTC [2]Suzhou Institute for Advanced Study of USTC [3]Department of Computer Science and Technology of USTC

Abstract

Model combination nearly always improves the performance of machine learning methods. Averaging the predictions of multi-model further decreases the error rate. In order to obtain multi high quality models more quickly, this article proposes a novel deep network architecture called "Fissionable Deep Neural Network", abbreviated as FDNN. Instead of just adjusting the weights in a fixed topology network, FDNN contains multi branches with shared parameters and multi Softmax layers. During training, the model divides until to be multi models. FDNN not only can reduce computational cost, but also overcome the interference of convergence between branches and give an opportunity for the branches falling into a poor local optimal solution to re-learn. It improves the performance of neural network on supervised learning which is demonstrated on MNIST and CIFAR-10 datasets.

A Structural Learning Method of Restricted Boltzmann Machine by Neuron Generation and Annihilation Algorithm

Shin Kamada[1], Takumi Ichimura[2]
[1]Graduate School of Information Sciences, Hiroshima City University, Japan [2]Faculty of Management and Information Systems, Prefectural University of Hiroshima, Japan

Abstract

Restricted Boltzmann Machine (RBM) is a generative stochastic energy-based model of artificial neural network for unsupervised learning. The adaptive learning method that can discover an optimal number of hidden neurons according to the input space is important method in terms of the stability of energy as well as the computational cost although a traditional RBM model cannot change its network structure during learning phase. Moreover, we should consider the regularities in the sparse of network to extract explicit knowledge from the network because the trained network is often a black box. In this paper, we propose the adaptive and structural learning method of RBM with Forgetting that can discover the regularities in the trained network which is the optimal structure by the neuron generation and annihilation algorithm. We evaluated our proposed model on MNIST and CIFAR-10 datasets.

Semi-supervised Learning for Convolutional Neural Networks using Mild Supervisory Signals

Takashi Shinozaki[1]
[1]NICT CiNet

Abstract

We propose a novel semi-supervised learning method for convolutional neural networks (CNNs). CNN is one of the most popular models for deep learning and its successes among various types of applications include image and speech recognition, image captioning, and the game of 'go'. However, the requirement for a vast amount of labeled data for supervised learning in CNNs is a serious problem. Unsupervised learning, which uses the information of unlabeled data, might be key to addressing the problem, although it has not been investigated sufficiently in CNN regimes. The proposed method involves both supervised and unsupervised learning in identical feedforward networks, and enables seamless switching among them. We validated the method using an image recognition task. The results showed that learning using non-labeled data dramatically improves the efficiency of supervised learning.

On the Singularity in Deep Neural Networks

Tohru Nitta[1]
[1]National Institute of Advanced Industrial Science and Technology

Abstract

In this paper, we analyze a deep neural network model from the viewpoint of singularities. First, we show that there exist a large number of critical points introduced by a hierarchical structure in the deep neural network as straight lines. Next, we derive sufficient conditions for the deep neural network having no critical points introduced by a hierarchical structure.

A Deep Neural Network Architecture Using Dimensionality Reduction with Sparse Matrices

Wataru Matsumoto[1], Manabu Hagiwara[2], Petros Boufounos[3], Kunihiko Fukushima[1,4], Toshisada Mariyama[1], Zhao Xiongxin[1]
[1]Mitsubishi Electric Corporation, Information Technology R&D Center, Kanagawa, Japan [2]Chiba University, Chiba, Japan [3]Mitsubishi Electric Research Laboratories, Cambridge, MA, USA [4]Fuzzy Logic System Institute, Fukuoka, Japan.

Abstract
We present a new deep neural network architecture, motivated by sparse random matrix theory, which uses a low-complexity embedding through a sparse matrix instead of a conventional stacked autoencoder. We regard autoencoders as an information-preserving dimensionality reduction method, similar to random projections in compressed sensing. Thus, exploiting recent theory on sparse matrices for dimensionality reduction, we demonstrate experimentally that classification performance does not deteriorate if the autoencoder is replaced with a computationally-efficient sparse dimensionality reduction matrix.

Noisy Softplus: A Biology Inspired Activation Function

Qian Liu[1], Steve Furber[1]
[1]University of Manchester

Abstract
The Spiking Neural Network (SNN) has not achieved the recognition/classification performance of its non-spiking competitor, the Artificial Neural Network(ANN), particularly when used in deep neural networks. The mapping of a well-trained ANN to an SNN is a hot topic in this field, especially using spiking neurons with biological characteristics. This paper proposes a new biologically-inspired activation function, Noisy Softplus, which is well-matched to the response function of LIF (Leaky Integrate-and-Fire) neurons. A convolutional network (ConvNet) was trained on the MNIST database with Noisy Softplus units and converted to an SNN while maintaining a close classification accuracy. This result demonstrates the equivalent recognition capability of the more biologically-realistic SNNs and bring biological features to the activation units in ANNs.

Compressing Word Embeddings

Martin Andrews[1]
[1]Red Cat Labs

Abstract

Recent methods for learning vector space representations of words have succeeded in capturing fine-grained semantic and syntactic regularities using large-scale unlabelled text analysis. However, these representations typically consist of dense vectors that require a great deal of storage and cause the internal structure of the vector space to be opaque. A more idealized representation of a vocabulary would be both compact and readily interpretable. With this goal, this paper first shows that Lloyd's algorithm can compress the standard dense vector representation by a factor of 10 without much loss in performance. Then, using that compressed size as a 'storage budget', we describe a new GPU-friendly factorization procedure to obtain a representation which gains interpretability as a side-effect of being sparse and non-negative in each encoding dimension. Word similarity and word-analogy tests are used to demonstrate the effectiveness of the compressed representations obtained.

October 19 (Wednesday)

Plenary 3	Clock Tower Centennial Hall	9:30	–	10:20
chair:	Ko Sakai			

DecNef: tool for revealing brain-mind causal relation
Mitsuo Kawato
Director, ATR Brain Information Communication Research Laboratory Group

WedAM-1 **Brain-machine interface**
Chair: Bao-Liang Lu, Kazushi Ikeda
Room: International Conference Hall I

10:40	-	11:00	Emotion Recognition Using Multimodal Deep Learning Wei Liu[1], Wei-Long Zheng[1], Bao-Liang Lu[1] [1]Shanghai Jiao Tong University
11:00	-	11:20	Continuous Vigilance Estimation using LSTM Neural Networks Nan Zhang[1], Wei-Long Zheng[1], Wei Liu[1], Bao-Liang Lu[1] [1]Shanghai Jiao Tong University
11:20	-	11:40	Motor Priming as a Brain-computer Interface Tom Stewart[1], Kiyoshi Hoshino[1], Andrzej Cichocki[2], Tomasz Rutkowski[3] [1]University of Tsukuba [2]RIKEN Brain Science Institute [3]The University of Tokyo
11:40	-	12:00	Discriminating Object from Non-Object Perception in a Visual Search Task by Joint Analysis of Neural and Eyetracking Data Andrea Finke[1], Helge Ritter[1] [1]Bielefeld University
12:00	-	12:20	Assessing the Properties of Single-Trial Fixation-Related Potentials in a Complex Choice Task Dennis Wobrock[1], Andrea Finke[2] [1]CITEC Bielefeld [2]Bielefeld University

WedAM-3 Computer Vision 1
Chair: Hayaru Shouno
Room: International Conference Hall III

10:40	-	11:00	Unconstrained face detection from a mobile source using convolutional neural networks Shonal Chaudhry[1], Rohitash Chandra[2] [1]Artificial Intelligence and Cybernetics Research Group [2]Nanyang Technological University
11:00	-	11:20	Driver Face Detection Based on Aggregate Channel Features and Deformable Part-Based Model in Traffic Camera Yang Wang[1], Xiaoma Xu[2], Mingtao Pei[1] [1]Beijing Institute of Technology [2]PetroChina
11:20	-	11:40	Segmentation with Selectively Propagated Constraints Peng Han[1], Guangzhen Liu[1], Songfang Huang[2], Wenwu Yuan[1], Zhiwu Lu[1] [1]Renmin University of China [2]IBM China Research Lab
11:40	-	12:00	Gaussian-Bernoulli Based Convolutional Restricted Boltzmann Machine for Images Feature Extraction Ziqiang Li[1], Xun Cai[1], Ti Liang[1] [1]Shandong university
12:00	-	12:20	Gaze Movement Control Neural Network Based on Multidimensional Topographic Class Grouping Wenqi Zhong[1], Jun Miao[1], Laiyun Qing[2] [1]Institute of Computing Technology, Chinese Academy of Sciences [2]University of Chinese Academy of Sciences

WedAM-4 **Machine Learning 4**
Chair: Gergana Lazarova, Nicoló Navarin
Room: Conference Room III

10:40	-	11:00	Kernel L1-minimization: Application to Kernel Sparse Representation based Classification Anupriya Gogna[1], Angshul Majumdar[1] [1]IIIT Delhi
11:00	-	11:20	Nuclear Norm Regularized Randomized Neural Network Anupriya Gogna[1], Angshul Majumdar[1] [1]IIIT Delhi
11:20	-	11:40	Gram-Schmidt Orthonormalization to the Adaptive ICA Function for Fixing the Permutation Ambiguity Yoshitatsu Matsuda[1], Kazunori Yamaguchi[1] [1]The University of Tokyo
11:40	-	12:00	Data Cleaning Using Complementary Fuzzy Support Vector Machine Technique Ratchakoon Pruengkarn[1], Kok Wai Wong[1], Chun Che Fung[1] [1]Murdoch University
12:00	-	12:20	Fault-Tolerant Incremental Learning for Extreme Learning Machines Chi Sing Leung[1], Ho Chun Leung[1], Eric Wong[1] [1]City University of Hong Kong

WedAM-5 **Time Series Analysis**
Chair: Min Han
Room: Conference Room IV

10:40	-	11:00	Chaotic feature selection and reconstruction in time series prediction Shamina Hussein[1], Rohitash Chandra[2] [1]The University of the South Pacific [2]Nanyang Technological University
11:00	-	11:20	$L_{1/2}$ Norm Regularized Echo State Network for Chaotic Time Series Prediction Meiling Xu[1], Min Han[1], Shunshoku Kanae[2] [1]Dalian University of Technology [2]Fukui University
11:20	-	11:40	SVD and Text Mining Integrated Approach to Measure Effects of Disasters on Japanese Economics – Effects of the Thai Flooding in 2011– Yukari Shirota[1], Yuriko Yano[1] [1]Gakushuin University
11:40	-	12:00	Deep Belief Network using Reinforcement Learning and its Applications to Time Series Forecasting Takaomi Hirata[1], Takashi Kuremoto[2], Masanao Obayashi[1], Shingo Mabu[2], Kunikazu Kobayashi[2] [1]Yamaguchi University, [2]Aichi Prefectural University
12:00	-	12:20	Neuron-Network Level problem decomposition method for Cooperative Coevolution of Recurrent Networks for Time Series Prediction Ravneil Nand[1], Emmenual Reddy[1], Mohammed Naseem[1] [1]University of the South Pacific

WedPM1-1	**Data-Driven Approach for Extracting Latent Features from Multi-Dimensional Data 1**
Chair:	Toshiaki Omori, Seiichi Ozawa
Room:	International Conference Hall I

14:00	-	14:20	Yet Another Schatten Norm for Tensor Recovery Chao Li[1], Lili Guo[1], Yu Tao[1], Jinyu Wang[1], Lin Qi[1], Zheng Dou[1] [1]Harbin Engineering University
14:20	-	14:40	Memory of reading literature in a hippocampal network model based on theta phase coding Naoyuki Sato[1] [1]Future University Hakodate
14:40	-	15:00	Combining Deep Learning and Preference Learning for Object Tracking Shuchao Pang[1] Juan del Coz[2] Zhezhou Yu[1] Oscar Luaces[2] Jorge Diez[2] [1]College of Computer Science and Technology, Jilin University, China [2]Artificial Intelligence Center, University of Oviedo at Gijón, Spain
15:00	-	15:20	A Cost-sensitive Learning Strategy for Feature Extraction from Imbalanced Data Ali Braytee[1], Wei Liu[1], Paul Kennedy[1] [1]UTS

WedPM1-3 Computer Vision 2
Chair: Rohitash Chandra, Yide Ma
Room: International Conference Hall III

14:00	-	14:20	Incremental Robust Nonnegative Matrix Factorization for Object tracking Fanghui Liu[1], Mingna Liu[2], Tao Zhou[1], Yu Qiao[3], Jie Yang[1] [1]Shanghai Jiao Tong University [2]Shanghai Institute of Spaceflight Control Technology, Infrared Detection Technology Research and Development Center, China Aerospace Science and Technology Corporation [3]Institute of Image Processing and Pattern Recognition, Shanghai Jiao Tong University
14:20	-	14:40	High precision direction-of-arrival estimation for wideband signals in environment with interference based on complex-valued neural networks Kazutaka Kikuta[1], Akira Hirose[1] [1]The University of Tokyo
14:40	-	15:00	Content-based Image Retrieval Using Deep Search Zhengzhong Zhou[1], Liqing Zhang[1] [1]Shanghai Jiao Tong University
15:00	-	15:20	Robust Part-Based Correlation Tracking Xiaodong Liu[1], Yue Zhou[1] [1]Institute of Image Processing and Pattern Recognition, Shanghai Jiao Tong University
15:20	-	15:40	A new Weight Adjusted Particle Swarm Optimization for Real-time Multiple Object Tracking Guang Liu[1], Zhenghao Chen[1], Henry Fung Yeung[1], Yuk Ying Chung[1], Wei-Chang Yeh[2] [1]the University of Sydney [2]National Tsing Hua University, Taiwan

WedPM1-4 **Machine Learning 5**
Chair: Katsuyuki Hagiwara, Chi Sing Leung
Room: Conference Room III

14:00	-	14:20	Character-Aware Convolutional Neural Networks for Paraphrase Identification Jiangping Huang[1], Donghong Ji[1], Shuxin Yao[2], Wenzhi Huang[1] [1]Wuhan University [2]Carnegie Mellon University
14:20	-	14:40	Learning a Discriminative Dictionary with CNN for Image Classification Shuai Yu[1], Jie Yang[1], Tao Zhang[1], Chao Ma[1], Lei Zhou[1], Xiangjian He[2] [1]Shanghai Jiao Tong University [2]University of Technology, Sydney, Australia
14:40	-	15:00	Online Weighted Multi-Task Feature Selection Wei Xue[1], Wensheng Zhang[2] [1]Nanjing University of Science and Technology [2]Chinese Academy of Sciences
15:00	-	15:20	Multithreading incremental learning scheme for embedded system to realize a high-throughput Daisuke Nishio[1], Koichiro Yamauchi[1] [1]Chubu University
15:20	-	15:40	Hyper-parameter tuning for graph kernels via Multiple Kernel Learning Carlo Maria Massimo[1], Nicolò Navarin[1], Alessandro Sperduti[1] [1]University of Padova

WedPM1-5 Topological and Graph Based Clustering Methods 1
Chair: Rushed Kanawati, Nistor Grozavu
Room: Conference Room IV

14:00	-	15:00	Tutorial Topological and Graph Based Clustering: Recent Algorithmic Advances Rushed Kanawati[1], Nistor Grozavu[1] [1] A3-LIPN, University Sorbonne Paris Cité
15:00	-	15:20	Parcellating whole brain for individuals by simple linear iterative clustering Jing Wang[1], Zilan Hu[2], Haixian Wang[1] [1]Southeast University [2]School of Mathematics and Physics, Anhui University of Technology, Maanshan, Anhui 243002, PR China
15:20	-	15:40	Overlapping Community Structure Detection of Brain Functional Network Using Non-negative Matrix Factorization Xuan Li[1], Zilan Hu[2], Haixian Wang[1] [1]Southeast University [2]School of Mathematics and Physics, Anhui University of Technology, Maanshan, Anhui 243002, PR China

WedPM2-1	**Data-Driven Approach for Extracting Latent Features from Multi-Dimensional Data 2**
Chair:	Toshiaki Omori, Seiichi Ozawa
Room:	International Conference Hall I

16:00	-	16:20	Nonnegative Tensor Train Decompositions for Multi-Domain Feature Extraction and Clustering Namgil Lee[1], Anh-Huy Phan[1], Fengyu Cong[2], Andrzej Cichocki[1] [1]RIKEN Brain Science Institute [2]Dalian University of Technology
16:20	-	16:40	Hyper-Parameter Optimization of Sticky HDP-HMM Through an Enhanced Particle Swarm Optimization Jiaxi Li[1], JunFu Yin[1], Yuk Ying Chung[1], Feng Sha[1] [1]University of Sydney
16:40	-	17:00	Approximate inference method for dynamic interactions in larger neural populations Christian Donner[1], Hideaki Shimazaki[2] [1]Bernstein Center for Compuational Neuroscience Berlin [2]RIKEN Brain Science Institute
17:00	-	17:20	Features learning and transformation based on Deep Autoencoders Eric Janvier[1], Nistor Grozavu[2], Thierry Couronne[1] [1]Mindlytix [2]LIPN, Paris 13 University
17:20	-	17:40	t-Distributed Stochastic Neighbor Embedding with Inhomogeneous Degrees of Freedom Jun Kitazono[1], Nistor Grozavu[2], Nicoleta Rogovschi[3], Toshiaki Omori[1], Seiichi Ozawa[1] [1]Kobe University [2]LIPN, Paris 13 University [3]LIPADE, University of Paris Descartes

WedPM2-3 Computer Vision 3
Chair: Rohitash Chandra, Yide Ma
Room: International Conference Hall III

16:00	-	16:20	Fast Visual Object Tracking Using Convolutional Filters Mingxuan Di[1] Guang Yang[1] Qinchuan Zhang[1] Kang Fu[1] Hongtao Lu[1] [1]Shanghai Jiao Tong University
16:20	-	16:40	An Effective Approach for Automatic LV Segmentation Based on GMM and ASM Yurun Ma[1], Deyuan Wang[1], Yide Ma[1], Ruoming Lei[1], Min Dong[1], Kemin Wang[1], Li Wang[1] [1]Lanzhou University
16:40	-	17:00	Position Gradient and Plane Consistency based Feature Extraction Sujan Chowdhury[1], Brijesh Verma[1], Ligang Zhang[1] [1]Central Queensland University
17:00	-	17:20	Fusion of Multi-View Multi-Exposure Images with Delaunay Triangulation Hanyi Yu[1], Yue Zhou[2] [1]Institute of Image Processing and Pattern Recognition, Shanghai Jiao Tong University [2]Institude of Image Processing and Pattern Recognition, Shanghai Jiao Tong University
17:20	-	17:40	Detection of Human Faces using Neural Networks Mozammel Chowdhury[1], Junbin Gao[2], Rafiqul Islam[1] [1]Charles Sturt University [2]University of Sydney, Australia

WedPM2-4 **Machine Learning 6**
Chair: Katsuyuki Hagiwara, Chi Sing Leung
Room: Conference Room III

16:00	-	16:20	A Corrector for the Sample Mahalanobis Distance Free from Estimating the Population Eigenvalues of Covariance Matrix Yasuyuki Kobayashi[1] [1]Teikyo University
16:20	-	16:40	Online Learning Neural Network for Adaptively Weighted Hybrid Modeling Shaoming Yang[1], Yalin Wang[1], Yongfei Xue[1], Bei Sun[1], Busong Yang[1] [1]Central South University, School of Information Science and Engineering
16:40	-	17:00	Semi-supervised Support Vector Machines - a Genetic Algorithm Approach Gergana Lazarova[1] [1]Sofia University St. Kliment Ohridski
17:00	-	17:20	Hinge Loss Projection for Classification Syukron Ishaq Alfarozi[1], Kuntpong Woraratpanya[1], Kitsuchart Pasupa[1], Masanori Sugimoto[2] [1]Faculty of Information Technology, King Mongkut's Institute of Technology Ladkrabang [2]Hokkaido University

WedPM2-5 Topological and Graph Based Clustering Methods 2
Chair: Rushed Kanawati, Nistor Grozavu
Room: Conference Room IV

16:00	-	16:20	Collaborative-based multi-scale clustering in very high resolution satellite Images Jeremie Sublime[1] Antoine Cornuéjols[1] Younes Bennani[2] [1]AgroParisTech [2]University Paris 13
16:20	-	16:40	Towards Ontology Reasoning for Topological Cluster Labeling Hatim Chahdi[1], Nistor Grozavu[2] [1]UMR Espace-Dev & LIPN [2]LIPN, Paris 13 University
16:40	-	17:00	Overlapping community detection using core label propagation and belonging function Jean-Philippe Attal[1], Maria Malek[1], Marc Zolghadri[2] [1]EISTI : École internationale des sciences du traitement de línformation [2]SUPMECA
17:00	-	17:20	A new clustering algorithm for dynamic data Parisa Rastin[1], Tong Zhang[1], Guenael Cabanes[1] [1]Université Paris 13

Poster2-1 : Applications
Room International Conference Hall II

Inferring Users' Gender from Interests: A Tag Embedding Approach
Peisong Zhu[1], Tieyun Qian[1], Ming Zhong[1], Xuhui Li[1]
[1]Wuhan University

Fast color quantization via fuzzy clustering
Laszlo Szilagyi[1,2], Gellert Denesi[1], Calin Enachescu[3]
[1]Sapientia University of Transylvania, Tirgu Mures, Romania [2]Budapest University of Technology and Economics, Hungary [3]Petru Maior University of Tirgu Mures, Romania

Extended Dependency-Based Word Embeddings for Aspect Extraction
Xin Wang[1], Yuanchao Liu[1], Chengjie Sun[1], Ming Liu[1], Xiaolong Wang[1]
[1]Harbin Institute of Technology

Topological Order Discovery via Deep Knowledge Tracing
Jiani Zhang[1], Irwin King[1]
[1]the Chinese University of Hong Kong

PTR: Phrase-Based Topical Ranking for Automatic Keyphrase Extraction in Scientific Publications
Minmei Wang[1], Bo Zhao[1], Yihua Huang[1]
[1]The National Key Laboratory for Novel Software Technology, Department of Computer Science and Technology, Nanjing University, China

Neural Network Based Association Rule Mining from Uncertain Data
Sameen Mansha[1], Zaheer Babar[1], Faisal Kamiran[1], Asim Karim[2]
[1]Information technology University, Punjab, Lahore, Pakistan [2]Lahore University of Management Sciences, Pakistan

Analysis and knowledge discovery by means of Self-Organising Maps for Gaia data releases
M. Álvarez[1], Carlos Dafonte[1], Daniel Garabato[1], Minia Manteiga[1]
[1]University of A Coruna

Poster2-2 : Computational & Cognitive Neurosciences
Room International Conference Hall II

Computational Model of the Cerebellum and the Basal Ganglia for Interval Timing Learning
Ohki Katakura[1], Tadashi Yamazaki[1]
[1]The University of Electro-Communications.

Bihemispheric cerebellar spiking network model to simulate acute VOR motor learning
Keiichiro Inagaki[1], Yutaka Hirata[1]
[1]Chubu University

Poster2-3 : Theory & Algorithms
Room International Conference Hall II

An Iterative Incremental Learning Algorithm for Complex-Valued Hopfield Associative Memory
Naoki Masuyama[1], Chu Kiong Loo[1]
[1]University of Malaya

LDA-Based Word Image Representation for Keyword Spotting on Historical Mongolian Documents
Hongxi Wei[1], Guanglai Gao[1], Xiangdong Su[1]
[1]Inner Mongolia University

Solving the Vanishing Information Problem with Repeated Potential Mutual Information Maximization
Ryotaro Kamimura[1]
[1]Tokai University

Self-Organization on a Sphere with Application to Topological Ordering of Chinese Characters
Andrew Paplinski[1]
[1]Monash University

A Spectrum Allocation Algorithm Based on Optimization and Protection in Cognitive Radio Networks
Jing Gao[1], Jianyu Lv[1], Song Xin[1]
[1]Northeastern University

A Conjugate Gradient-based Efficient Algorithm for Training Single Hidden Layer Neural Networks
Xiaoling Gong[1], Jian Wang[1]
[1]China University of Petroleum

The Ability of Learning Algorithms for Fuzzy Inference Systems using Vector Quantization
Hirofumi Miyajima[1], Noritaka Shigei[2], Hiromi Miyajima[2]
[1]Nagasaki University [2]Kagoshima University

Learning Phrase Representations Based on Word and Character Embeddings
Jiangping Huang[1], Donghong Ji[1], Shuxin Yao[2], Wenzhi Huang[1], Bo Chen[1]
[1]Wuhan University [2]Carnegie Mellon University

A Mobile-Based Obstacle Detection Method: Application to the Assistance of Visually Impaired People
Manal Alshehri[1], Salma Kammoun Jarraya[2], Hanene Ben-Abdallah[2]
[1]Faculty of Computing and Information Technology, King Abdulaziz University, Jeddah, Saudi Arabia [2]Faculty of Computing and Information Technology, King Abdulaziz University, Jeddah, Saudi Arabia, MIRACL Laboratory

t-SNE based Visualisation and Clustering of Geological Domain
Mehala Balamurali[1], Arman Melkumyan[1]
[1]University of Sydney

Data-based Optimal Tracking Control of Nonaffine Nonlinear Discrete-time Systems
Biao Luo[1], Derong Liu[2], Tingwen Huang[3], Chao Li[1]
[1]Institute of Automation, Chinese Academy of Sciences [2]University of Science and Technology Beijing [3]Texas A&M University at Qatar

Parallel Learning for Combined Knowledge Acquisition Model
Kohei Henmi[1], Motonobu Hattori[1]
[1]University of Yamanashi

Time series classification based on multi-codebook important time subsequence approximation algorithm
Zhiwei Tao[1], Li Zhang[1], Bangjun Wang[1], Fanzhang Li[1]
[1]Soochow University

Performance Improvement via Bagging in Ensemble Prediction of Chaotic Time Series Using Similarity of Attractors and LOOCV Predictable Horizon
Mitsuki Toidani[1], Kazuya Matsuo[1], Shuichi Kurogi[1]
[1]Kyushu Institute of Technology

A review of EEG Signal Simulation methods
Ibrahima Faye[1], Muhammad Izhan Noorzi[1]
[1]Universiti Teknologi PETRONAS

A New Blind Image Quality Assessment Based on Pairwise
Jianbin Jiang[1], Yue Zhou[1], Liming He[1]
[1]Institude of Image Processing and Pattern Recognition, Shanghai Jiao Tong University

Self-organizing maps as feature detectors for supervised neural network pattern recognition
Macario II Cordel[1], Arren Matthew Antioquia[1], Arnulfo Azcarraga[1]
[1]De La Salle University

A Review of Electroencephalogram-based Analysis and Classification Frameworks for Dyslexia
Harshani Perera[1], Mohd Fairuz Shiratuddin[1], Kok Wai Wong[1]
[1]Murdoch University

Rule-Based Grass Biomass Classification for Roadside Fire Risk Assessment
Ligang Zhang[1], Brijesh Verma[1]
[1]Central Queensland University

Efficient Recognition of Attentional Bias using EEG data and the NeuCube Evolving Spatio-Temporal Data Machine
Zohreh Gholami Doborjeh[1], Maryam Gholami Doborjeh[1], Nikola Kasabov[1]
[1]Auckland University of Technology

Plenary 3 (abstract)

Plenary 3 Clock Tower Centennial Hall

DecNef: tool for revealing brain-mind causal relation

Mitsuo Kawato[1]
[1] Director, ATR Brain Information Communication Research Laboratory Group, Kyoto, Japan

Abstract

One of the most important hypotheses in neuroscience is that human mind is caused by a specific spatiotemporal activity pattern in the brain. Here, human mind includes perception, emotion, movement control, action plan, attention, memory, metacognition and consciousness. This is a central hypothesis for computational and system neuroscience, but has never been experimentally examined. One of the reasons for this failure is that most neuroscientists including myself, from the beginning, gave up the possibility to experimentally control spatiotemporal brain activity in humans. Decoded neurofeedback (DecNef) is a novel method to fulfill this requirement by combining real-time fMRI neurofeedback, decoding of multi-voxel patterns by sparse machine learning algorithms, and reinforcement learning by human participants while avoiding "curse of dimensionality". Kazuhisa Shibata and colleagues demonstrated that V1/V2 patterns can be controlled for specific orientation information (Science, 2011). In the past 5 years, we succeeded to control color in V1/V2 (Amano et al., Curr Biol, 2016), facial preference in the cingulate cortex (Shibata et al., PLoS Biol, 2016), perceptual confidence for motion discrimination in dorsolateral prefrontal cortex and inferior parietal lobule (Cortese et al., under review, 2016), and reduction of fear memory in V1/V2 (Koizumi et al., under revision, 2016) by DecNef. Furthermore, DecNef was shown to be capable of changing brain dynamics for therapeutic purposes (central pain by Yanagisawa, Saito et al., obsessive and compulsive disorder by Sakai and Tanaka).

Biography

Mitsuo Kawato received the B.S. degree in physics from Tokyo University in 1976 and the M.E. and Ph.D. degrees in biophysical engineering from Osaka University in 1978 and 1981, respectively. From 1981 to 1988, he was a faculty member and lecturer at Osaka University. From 1988, he was a senior researcher and then a supervisor in ATR Auditory and Visual Perception Research Laboratories. In 1992, he became department head of Department 3, ATR Human Information Processing Research Laboratories. From 2003, he has been Director of ATR Computational Neuroscience Laboratories. For the last 30 years, he has been working in computational neuroscience.

Wednesday AM (abstract)

WedAM-1 Brain-machine interface

Emotion Recognition Using Multimodal Deep Learning

Wei Liu[1], Wei-Long Zheng[1], Bao-Liang Lu[1]
[1]Shanghai Jiao Tong University

Abstract

To enhance the performance of affective models and reduce the cost of acquiring physiological signals for real-world applications, we adopt multimodal deep learning approach to construct affective models with SEED and DEAP datasets to recognize different kinds of emotions. We demonstrate that high level representation features extracted by the Bimodal Deep AutoEncoder (BDAE) are effective for emotion recognition. With the BDAE network, we achieve mean accuracies of 91.01% and 83.25% on SEED and DEAP datasets, respectively, which are much superior to those of the state-of-the-art approaches. By analysing the confusing matrices, we found that EEG and eye features contain complementary information and the BDAE network could fully take advantage of this complement property to enhance emotion recognition.

Continuous Vigilance Estimation using LSTM Neural Networks

Nan Zhang[1], Wei-Long Zheng[1], Wei Liu[1], Bao-Liang Lu[1]
[1]Shanghai Jiao Tong University

Abstract

In this paper, we propose a novel continuous vigilance estimation approach using LSTM Neural Networks and combining Electroencephalogram (EEG) and forehead Electrooculogram (EOG) signals. We combine these two modalities to leverage their complementary information using a multimodal deep learning method. Moreover, since the change of vigilance level is a time dependent process, temporal dependency information is explored in this paper, which significantly improves the performance of vigilance estimation. We introduce two Recurrent Neural Network (RNN) architectures, the F-LSTM and the S-LSTM, to encode the time sequences of EEG and EOG into a high level combined representation, from which we can predict the vigilance levels. The experimental results demonstrate that both of the two RNN multimodal structures can improve the performance of vigilance estimation models in comparison with the single modality models and non-temporal dependent models

Motor Priming as a Brain-computer Interface

Tom Stewart[1], Kiyoshi Hoshino[1], Andrzej Cichocki[2], Tomasz Rutkowski[3]
[1]University of Tsukuba [2]RIKEN Brain Science Institute [3]The University of Tokyo

Abstract

This paper reports on a project to overcome a difficulty associated with motor imagery (MI) in a brain–computer interface (BCI), in which user training relies on discovering how to best carry out the MI given only open-ended instructions. To address this challenge we investigate the use of a motor priming (MP), a similar mental task but one linked to a tangible behavioural goal. To investigate the efficacy of this approach in creating the changes in brain activity necessary to drive a BCI, an experiment is carried out in which the user is required to prepare and execute predefined movements. Significant lateralisations of alpha activity are discussed and significant classification accuracies of movement preparation versus no preparation are also reported; indicating that this method is promising alternative to motor imagery in driving a BCI.

Discriminating Object from Non-Object Perception in a Visual Search Task by Joint Analysis of Neural and Eyetracking Data

Andrea Finke[1], Helge Ritter[1]
[1]Bielefeld University

Abstract

The single-trial classification of neural responses to stimuli is an essential element of non-invasive brain-machine interfaces (BMI) based on the electroencephalogram (EEG). However, typically, these stimuli are artificial and the classified neural responses only indirectly related to the content of the stimulus. Fixation-related potentials (FRP) promise to overcome these limitations by directly reflecting the content of visual information that is perceived. We present a novel approach for discriminating between single-trial FRP related to fixations on objects versus on a plain background. The approach is based on a source power decomposition that exploits fixation parameters as target variables to guide the optimization. Our results show that this method is able to classify object versus non-object epochs with a much better accuracy than reported previously. Hence, we provide a further step to exploiting FRP for more versatile and natural BMI.

Assessing the Properties of Single-Trial Fixation-Related Potentials in a Complex Choice Task

Dennis Wobrock[1], Andrea Finke[2]
[1]CITEC Bielefeld [2]Bielefeld University

Abstract

Event-related potentials (ERP) are usually studied by means of their grand averages, or classified on a single-trial level, like in brain-machine interfaces (BMI). Both approaches do not offer a detailed insight into the individual, qualitative variations of the ERP occurring on single-trial level. These variations, however, convey valuable information on subtle but relevant differences in the neural processes that generate these potentials. The latter is even more important, when ERP are studied in more complex scenarios, which is essential to improve and extend current BMI. We propose an approach for assessing these variations, namely amplitude, latency and morphology, in fixation-related potentials (FRP). To this end, we conducted a study with a complex, real-world like choice task to acquire FRP data. Then, we present our method based on multiple-linear regression and outline, how this method may be used for a detailed, qualitative analysis of single-trial FRP data.

WedAM-3 Computer vision 1

Unconstrained face detection from a mobile source using convolutional neural networks

Shonal Chaudhry[1], Rohitash Chandra[2]
[1]Artificial Intelligence and Cybernetics Research Group [2]Nanyang Technological University

Abstract
We present unconstrained mobile face detection using convolutional neural networks which have potential application for guidance systems for visually impaired persons. We develop a dataset of videos captured from a mobile source that features motion blur and noise from camera shakes. This makes the application a very challenging aspect of unconstrained face detection. The performance of the convolutional neural network is compared with a cascade classifier. The results show promising performance in daylight and artificial lighting conditions while the challenges lie for moonlight conditions with the need for reduction of false positives in order to develop a robust system.

Driver Face Detection Based on Aggregate Channel Features and Deformable Part-Based Model in Traffic Camera

Yang Wang[1], Xiaoma Xu[2], Mingtao Pei[1]
[1]Beijing Institute of Technology [2]PetroChina

Abstract
We explore the problem of detecting driver faces in cabs from images taken by traffic cameras. Dim light in cabs, occlusion and low resolution make it a challenging problem. We employ aggregate channel features instead of a single feature to reduce the miss rate, which will introduce more false positives. Based on the observation that most running vehicles have a license plate and the relative position between the plate and driver face has an approximately fixed pattern, we refer to the concept of deformable part-based model and regard a candidate face and a plate as two deformable parts of a face-plate couple. A candidate face will be rejected if it has a low confidence score. Experiment results demonstrate the effectiveness of our method.

Segmentation with Selectively Propagated Constraints

Peng Han[1], Guangzhen Liu[1], Songfang Huang[2], Wenwu Yuan[1], Zhiwu Lu[1]
[1]Renmin University of China [2]IBM China Research Lab

Abstract

This paper presents a novel selective constraint propagation method for constrained image segmentation. In the literature, many pairwise constraint propagation methods have been developed to exploit pairwise constraints for cluster analysis. However, since these methods mostly have a polynomial time complexity, they are not much suitable for segmentation of images even with a moderate size, which is equal to cluster analysis with a large data size. In this paper, we thus choose to perform pairwise constraint propagation only over a selected subset of pixels, but not over the whole image. Such a selective constraint propagation problem is then solved by an efficient graph-based learning algorithm. Finally, the selectively propagated constraints are exploited based on L1-minimization for normalized cuts over the whole image. The experimental results show the promising performance of the proposed method.

Gaussian-Bernoulli Based Convolutional Restricted Boltzmann Machine for Images Feature Extraction

Ziqiang Li[1], Xun Cai[1], Ti Liang[1]
[1]Shandong university

Abstract

Image feature extraction is an essential step in image recognition. In this paper, taking the benefits of the effectiveness of Gaussian-Bernoulli Restricted Boltzmann Machine (GRBM) for learning discriminative image features and the capability of Convolutional Neural Network (CNN) for learning spatial features, we propose a hybrid model called Convolutional Gaussian-Bernoulli Restricted Boltzmann Machine(CGRBM) for image feature extraction by combining GRBM with CNN. Experimental results implemented on some benchmark datasets showed that our model is more effective for natural images recognition tasks than some popular methods, which is suggested that our proposed method is a potential applicable method for real-valued image feature extraction and recognition.

Gaze Movement Control Neural Network Based on Multidimensional Topographic Class Grouping

Wenqi Zhong[1], Jun Miao[1], Laiyun Qing[2]
[1]Institute of Computing Technology, Chinese Academy of Sciences [2]University of Chinese Academy of Sciences

Abstract

Target search is an important ability of the human visual system. One major problem is that the real human visual cognitive process, which requires only few samples for learning, has abilities of inference with obtained knowledge for searching when he meets the new target. Based on the Topographic Class Grouping(TCG) and a series of models of Visual Perceiving and Eyeball-Motion Controlling Neural Networks, we make effective improvements to the models, by incorporating the cerebral self-organizing feature mapping function in terms of multidimensional TCG(MTCG). In this paper, we propose the Gaze Movement Control Neural Network(GMCNN) based on MTCG. Experiments show that GMCNN by adding a block of MTCG and by self-organizing visual field image features-spatial relationship clustering achieves the visual inference and stable results on the target search tasks.

WedAM-4 Machine learning 4

Kernel L1-minimization: Application to Kernel Sparse Representation based Classification

Anupriya Gogna[1], Angshul Majumdar[1]
[1]IIIT Delhi

Abstract

The sparse representation based classification (SRC) was initially proposed for face recognition problems. However, SRC was found to excel in a variety of classification tasks. There have been many extensions to SRC, of which group SRC, kernel SRC being the prominent ones. Prior methods in kernel SRC used greedy methods like Orthogonal Matching Pursuit (OMP). It is well known that for solving a sparse recovery problem, both in theory and in practice, l1-minimization is a better approach compared to OMP. The standard l1-minimization is a solved problem. For the first time in this work, we propose a technique for Kernel l1-minimization. Through simulation results we show that our proposed method outperforms prior kernelised greedy sparse recovery tech-niques.

Nuclear Norm Regularized Randomized Neural Network

Anupriya Gogna[1], Angshul Majumdar[1]
[1]IIIT Delhi

Abstract

Extreme Learning Machine (ELM) or Randomized Neural Network (RNN) is a feed-forward neural network where the network weights between the input and the hidden layer are not learned; they are assigned from some probability distribu-tion. The weights between the hidden layer and the output targets are learnt. Neu-ral networks are believed to mimic the human brain; it is well known that the brain is a redundant network. In this work we propose to explicitly model the re-dundancy of the human brain. We model redundancy as linear dependency of link weights; this leads to a low-rank model of the output (hidden layer to target) net-work. This is solved by imposing a nuclear norm penalty. The proposed tech-nique is compared with the basic ELM and the Sparse ELM. Results on bench-mark datasets, show that our method outperforms both of them.

Gram-Schmidt Orthonormalization to the Adaptive ICA Function for Fixing the Permutation Ambiguity

Yoshitatsu Matsuda[1], Kazunori Yamaguchi[1]
[1]The University of Tokyo

Abstract

Recently, we have proposed a new objective function of ICA called the adaptive ICA function (AIF). AIF is a summation of weighted 4th-order statistics, where the weights are determined by adaptively estimated kurtoses. In this paper, the Gram-Schmidt orthonormalization is applied to the optimization of AIF. The proposed method is theoretically guaranteed to extract the independent components in the unique order of the degree of non-Gaussianity. Consequently, it enables us to fix the permutation ambiguity. Experimental results on blind image separation problems show the usefulness of the proposed method.

Data Cleaning Using Complementary Fuzzy Support Vector Machine Technique

Ratchakoon Pruengkarn[1], Kok Wai Wong[1], Chun Che Fung[1]
[1]Murdoch University

Abstract

In this paper, a Complementary Fuzzy Support Vector Machine (CMTFSVM) technique is proposed to handle outlier and noise in classification problems. Fuzzy membership values are applied for each input point to reflect the de-gree of importance of the instances. Datasets from the UCI and KEEL are used for the comparison. In order to confirm the proposed methodology, 40% random noise is added to the datasets. The experiment results of CMTFSVM are analysed and compared with the Complementary Neural Network (CMTNN). The outcome indicated that the combined CMTFSVM outperformed the CMTNN approach.

Fault-Tolerant Incremental Learning for Extreme Learning Machines

Chi Sing Leung[1], Ho Chun Leung[1], Eric Wong[1]
[1]City University of Hong Kong

Abstract

The existing incremental learning algorithms, called incremental-ELM (I-ELM) and convex I-ELM (CI-ELM), for extreme learning machines (ELMs) cannot handle the fault situation. This paper proposes two fault-tolerant incremental ELM algorithms, namely fault-tolerant I-ELM (FTI-ELM) and fault-tolerant CI-ELM (FTCI-ELM). The FTI-ELM only tunes the output weight of the newly additive node to minimize the training set error of faulty networks. It keeps all the previous learned weights unchanged. Its fault-tolerant performance is better than that of I-ELM and CI-ELM. To further improve the performance, the FTCI-ELM is proposed. It tunes the output weight of the newly additive node, as well as using a simple scheme to modify the existing output weights, to maximize the reduction in the training set error of faulty networks.

WedAM-5 Time series analysis

Chaotic feature selection and reconstruction in time series prediction

Shamina Hussein[1], Rohitash Chandra[2]
[1]The University of the South Pacific [2]Nanyang Technological University

Abstract
The challenge in feature selection for time series lies in achieving similar prediction performance when compared with the original dataset. The method has to ensure that important information has not been lost by with feature selection for data reduction. We present a chaotic feature selection and reconstruction method based on statistical analysis for time series prediction. The method can also be viewed as a way for reduction of data through selection of most relevant features with the hope of reducing training time for learning algorithms. We employ cooperative neuro-evolution as a machine learning tool to evaluate the performance of the proposed method. The results show that our method gives a data reduction of up to 42% with a similar performance when compared to the literature.

$L_{1/2}$ Norm Regularized Echo State Network for Chaotic Time Series Prediction

Meiling Xu[1], Min Han[1], Shunshoku Kanae[2]
[1]Dalian University of Technology [2]Fukui University

Abstract
Echo state network contains a randomly connected hidden layer and an adaptable output layer. It can overcome the problems associated with the complex computation and local optima. But there may be ill-posed problem when large reservoir state matrix is used to calculate the output weights by least square estimation. In this study, we use L1/2 regularization to calculate the output weights to get a sparse solution in order to solve the ill-posed problem and improve the general-ized performance. In addition, an operation of iterated prediction is conducted to test the effectiveness of the proposed L1/2ESN for capturing the dynamics of the chaotic time series. Experimental results illustrate that the predictor has been de-signed properly. It outperforms other modified ESN models in both sparsity and accuracy.

SVD and Text Mining Integrated Approach to Measure Effects of Disasters on Japanese Economics – Effects of the Thai Flooding in 2011–

Yukari Shirota[1], Yuriko Yano[1]
[1]Gakushuin University

Abstract

In this paper, we analyzed effects of the 2011 Thai flooding on Japanese econom-ics. In the paper, we propose, as a new time series economics data analysis meth-od, an integrated approach of Singular Value Decomposition on stock data and news article text mining. There we first find the correlations among companies ' stock data and then in order to find the latent logical reasons of the associations, we conduct text mining. The paper shows the two-stage approach ' s advantages to refine the logical reasoning. Concerning the Thai flooding effects on the Japan ' s economy, as unexpected moves, we have found the serious harms on the Japa-nese food and drink companies and its quick recoveries.

Deep Belief Network using Reinforcement Learning and its Applications to Time Series Forecasting

Takaomi Hirata[1], Takashi Kuremoto[2], Masanao Obayashi[1], Shingo Mabu[2], Kunikazu Kobayashi[2],
[1]Yamaguchi University, [2]Aichi Prefectural University

Abstract

Artificial neural networks (ANNs) typified by deep learning (DL) is one of the artificial intelligence technology which is attracting the most attention of researchers recently. However, the learning algorithm used in DL is usually with the famous error-backpropagation (BP) method. In this paper, we adopt a reinforcement learning (RL) algorithm " Stochastic Gradient Ascent (SGA) " proposed by Kimura & Kobayashi into a Deep Belief Net (DBN) with multiple restricted Boltzmann machines (RBMs) instead of BP learning method. A long-term prediction experiment, which used a benchmark of time series forecasting competition, was performed to verify the effectiveness of the proposed method.

Neuron-Network Level problem decomposition method for Cooperative Coevolution of Recurrent Networks for Time Series Prediction

Ravneil Nand[1], Emmenual Reddy[1], Mohammed Naseem[1]
[1]University of the South Pacific

Abstract

The breaking down of a particular problem through problem decomposition has enabled complex problems to be solved efficiently. The two major problem decomposition methods used in cooperative coevolution are synapse and neuron level. The combination of both the problem decomposition as a hybrid problem decomposition has been seen applied in time series prediction. The different problem decomposition methods applied at particular area of a network can share its strengths to solve the problem better, which forms the major motivation. In this paper, we are proposing a problem decomposition method that combines neuron and network level problem decompositions for Elman recurrent neural networks and applied to time series prediction. The results reveal that the proposed method has got better results in few datasets when compared to two popular standalone methods. The results are better in selected cases for proposed method when compared to several other approaches from the literature.

Wednesday PM1 (abstract)

WedPM1-1 Data-Driven Approach for Extracting Latent Features from Multi-Dimensional Data 1

Yet Another Schatten Norm for Tensor Recovery

Chao Li[1], Lili Guo[1], Yu Tao[1], Jinyu Wang[1], Lin Qi[1], Zheng Dou[1]
[1]Harbin Engineering University

Abstract
In this paper, we introduce a new class of Schatten norms for tensor recovery. In the new norm, unfoldings of a tensor along not only every single order but also all combinations of orders are taken into account. Additionally, we prove that the proposed tensor norm has similar properties to matrix Schatten norm, and also provides several propositions which is useful in the recovery problem. Furthermore, for reliable recovery of a tensor with Gaussian measurements, we show the necessary size of measurements using the new norm. Compared to using conventional overlapped Schatten norm, the new norm results in less measurements for reliable recovery with high probability. Finally, experimental results demonstrate the efficiency of the new norm in video in-painting.

Memory of reading literature in a hippocampal network model based on theta phase coding

Naoyuki Sato[1]
[1]Future University Hakodate

Abstract
Using computer simulations, the authors have demonstrated that temporal compression based on theta phase coding in the hippocampus is essential for the encoding of episodic memory occurring on a behavioral timescale (¿ a few seconds). In this study, the memory of reading literature was evaluated using a network model based on theta phase coding. Input was derived from an eye movement sequence during reading and each fixated word was encoded by a vector computed from a statistical language model with a large text corpus. The results successfully demonstrated a memory generated by a word sequence during a 6-min reading session and this suggests a general role for theta phase coding in the formation of episodic memory.

Combining Deep Learning and Preference Learning for Object Tracking

Shuchao Pang[1], Juan del Coz[2], Zhezhou Yu[1], Oscar Luaces[2], Jorge Diez[2]
[1]College of Computer Science and Technology, Jilin University, China [2]Artificial Intelligence Center, University of Oviedo at Gijón, Spain

Abstract

Object tracking is nowadays a hot topic in computer vision. Generally speaking, its aim is to find a target object in every frame of a video sequence. In order to build a tracking system, this paper proposes to combine two different learning frameworks: deep learning and preference learning. On the one hand, deep learning is used to automatically extract latent features for describing the multi-dimensional raw images. Previous research has shown that deep learning has been successfully applied in different computer vision applications. On the other hand, object tracking can be seen as a ranking problem, in the sense that the regions of an image can be ranked according to their level of overlapping with the target object. Preference learning is used to build the ranking function. The experimental results of our method, called DPL2 (Deep & Preference Learning), are competitive with respect to the state-of-the-art algorithms.

A Cost-sensitive Learning Strategy for Feature Extraction from Imbalanced Data

Ali Braytee[1], Wei Liu[1], Paul Kennedy[1]
[1]UTS

Abstract

In this paper, novel cost-sensitive principal component analysis (CSPCA) and cost-sensitive non-negative matrix factorization (CSNMF) methods are proposed for handling the problem of feature extraction from imbalanced data. The presence of highly imbalanced data misleads existing feature extraction techniques to produce biased features, which results in poor classification performance especially for the minor class problem. To solve this problem, we propose a cost-sensitive learning strategy for feature extraction techniques that uses the imbalance ratio of classes to discount the majority samples. This strategy is adapted to PCA and NMF. The main advantage of the proposed methods is that they are able to lessen the inherent bias of the extracted features to the majority class in existing PCA and NMF algorithms. A series of experiments on twelve imbalanced public datasets show that the proposed methods outperformed the state-of-the-art methods on multiple classifiers.

WedPM1-3 Computer vision 2

Incremental Robust Nonnegative Matrix Factorization for Object tracking

Fanghui Liu[1], Mingna Liu[2], Tao Zhou[1], Yu Qiao[3], Jie Yang[1]
[1]Shanghai Jiao Tong University [2]Shanghai Institute of Spaceflight Control Technology, Infrared Detection Technology Research and Development Center, China Aerospace Science and Technology Corporation [3]Institute of Image Processing and Pattern Recognition, Shanghai Jiao Tong University

Abstract
Nonnegative Matrix Factorization (NMF) has received considerable attention in visual tracking. However noises and outliers are not tackled well due to Frobenius norm in NMF's objective function. To address this issue, in this paper, NMF with $L_{2,1}$ norm loss function (robust NMF) is introduced into appearance modelling in visual tracking. Compared to standard NMF, robust NMF not only handles noises and outliers but also provides sparsity property. In our visual tracking framework, basis matrix from robust NMF is used for appearance modelling with additional ℓ_1 constraint on reconstruction error. The corresponding iterative algorithm is proposed to solve this problem. To strengthen its practicality in visual tracking, multiplicative update rules in incremental learning for robust NMF are proposed for model update. Experiments on the benchmark show that the proposed method achieves favorable performance compared with other state-of-the-art methods.

High precision direction-of-arrival estimation for wideband signals in environment with interference based on complex-valued neural networks

Kazutaka Kikuta[1], Akira Hirose[1]
[1]The University of Tokyo

Abstract
We propose a null steering scheme for wideband acoustic pulses and narrow band interference (NBI) using direction of arrival (DoA) estimation based on complex-valued spatio-temporal neural networks (CVSTNNs) and power inversion adaptive array (PIAA). For acoustic imaging, pulse spectrum should be wide to make the pulses less invasive. When a pulse has a wide frequency band, narrow band interference causes DoA errors in conventional CVSTNN. We use the weights of PIAA as the initial weights of CVSTNN to achieve higher precision in DoA estimation. Simulations demonstrate that the proposed method realizes accurate DoA estimation than the conventional CVSTNN method.

Content-based Image Retrieval Using Deep Search

Zhengzhong Zhou[1], Liqing Zhang[1]
[1]Shanghai Jiao Tong University

Abstract

The aim of Content-based Image Retrieval (CBIR) is to find a set of images that best matches the query based on visual features. Most existing CBIR systems find similar images in low level features, while Text-based Image Retrieval (TBIR) systems find images with relevant tags regardless of contents in the images. Generally, people are more interested in images with similarity both in contours and high-level concepts. Therefore, we propose a new strategy called Deep Search to meet this requirement. It mines knowledge from the similar images of original queries, in order to compensate for the missing information in feature extraction process. To evaluate the performance of Deep Search approach, we apply this method to three different CBIR systems (HOF, HOG and GIST) in our experiments. The results show that Deep Search greatly improves the performance of original algorithms, and is not restricted to any particular methods.

Robust Part-Based Correlation Tracking

Xiaodong Liu[1], Yue Zhou[1]
[1]Institute of Image Processing and Pattern Recognition, Shanghai Jiao Tong University

Abstract

Visual tracking is a challenging task where the target may undergo background clutters, deformation, severe occlusion and out-of-view in video sequences. In this paper, we propose a novel tracking method, which utilizes representative parts of the target to handle occlusion situations. For the sake of efficiency, we train a classifier for each part using correlation filter which has been used in visual tracking recently duo to its computational efficiency. In addition, we exploit the motion vectors of reliable parts between two consecutive frames to estimate the position of the object target and we utilize the spatial relationship between representative part and target center to estimate the scale of the target. Furthermore, part models are adaptively updated to avoid introducing errors which can cause model drift. Extensive experiments show that our algorithm is comparable to state-of-the-art methods on visual tracking benchmark in terms of accuracy and robustness.

A new Weight Adjusted Particle Swarm Optimization for Real-time Multiple Object Tracking

Guang Liu[1], Zhenghao Chen[1], Henry Fung Yeung[1], Yuk Ying Chung[1], Wei-Chang Yeh[2]
[1]the University of Sydney [2]National Tsing Hua University, Taiwan

Abstract

This paper proposes a novel Weight Adjusted Particle Swarm Optimization (WAPSO) to overcome the occlusion problem and computational cost in multiple object tracking. To this end, a new update strategy of inertia weight of the particles in WAPSO is designed to maintain particle diversity and prevent pre-mature convergence. Meanwhile, the implementation of a mechanism that enlarges the search space upon the detection of occlusion enhances WAPSO's robustness to non-linear target motion. In addition, the choice of Root Sum Squared Errors as the fitness function further increases the speed of the proposed approach. The experimental results has shown that in combination with the model feature that enables initialization of multiple independent swarms, the high-speed WAPSO algorithm can be applied to multiple non-linear object tracking for real-time applications.

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Character-Aware Convolutional Neural Networks for Paraphrase Identification

Jiangping Huang[1], Donghong Ji[1], Shuxin Yao[2], Wenzhi Huang[1]
[1]Wuhan University [2]Carnegie Mellon University

Abstract

Convolutional Neural Network (CNN) have been successfully used for many natural language processing applications. In this paper, we propose a novel CNN model for sentence-level paraphrase identification. We learn the sentence representations using character-aware convolutional neural network that relies on character-level input and gives sentence-level representation. Our model adopts both random and one-hot initialized methods for character representation and trained with two paraphrase identification corpora including news and social media sentences. A comparison between the results of our approach and the typical systems participating in challenge on the news sentence, suggest that our model obtains a comparative performance with these baselines. The experimental result with tweets corpus shows that the proposed model has a significant performance than baselines. The results also suggest that character inputs are effective for modeling sentences.

Learning a Discriminative Dictionary with CNN for Image Classification

Shuai Yu[1], Jie Yang[1], Tao Zhang[1], Chao Ma[1], Lei Zhou[1], Xiangjian He[2]
[1]Shanghai Jiao Tong University [2]University of Technology, Sydney, Australia

Abstract

In this paper, we propose a novel framework for image recognition based on a extended sparse model. First, we use the CNN models pre-trained on large datasets to generate features. Then we propose an extended sparse model which learns a dictionary from the CNN features by incorporating the reconstruction residual term and the coefficients adjustment term. Minimizing the reconstruction residual term guarantees that the class-specific sub-dictionary has good representation power for the samples from the corresponding class and minimizing the coefficients adjustment term encourages samples from different classes to be reconstructed by different class-specific sub-dictionaries. With the dictionary, the representation residual and coefficients will be discriminative. Finally, a metric involving these discriminative information is introduced for image clas-sification. Experiments on Caltech101 and PASCAL VOC 2012 datasets show the effectiveness of the proposed method on image classification.

Online Weighted Multi-Task Feature Selection

Wei Xue[1], Wensheng Zhang[2]
[1]Nanjing University of Science and Technology [2]Chinese Academy of Sciences

Abstract

The goal of multi-task feature selection is to learn explanatory features across multiple related tasks. In this paper, we develop a weighted feature selection model to enhance the sparsity of the learning variables and propose an online algorithm to solve this model. The worst-case bounds of the time complexity and the memory cost of this algorithm at each iteration are both in O(NxQ), where N is the number of feature dimensions and Q is the number of tasks. At each iteration, the learning variables can be solved analytically based on a memory of the previous (sub)gradients and the whole weighted regularization, and the weight coefficients used for the next iteration are updated by the current learned solution. A theoretical analysis for the regret bound of the proposed algorithm is presented, along with experiments on public data demonstrating that it can yield better performance, e.g., in terms of convergence speed and sparsity.

Multithreading incremental learning scheme for embedded system to realize a high-throughput

Daisuke Nishio[1], Koichiro Yamauchi[1]
[1]Chubu University

Abstract

This paper proposes an implementation technique for the incremental learning methods on a budget. Normally, they proceed online learning by alternating recognition and learning, so that they cannot respond to the next new instance until the previous learning is finished. Unfortunately, their computational complexities for the learning are too high to realize a quick response to new input. To overcome this problem, this paper introduces multi-threading technique for such learning scheme. Therefore, the recognition thread and learning thread are executed in parallel so that the system can respond to new instance even when it is in the progress of the learning. Moreover, this paper also shows such multi-threading learning scheme sometime needs a "sleep-period" to complete the learning like biological brain. During the "sleep-period", the leaning system prohibits receiving any sensory inputs and yielding outputs.

Hyper-parameter tuning for graph kernels via Multiple Kernel Learning

Carlo Maria Massimo[1], Nicolò Navarin[1], Alessandro Sperduti[1]
[1]University of Padova

Abstract

Kernelized learning algorithms have seen a steady growth in popularity during the last decades. The procedure to estimate the performances of these kernels in real applications is typical computationally demanding due to the process of hyper-parameter selection. This is especially true for graph kernels, which are computationally quite expensive. In this paper, we study an approach that substitutes the commonly adopted procedure for kernel hyper-parameter selection by a multiple kernel learning procedure that learns a linear combination of kernel matrices obtained by the same kernel with different values for the hyper- parameters. Empirical results on real-world graph datasets show that the proposed methodology is faster than the baseline method when the number of parameter configurations is large, while always maintaining comparable and in some cases superior performances.

WedPM1-5 Topological and Graph Based Clustering Methods 1

Tutorial

Topological and Graph Based Clustering: Recent Algorithmic Advances

Rushed Kanawati[1], Nistor Grozavu[1]
[1]A3-LIPN, University Sorbonne Paris Cité

Abstract

One of the main tasks in the field of high dimensional data analysis and exploration is to compute simplified, usually visual, views of processed data. Clustering and projection are two main methods classically applied to achieve this kind of tasks. Clustering algorithms produce a grouping of data according to a given criterion such that similar data items are grouped together. Projection methods represent data points in a low-dimensional space such that clusters and the metric relationships of the data items are preserved as faithfully as possible. However, in the actual era of big data and connected devices, a lot of datasets are shaped in form of large-scale dynamic attributed graphs. Non relational data can also be shaped in form of graphs by applying similarity-based graph construction approaches. New approaches for data clustering and projection are then required. In this tutorial we make the point on the latest algorithmic advances in the field of graph-based and topological clustering approaches.

Tutorial outline :

```
1- Introduction
2- Building graphs from data
3- Community detection in complex networks
4- Topological clustering approaches
        4.1 Spectral clustering methods
        4.2 Self-Organization map
5- Multi-view clustering approaches
        5.1 Community detection in multiplex networks
        5.2. Collaborative clustering
6- Applications
        6.1 A multiplex-based clustering ensemble selection approach.
        6.2 Visual information retrieval
7. Conclusion & hot research directions
```

Parcellating whole brain for individuals by simple linear iterative clustering

Jing Wang[1], Zilan Hu[2], Haixian Wang[1]
[1]Southeast University [2]School of Mathematics and Physics, Anhui University of Technology, Maanshan, Anhui 243002, PR China

Abstract

This paper utilizes a supervoxel method called simple linear iterative clustering (SLIC) to parcellate whole brain into functional subunits using resting-state fMRI data. The parcellation algorithm is directly applied on the resting-state fMRI time series without feature extraction, and the parcellation is conducted on the individual subject level. In order to obtain parcellations with multiple granularities, we vary the cluster number in a wide range. To demonstrate the reasonability of the proposed approach, we compare it with a state-of-the-art whole brain parcellation approach, i.e., the normalized cuts (Ncut) approach. The experimental results show that the proposed approach achieves satisfying performances in terms of spatial contiguity, functional homogeneity and reproducibility. The proposed approach could be used to generate individualized brain atlases for applications such as personalized medicine.

Overlapping Community Structure Detection of Brain Functional Network Using Non-negative Matrix Factorization

Xuan Li[1], Zilan Hu[2], Haixian Wang[1]
[1]Southeast University [2]School of Mathematics and Physics, Anhui University of Technology, Maanshan, Anhui 243002, PR China

Abstract

Community structure, as a main feature of a complex network, has been investigated recently under the assumption that the identified communities are non-overlapping. However, few studies have revealed the overlapping community structure of the brain functional network, despite the fact that communities of most real networks overlap. In this paper, we propose a novel framework to identify the overlapping community structure of the brain functional network by using the symmetric non-negative matrix factorization (SNMF), in which we develop a non-negative adaptive sparse representation (NASR) to produce an association matrix. Experimental results on fMRI data sets show that, compared with modularity optimization, normalized cuts and affinity propagation, SNMF identifies the community structure more accurately and can shed new light on the understanding of brain functional systems.

Wednesday PM2 (abstract)

WedPM2-1 Data-Driven Approach for Extracting Latent Features from Multi-Dimensional Data 2

Nonnegative Tensor Train Decompositions for Multi-Domain Feature Extraction and Clustering

Namgil Lee[1], Anh-Huy Phan[1], Fengyu Cong[2], Andrzej Cichocki[1]
[1]RIKEN Brain Science Institute [2]Dalian University of Technology

Abstract

Tensor train (TT) is one of the modern tensor decomposition models for low-rank approximation of high-order tensors. For nonnegative multiway array data analysis, we propose a nonnegative TT (NTT) decomposition algorithm for the NTT model and a hybrid model called the NTT-Tucker model. By employing the hierarchical alternating least squares approach, each fiber vector of core tensors is optimized efficiently at each iteration. We compared the performances of the proposed method with a standard nonnegative Tucker decomposition (NTD) algorithm by using benchmark data sets including event-related potential data and facial image data in multi-domain feature extraction and clustering tasks. It is illustrated that the proposed algorithm extracts physically meaningful features with relatively low storage and computational costs compared to the standard NTD model.

Hyper-Parameter Optimization of Sticky HDP-HMM Through an Enhanced Particle Swarm Optimization

Jiaxi Li[1], JunFu Yin[1], Yuk Ying Chung[1], Feng Sha[1]
[1]University of Sydney

Abstract

Faced with the problem of uncertainties in object trajectory and pattern recognition in terms of the non-parametric Bayesian approach, we have derived that 2 major methods of optimizing hierarchical Dirichlet process hidden Markov model (HDP-HMM) for the task. HDP-HMM suffers from poor performance not only on moderate dimensional data, but also sensitivity to its parameter settings. For the purpose of optimizing HDP-HMM on dimensional data, test for optimized results will be carried on the Tum Kitchen dataset, which was provided for the purpose of research the motion and activity recognitions. The optimization techniques capture the best hyper-parameters which then produce optimal solution to the task given in a certain search space.

Approximate inference method for dynamic interactions in larger neural populations

Christian Donner[1], Hideaki Shimazaki[2]
[1]Bernstein Center for Compuational Neuroscience Berlin [2]RIKEN Brain Science Institute

Abstract

The maximum entropy method has been successfully employed to explain stationary spiking activity of a neural population by using fewer features than the number of possible activity patterns. Modeling network activity in vivo, however, has been challenging because features such as spike-rates and interactions can change according to sensory stimulation, behavior, or brain state. To capture the time-dependent activity, Shimazaki et al. (PLOS Comp Biol, 2012) previously introduced a state-space framework for the latent dynamics of neural interactions. However, the exact method suffers from computational cost; therefore its application was limited to only 15 neurons. Here we introduce the pseudolikelihood method combined with the TAP or Bethe approximation to the state-space model, and make it possible to estimate dynamic pairwise interactions of up to 30 neurons. These analytic approximations allow analyses of time-varying activity of larger networks in relation to stimuli or behavior.

Features learning and transformation based on Deep Autoencoders

Eric Janvier[1], Nistor Grozavu[2], Thierry Couronne[1]
[1]Mindlytix [2]LIPN, Paris 13 University

Abstract

Tag recommendation has become one of the most important ways of an organization to index online resources like articles, movies, and music in order to recommend it to potential users. Since reommendation information is usually very sparse, effective learning of the content representation for these resources is crucial to accurate the recommendation. One of the issue of this problem is features transformation or features learning. In this paper, we propose an hybrid framework with a deep learning model called stacked denoising autoencoder (SDAE), the SVD and Diffusion Maps to learn more effective content representation. The proposed framerwork is tested on real tag recommendation dataset which was validated by using internal clustering indexes and by experts.

t-Distributed Stochastic Neighbor Embedding with Inhomogeneous Degrees of Freedom

Jun Kitazono[1], Nistor Grozavu[2], Nicoleta Rogovschi[3], Toshiaki Omori[1], Seiichi Ozawa[1]
[1]Kobe University [2]LIPN, Paris 13 University [3]LIPADE, University of Paris Descartes

Abstract

One of the dimension reduction (DR) methods for data-visualization, t-distributed stochastic neighbor embedding (t-SNE), has drawn increasing attention. t-SNE gives us better visualization than conventional DR methods, by relieving so-called crowding problem. The crowding problem is one of the curses of dimensionality, which is caused by discrepancy between high and low dimensional spaces. However, in t-SNE, it is assumed that the strength of the discrepancy is the same for all samples in all datasets regardless of ununiformity of distributions or the difference in dimensions, and this assumption sometimes ruins visualization. Here we propose a new DR method inhomogeneous t-SNE, in which the strength is estimated for each point and dataset. Experimental results show that such pointwise estimation is important for reasonable visualization and that the proposed method achieves better visualization than the original t-SNE.

WedPM2-3 Computer vision 3

Fast Visual Object Tracking Using Convolutional Filters

Mingxuan Di[1] Guang Yang[1] Qinchuan Zhang[1] Kang Fu[1] Hongtao Lu[1]
[1]Shanghai Jiao Tong University

Abstract
Recently, a class of tracking techniques called synthetic exact filters has been shown to give promising results at impressive speeds. Synthetic exact filters are trained using a large number of training images and associated continuous labels, however, there is not much theory behind it. In this paper, we theoretically explain the reason why synthetic exact filters based methods work well and propose a novel visual object tracking algorithm based on convolutional filters, which are trained only by training images without labels. Advantages of the convolutional filters training include: faster and more robust than synthetic exact filters, insensitive to parameters and simpler in pre-processing of training images. Experiments on many challenging video sequences demonstrate that our convolutional filters based tracker is competitive with the state-of-the-art trackers in accuracy and outperforms most trackers in efficiency.

An Effective Approach for Automatic LV Segmentation Based on GMM and ASM

Yurun Ma[1], Deyuan Wang[1], Yide Ma[1], Ruoming Lei[1], Min Dong[1], Kemin Wang[1], Li Wang[1]
[1]Lanzhou University

Abstract
In this paper, we propose a novel approach for automatic left ventricle (LV) segmentation in cardiac magnetic resonance images (CMRI). This algorithm incorporates three key techniques: (1) the mid-ventricular coarse segmentation based on Gaussian mixture model (GMM); (2) the mid-slice endo-/epi-cardial initialization based on geometric transformation; (3) the myocardium tracking based on active shape models (ASM). Experiment results tested on a standard database demonstrate the effectiveness and competitiveness of the proposed method.

Position Gradient and Plane Consistency based Feature Extraction

Sujan Chowdhury[1], Brijesh Verma[1], Ligang Zhang[1]
[1]Central Queensland University

Abstract

Labeling scene objects is an essential task for many computer vision applications. However, differentiating scene objects with visual similarity is a very challenging task. To overcome this challenge, this paper proposes a position gradient and plane consistency based feature which is designed to distinguish visually similar objects and improve the overall labeling accuracy. Using the proposed feature we can differentiate objects with the same histogram of the gradient as well as we can differentiate horizontal and vertical objects. Integrating the proposed feature with low-level texture features and a neural network classifier, we achieve a superior performance (82%) compared to state-of-the-art scene labeling methods on the Stanford background dataset.

Fusion of Multi-View Multi-Exposure Images with Delaunay Triangulation

Hanyi Yu[1], Yue Zhou[2]
[1]Institute of Image Processing and Pattern Recognition, Shanghai Jiao Tong University [2]Institude of Image Processing and Pattern Recognition, Shanghai Jiao Tong University

Abstract

In this paper, we present a completely automatic method for multi-view multi-exposure image fusion. The technique adopts the normalized cross-correlation (NCC) as the measurement of the similarity of interest points. With the matched feature points, we divide images into a set of triangles by Delaunay triangulation. Then we apply affine transformation to each matched triangle pairs respectively to get the registration of multi-view images. After images aligned, we partition the image domain into uniformed regions and select the images that provides the most information with certain blocks. The selected images are fused together under monotonically blending functions.

Detection of Human Faces using Neural Networks

Mozammel Chowdhury[1], Junbin Gao[2], Rafiqul Islam[1]
[1]Charles Sturt University [2]University of Sydney, Australia

Abstract

Human face detection is a key technology in machine vision applications including human recognition, access control, security surveillance and so on. This research proposes a precise scheme for human face detection using a hybrid neural network. The system is based on visual information of the face image sequences and is commenced with estimation of the skin area depending on color components. In this paper we have considered HSV and YCbCr color space to extract the visual features. These features are used to train the hybrid network consisting of a bidirectional associative memory (BAM) and a back propagation neural network (BPNN). The BAM is used for dimensional reduction and the multi-layer BPNN is used for training the facial color features. Our system provides superior performance comparable to the existing methods in terms of both accuracy and computational efficiency. The low computation time required for face detection makes it suitable to be employed in real time applications.

Implementation of a modular Growing When Required neural gas architecture for recognition of falls

Frederico Belmonte Klein[1], Karla Stepanova[2], Angelo Cangelosi[1]
[1]Plymouth University [2]FEL CTU in Prague

Abstract

In this paper we aim for the replication of a state of the art architecture for recognition of human actions using skeleton poses obtained from a depth sensor. We review the usefulness of accurate human action recognition in the field of robotic elderly care, focusing on fall detection. We attempt fall recognition using a chained Growing When Required neural gas classifier that is fed only skeleton joints data. We test this architecture against Recurrent SOMs (RSOMs) to classify the TST Fall detection database ver. 2, a specialised dataset for fall sequences. We also introduce a simplified mathematical model of falls for easier and faster bench-testing of classification algorithms for fall detection. The outcome of classifying falls from our mathematical model was successful with an accuracy of $97.12 \pm 1.65\%$ and from the TST Fall detection database ver. 2 with an accuracy of 90.2 ± 2.68 % when a filter was added.

Position Gradient and Plane Consistency based Feature Extraction

Sujan Chowdhury[1], Brijesh Verma[1], Ligang Zhang[1]
[1]Central Queensland University

Abstract

Labeling scene objects is an essential task for many computer vision applications. However, differentiating scene objects with visual similarity is a very challenging task. To overcome this challenge, this paper proposes a position gradient and plane consistency based feature which is designed to distinguish visually similar objects and improve the overall labeling accuracy. Using the proposed feature we can differentiate objects with the same histogram of the gradient as well as we can differentiate horizontal and vertical objects. Integrating the proposed feature with low-level texture features and a neural network classifier, we achieve a superior performance (82%) compared to state-of-the-art scene labeling methods on the Stanford background dataset.

Fusion of Multi-View Multi-Exposure Images with Delaunay Triangulation

Hanyi Yu[1], Yue Zhou[2]
[1]Institute of Image Processing and Pattern Recognition, Shanghai Jiao Tong University [2]Institude of Image Processing and Pattern Recognition, Shanghai Jiao Tong University

Abstract

In this paper, we present a completely automatic method for multi-view multi-exposure image fusion. The technique adopts the normalized cross-correlation (NCC) as the measurement of the similarity of interest points. With the matched feature points, we divide images into a set of triangles by Delaunay triangulation. Then we apply affine transformation to each matched triangle pairs respectively to get the registration of multi-view images. After images aligned, we partition the image domain into uniformed regions and select the images that provides the most information with certain blocks. The selected images are fused together under monotonically blending functions.

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A Corrector for the Sample Mahalanobis Distance Free from Estimating the Population Eigenvalues of Covariance Matrix

Yasuyuki Kobayashi[1]
[1]Teikyo University

Abstract

To correct the effect deteriorating the recognition performance of the sample Mahalanobis distance by a small number of learning sample, a new corrector for the sample Mahalanobis distance toward the corresponding population Mahalanobis distance is proposed without the population eigenvalues estimated from the sample covariance matrix defining the sample Mahalanobis distance. To omit computing the population eigenvalues difficult to estimate, the corrector uses the Stein ' s estimator of covariance matrix. And the corrector also uses accurate expectation of the principal component of the sample Mahalanobis distance by the delta method in statistics. Numerical experiments show that the proposed corrector improves the probability distribution and the recognition performance in comparison with the sample Mahalanobis distance.

Online Learning Neural Network for Adaptively Weighted Hybrid Modeling

Shaoming Yang[1], Yalin Wang[1], Yongfei Xue[1], Bei Sun[1], Busong Yang[1]
[1]Central South University, School of Information Science and Engineering

Abstract

The soft sensor models constructed based on historical data have poor generalization due to the characters of strong non-linearity and time-varying dynamics. Moving window and recursively sample updating online modeling methods can not achieve a balance between accuracy and training speed. Aiming at these problems, a novel online learning neural network (LNN) selects high-quality samples with just-in-time learning (JITL) for modeling. And the local samples could be further determined by principal component analysis (PCA). The LNN model shows better performance but poor stability. Weighted multiple sub models, the hybrid model improves accuracy by covering deficiencies. Additionally, the weights could be developed with mean square error (MSE) of each sub model. And the detailed simulation results verify the superiority of adaptive weighted hybrid model.

Semi-supervised Support Vector Machines - a Genetic Algorithm Approach

Gergana Lazarova[1]
[1]Sofia University St. Kliment Ohridski

Abstract

Semi-supervised learning combines both labeled and unlabeled examples in order to find better future predictions. Semi-supervised support vector machines (SSSVM) present a non-convex optimization problem. In this paper a genetic algorithm is used to optimize the non-convex error - GSSSVM. It is experimented with multiple datasets and the performance of the genetic algorithm is compared to its supervised equivalent and shows very good results. A tailor-made modification of the genetic algorithm is also proposed which uses less unlabeled examples — the closest neighbors of the labeled instances.

Hinge Loss Projection for Classification

Syukron Ishaq Alfarozi[1], Kuntpong Woraratpanya[1], Kitsuchart Pasupa[1], Masanori Sugimoto[2]
[1]Faculty of Information Technology, King Mongkut's Institute of Technology Ladkrabang [2]Hokkaido University

Abstract

Hinge loss is one-sided function which gives optimal solution than that of squared error (SE) loss function in case of classification. It allows data points which have a value greater than 1 and less than -1 for positive and negative classes, respectively. These have zero contribution to hinge function. However, in the most classification tasks, least square (LS) method such as ridge regression uses SE instead of hinge function. In this paper, a simple projection method is used to minimize hinge loss function through LS methods. We modify the ridge regression and its kernel based version i.e. kernel ridge regression so that it can adopt to hinge function instead of using SE in case of classification problem. The results show the effectiveness of hinge loss projection method especially on imbalanced data sets in terms of geometric mean (GM).

WedPM2-5 Topological and Graph Based Clustering Methods 2

Collaborative-based multi-scale clustering in very high resolution satellite Images

Jeremie Sublime[1], Antoine Cornuéjols[1], Younes Bennani[2]
[1]AgroParisTech [2]University Paris 13

Abstract
In this article, we show an application of collaborative clustering applied to real data from very high resolution images. Our proposed method makes it possible to have several algorithms working at different scales of details while exchanging their information on the clusters. Our method that aims at strengthening the hierarchical links between the clusters extracted at different level of detail has shown good results in terms of clustering quality based on common unsupervised learning indexes, but also when using external indexes: We compared our results with other algorithms and analyzed them based on an expert ground truth.

Towards Ontology Reasoning for Topological Cluster Labeling

Hatim Chahdi[1], Nistor Grozavu[2]
[1]UMR Espace-Dev & LIPN [2]LIPN, Paris 13 University

Abstract
In this paper, we present a new approach combining topological unsupervised learning with ontology based reasoning to achieve both : (i) automatic interpretation of clustering, and (ii) scaling ontology reasoning over large datasets. The interest of such approach holds on the use of expert knowledge to automate cluster labeling and gives them high level semantics that meets the user interest. The proposed approach is based on two steps. The first step performs a topographic unsupervised learning based on the SOM (Self-Organizing Maps) algorithm. The second step integrates expert knowledge in the map using ontology reasoning over the prototypes and provides an automatic interpretation of the clusters. We apply our approach to the real problem of satellite image classification. The experiments highlight the capacity of our approach to obtain a semantically labeled topographic map and the obtained results show very promising performances.

Overlapping community detection using core label propagation and belonging function

Jean-Philippe Attal[1], Maria Malek[1], Marc Zolghadri[2]
[1]EISTI : École internationale des sciences du traitement de línformation [2]SUPMECA

Abstract

Label propagation is one of the fastest methods for community detection, with a near linear time complexity. It acts locally. Each node interacts with neighbours to change its own label by a majority vote. But this method has three major drawbacks: (i) it can lead to huge communities without sense called also monster communities, (ii) it is unstable, and (iii) it is unable to detect overlapping communities. In this paper, we suggest new techniques that improve considerably the basic technique by using an existing core detection label propagation technique. It is then possible to detect overlapping communities through a belonging function which qualifies the belonging degree of nodes to several communities. Nodes are assigned and replicated by the function a number of times to communities which are found automatically. User may also interact with the technique by imposing and freezing the number of communities a node may belong to. A comparative analysis will be done.

A new clustering algorithm for dynamic data

Parisa Rastin[1], Tong Zhang[1], Guenael Cabanes[1]
[1]Université Paris 13

Abstract

We propose in this paper an algorithm for the discovery and the monitoring of clusters in dynamic datasets. The proposed method is based on a Growing Neural Gas and learns simultaneously the prototypes and their segmentation using and estimation of the local density of data to detect the boundaries between clusters. The quality of our algorithm is evaluated on a set of artificial datasets presenting a set of static and dynamic cluster structures.

Poster Session 2 (abstract)

Poster2-1 Applications

Inferring Users' Gender from Interests: A Tag Embedding Approach

Peisong Zhu[1], Tieyun Qian[1], Ming Zhong[1], Xuhui Li[1]
[1]Wuhan University

Abstract

This paper studies the problem of gender prediction of users in social media using their interest tags. The challenge is that the tag feature vector is extremely sparse and short, i.e., less than 10 tags for each user. We present a novel conceptual class based method which enriches and centralizes the feature space. We first identify the discriminating tags based on the tag distribution. We then build the initial conceptual class by taking the advantage of the generalization andspecification operations on these tags. Finally, we model class expansion as a problem of computing the similarity between one tag and a set of tags in one conceptual class in the embedding space. We conduct extensive experiments on a real dataset from Sina Weibo. Results demonstrate that our proposed method significantly enhances the quality of the feature space and improves the performance of gender classification. Its accuracy reaches 82.25% while that for the original tag vector is only 62.75%.

Fast color quantization via fuzzy clustering

Laszlo Szilagyi[1,2], Gellert Denesi[1], Calin Enachescu[3]
[1]Sapientia University of Transylvania, Tirgu Mures, Romania [2]Budapest University of Technology and Economics, Hungary [3]Petru Maior University of Tirgu Mures, Romania

Abstract

This comparative study employs several modified versions of the fuzzy c-means algorithm in image color reduction, with the aim of assessing their accuracy and efficiency. To assure equal chances for all algorithms, a common framework was established that preprocesses input images in terms of a preliminary color quantization, extraction of histogram and selection of frequently occurring colors of the image. Selected colors were fed to clustering by studied c-means algorithm variants. Besides the conventional fuzzy c-means (FCM) algorithm, the so-called generalized improved partition FCM algorithm, and several versions of the generalized suppressed FCM were considered. Accuracy was assessed by the average color difference between input and output images, while efficiency tests monitored the total runtime. All modified algorithms were found more accurate, and some suppressed models also faster than FCM.

Extended Dependency-Based Word Embeddings for Aspect Extraction

Xin Wang[1], Yuanchao Liu[1], Chengjie Sun[1], Ming Liu[1], Xiaolong Wang[1]
[1]Harbin Institute of Technology

Abstract

Extracting aspects from opinion reviews is an essential task of fine-grained sentiment analysis. In this paper, we explore a new perspective to achieve better extraction performance by improving word representations. Outer products of dependency-based word vectors and specialized features are introduced as representations of words. With such representations composed in recurrent neural networks, we can make use of advantages of both word embeddings and traditional features. Evaluated on SemEval 2014 task 4 dataset, the proposed method outperforms existing recurrent model based systems, achieving a result comparable with the state-of-the-art methods.

Topological Order Discovery via Deep Knowledge Tracing

Jiani Zhang[1], Irwin King[1]
[1]the Chinese University of Hong Kong

Abstract

The goal of discovering topological order of skills is to generate a sequence of skills satisfying all prerequisite requirements. Very few previous studies have examined this task from knowledge tracing perspective. In this paper, we introduce a new task of discovering topological order of skills using students ' exercise performance and explore the utility of Deep Knowledge Tracing (DKT) to solve this task. The learned topological results can be used to improve students ' learning efficiency by providing students with personalized learning paths and predicting students' future exercise performance. Experimental results demonstrate that our method is effective to generate reasonable topological order of skills.

PTR: Phrase-Based Topical Ranking for Automatic Keyphrase Extraction in Scientific Publications

Minmei Wang[1], Bo Zhao[1], Yihua Huang[1]
[1]The National Key Laboratory for Novel Software Technology, Department of Computer Science and Technology, Nanjing University, China

Abstract

Automatic keyphrase extraction plays an important role for many information retrieval (IR) and natural language processing (NLP) tasks. Motivated by the facts that phrases have more semantic information than single words and a document consists of multiple semantic topics, we present PTR, a phrase-based topical ranking method for keyphrase extraction in scientific publications. Candidate keyphrases are divided into different topics by LDA and used as vertices in a phrase-based graph of the topic. We then decompose PageRank into multiple weighted-PageRank to rank phrases for each topic. Keyphrases are finally generated by selecting candidates according to their overall scores on all related topics. Experimental results show that PTR has good performance on several datasets.

Neural Network Based Association Rule Mining from Uncertain Data

Sameen Mansha[1], Zaheer Babar[1], Faisal Kamiran[1], Asim Karim[2]
[1]Information technology University, Punjab, Lahore, Pakistan [2]Lahore University of Management Sciences, Pakistan

Abstract

In data mining, the U-Apriori algorithm is typically used for Association Rule Mining (ARM) from uncertain data. However, it takes too much time in finding frequent itemsets from large datasets. This paper proposes a novel algorithm based on Self-Organizing Map (SOM) clustering for ARM from uncertain data. It supports the feasibility of neural network for generating frequent itemsets and association rules effectively. We take transactions in which itemsets are associated with probabilities of occurrence. Each transaction is converted to an input vector under a probabilistic framework. SOM is employed to train these input vectors and visualize the relationship between the items in a database. Distance map based on the weights of winning neurons and support count of items is used as a criteria to prune data space. As shown in our experiments, the proposed SOM is a promising alternative to typical mining algorithms for ARM from uncertain data.

Analysis and knowledge discovery by means of Self-Organising Maps for Gaia data releases

M. Álvarez[1], Carlos Dafonte[1], Daniel Garabato[1], Minia Manteiga[1]
[1]University of A Coruna

Abstract

A billion stars: this is the approximate amount of visible objects estimated to be observed by the Gaia satellite, representing roughly 1% of the objects in the Galaxy. It constitutes the biggest amount of data gathered to date: by the end of the mission, the data archive will exceed 1 Petabyte. Now, in order to process this data, the Gaia mission conceived the Data Processing and Analysis Consortium, which will apply data mining techniques such as Self-Organizing Maps. This paper shows a useful technique for source clustering, focusing on the development of an advanced visualization tool based on this technique.

Poster2-2 Computational & Cognitive Neurosciences

Computational Model of the Cerebellum and the Basal Ganglia for Interval Timing Learning

Ohki Katakura[1], Tadashi Yamazaki[1]
[1]The University of Electro-Communications

Abstract

In temporal information processing, both the cerebellum and the basal ganglia play essential roles. In particular, for interval timing learning, the cerebellum exhibits temporally localized activity around the onset of the unconditioned stimulus, whereas the basal ganglia represents the passage of time by their ramping-up activity from the onset of the conditioned stimulus to that of the unconditioned stimulus. We present a unified computational model of the cerebellum and the basal ganglia for the interval timing learning task. We report that our model reproduces the localized activity in the cerebellum and the gradual increase of the activity in the basal ganglia. These results suggest that the cerebellum and the basal ganglia play different roles in temporal information processing.

Bihemispheric cerebellar spiking network model to simulate acute VOR motor learning

Keiichiro Inagaki[1], Yutaka Hirata[1]
[1]Chubu University

Abstract

The vestibuloocular reflex (VOR) is an adaptive control system. The cerebellar flocculus is intimately involved in the VOR adaptive motor control. The cerebellar flocculus has bihemispheric architecture and the several lines of unilateral lesion study indicated that each cerebellar hemisphere plays different roles in the leftward and rightward eye movement control and learning. However, roles of bihemispheric cerebellar architecture underlying the VOR motor learning have not been fully understood. Here we configure an anatomically/physiologically plausible bihemispheric cerebellar neuronal network model composed of spiking neurons as a platform to unveil roles and capacities of bihemispheric cerebellar architecture in the VOR motor learning.

Poster2-3 Theory & Algorithms

An Iterative Incremental Learning Algorithm for Complex-Valued Hopfield Associative Memory

Naoki Masuyama[1], Chu Kiong Loo[1]
[1]University of Malaya

Abstract

This paper discusses a complex-valued Hopfield associative memory with an iterative incremental learning algorithm. The mathematical proofs derive that the weight matrix is approximated as a weight matrix by the complex-valued pseudo inverse algorithm. Furthermore, the minimum number of iterations for the learning sequence is defined with maintaining the network stability. From the result of simulation experiment in terms of memory capacity and noise tolerance, the proposed model has the superior ability than the model with a complex-valued pseudo inverse learning algorithm.

LDA-Based Word Image Representation for Keyword Spotting on Historical Mongolian Documents

Hongxi Wei[1], Guanglai Gao[1], Xiangdong Su[1]
[1]Inner Mongolia University

Abstract

The original Bag-of-Visual-Words approach discards the spatial relations of the visual words. In this paper, a LDA-based topic model is adopted to obtain the semantic relations of visual words for each word image. Because the LDA-based topic model usually hurts retrieval performance when directly employs itself. Therefore, the LDA-based topic model is linearly combined with a visual language model for each word image in this study. After that, the basic query likelihood model is used for realizing the procedure of retrieval. The experimental results on our dataset show that the proposed LDA-based representation approach can efficiently and accurately attain to the aim of keyword spotting on a collection of historical Mongolian documents. Meanwhile, the proposed approach improves the performance significantly than the original BoVW approach.

Solving the Vanishing Information Problem with Repeated Potential Mutual Information Maximization

Ryotaro Kamimura[1]
[1]Tokai University

Abstract

The present paper shows how to solve the problem of vanishing information in potential mutual information maximization. We have previously developed a new information-theoretic method called "potential learning" which aims to extract the most important features through simplified information maximization. However, one of the major problems is that the potential effect diminishes considerably in the course of learning and it becomes impossible to take into account the potentiality in learning. To solve this problem, we here introduce repeated information maximization. The method was applied to the on-line article popularity data set to estimate the popularity of articles. The results show that the potentiality information maximization could increase mutual information even with 50 hidden neurons, and lead to improved generalization performance.

Self-Organization on a Sphere with Application to Topological Ordering of Chinese Characters

Andrew Paplinski[1]
[1]Monash University

Abstract

We consider a case of self-organization in which a relatively small number N of data points is mapped on a larger number M of nodes. This is a reverse situation to a typical clustering problem when a node represents a center of the cluster of data points. In our case the objective is to have a Gaussian-like distribution of weights over nodes in the neighbourhood of the winner for a given stimulus. The fact that $M > N$ creates some problem with using learning schemes related to Gaussian Mixture Models. We also show how the objects, Chinese characters in our case, can be topologically ordered on a surface of a 3D sphere. A Chinese character is represented by an angular integral of the Radon Transform (aniRT) which is an RTS-invariant 1-D signature function of an image.

A Spectrum Allocation Algorithm Based on Optimization and Protection in Cognitive Radio Networks

Jing Gao[1], Jianyu Lv[1], Song Xin[1]
[1]Northeastern University

Abstract

Cognitive radio network (CRN) is proposed to solve the problem of the scarce radio spectrum resources. In CRN, primary users (PUs) are allowed to lease out their unused spectrum sharing with cognitive users (CUs). In this paper, we propose a spectrum allocation algorithm based on CUs-demand and PUs-protection in CRN. Our objection is to make the allocated spectrum satisfy CUs demands as much as possible, avoiding the CUs interfering the PUs in the process of spectrum allocation. Simulation results indicate that this algorithm can improve the total spectrum reward, the satisfaction rate of CUs and the protection rate.

A Conjugate Gradient-based Efficient Algorithm for Training Single Hidden Layer Neural Networks

Xiaoling Gong[1], Jian Wang[1]
[1]China University of Petroleum

Abstract

Efficient training techniques for single hidden layer neural networks (SHLNNs) have always attracted considerable interests. Extreme Learning Machine (ELM) is one of such popular networks that has faster training speed than typical back propagation (BP) neural networks based on gradient descent method. However, it requires more hidden neurons than BP neural networks to reach the required classification accuracy, which leads to more test time in practice. A novel learning algorithm (USA) for SHLNNs which updates the weights by using gradient method has been presented to reduce the number of hidden neurons in ELM's framework. In this paper, we employ the conjugate gradient method to train SHLNNs on the MNIST digit recognition problem. The experiment demonstrates better generalization and shows that the network requires less hidden neurons than the common ELM and USA models.

The Ability of Learning Algorithms for Fuzzy Inference Systems using Vector Quantization

Hirofumi Miyajima[1], Noritaka Shigei[2], Hiromi Miyajima[2]
[1]Nagasaki University [2]Kagoshima University

Abstract

Many studies on learning of fuzzy inference systems have been made. Speci cally, it is known that learning methods using VQ (Vector Quantization) and SDM (Steepest Descend Method) are supe- rior to other methods. We already proposed new learning methods it- erating VQ and SDM. In their learning methods, VQ is used only in determination of parameters for the antecedent part of fuzzy rules. In order to improve them, we added the method determining of parameters for the consequent part of fuzzy rules to processing of VQ and SDM. That is, we proposed a learning method composed of three stages as VQ, GIM(Generalized Inverse Matrix) and SDM in the previous paper. In this paper, the ability of the proposed method is compared with other ones using VQ. As a result, it is shown that the proposed method outper- forms conventional ones using VQ in terms of accuracy and the number of rules.

An improved multi-strategy ensemble artificial bee colony algorithm with neighborhood search

Xinyu Zhou[1], Mingwen Wang[1], Jianyi Wan[1], Jiali Zuo[1]
[1]Jiangxi Normal University

Abstract

Artificial bee colony (ABC) algorithm has been shown its good performance over many optimization problems. Recently, a multi-strategy ensemble ABC (MEABC) algorithm was proposed which employed three distinct solution search strategies. Although its such mechanism works well, it may run the risk of causing the problem of premature convergence when solving complex optimization problems. Hence, we present an improved version by integrating the neighborhood search operator of which object is to perturb the global best food source for better balancing the exploration and exploitation. Experiments are conducted on a set of 22 well-known benchmark functions, and the results show that both of the quality of final results and convergence speed can be improved.

Gender-Specific Classifiers in Phoneme Recognition and Academic Emotion Detection

Judith Azcarraga[1], Arnulfo Azcarraga[1], Arces Talavera[1]
[1]De La Salle University

Abstract

Gender-specific classifiers outperform general classifiers, where all data from both male and female users are combined. In calibrated experiments designed to demonstrate this, two sets of data were used to build male-specific and female-specific classifiers to predict vowel phonemes based on speech signals, and negative emotions based on brainwave (EEG) signals. The MLP, trained as general classifier, recognizes vowel phonemes with an accuracy of 91%, while that for EEG signals has an average accuracy of 59%. The performance significantly improves with gender-specific classifiers, with increased average accuracies of 94% and 96% for the vowel phoneme set; and for the EEG dataset of 65% and 71% for male-only and female-only classifiers, respectively. Performance rates using recall and precision show the same trend. A further probe is done using SOM to visualize the distribution of the sub-clusters among male and female users.

Local Invariance Representation Learning Algorithm With Multi-Layer Extreme Learning Machine

Xibin Jia[1], Xiaobo Li[1], Hua Du[1], Bir Bhanu[2]
[1]Beijing University of Technology [2]University of California Riverside

Abstract

Multi-layer extreme learning machine(ML-ELM) is a stacked extreme learning machine based auto-encoding (ELM-AE).It provides an effective solution for deep feature extraction with higher training efficiency.To enhance the local-input invariance of feature extraction, we propose a contractive multi-layer extreme learning machine (C-ML-ELM) by adding a penalty term in the optimization function to minimize derivative of output to input at each hidden layer.In this way,the extracted feature is supposed to keep consecutiveness attribution of an image.The experiments have been done on MNIST handwriting dataset and face expression dataset CAFE .The results show that it outperforms several state-of-art classification algorithms with less error and higher training efficiency.

Two-dimensional Soft Linear Discriminant Projection for Robust Image Feature Extraction and Recognition

Yu Tang[1], Zhao Zhang[1], Yan Zhang[1]
[1]Soochow University

Abstract

In this study, we propose a Robust Soft Linear Discriminant Projection (RS-LDP) algorithm for extracting two-dimensional (2D) image features for recognition. RS-LDP is based on the soft label linear discriminant analysis (SL-LDA) that is shown to be effective for semi-supervised feature learning, but SLDA works in the vector space and thus extract one-dimensional (1D) features directly, so it has to convert the two-dimensional (2D) image matrices into the 1D vectorized representations in a high-dimensional space when dealing with images. But such transformation usually destroys the intrinsic topology structures of the images pixels and thus loses certain important information, which may result in degraded performance. Compared with SL-LDA for representation, our RS-LDP can effectively preserve the topology structures among image pixels, and more importantly it would be more efficient due to the matrix representations.

Asymmetric Synaptic Connections in Z(2) Gauge Neural Network

Atsutomo Murai[1], Tetsuo Matsui[1]
[1]Kindai University

Abstract

We consider Z(2) gauge neural network which involves neuron variables $S_i(=\pm 1)$ and synaptic connection (gauge) variables $J_{ij}(=\pm 1)$. Its energy consists of the Hopfield term $-c_1 S_i J_{ij} S_j$ and the reverberation term $-c_2 J_{ij} J_{jk} J_{ki}$ for signal propagation on a closed loop. The model of symmetric couplings $J_{ij} = J_{ji}$ has been studied; its phase diagram in the $c_2 - c_1$ plane exhibits Higgs, Coulomb and confinement phases, each of which is characterized by the ability of learning and/or recalling patterns. In this paper, we consider the model of asymmetric coupling (J_{ij} and J_{ji} are independent), and examine the effect of asymmetry on a partially connected random network.

SOMphony: Visualizing Symphonies using Self Organizing Maps

Arnulfo Azcarraga[1], Fritz Kevin Flores[1]
[1]De La Salle University

Abstract

Symphonies are musical compositions played by a full orchestra which have evolved since the 16th Century. Self-Organizing Maps (SOM) are shown to be useful in visualizing symphonies as a musical trajectory across nodes in a trained map. This allows for some insights about the relationships and influences between and among composers in terms of their composition styles, and how the symphonic compositions have evolved over the years from one major music period to the next. The research focuses on Self Organizing Maps that are trained using 1-second music segments extracted from 45 different symphonies, from 15 different composers, with 3 composers from each of the 5 major musical periods. The trained SOM is further processed by doing a k-means clustering of the node vectors, which then allows for the quantitative comparison of music trajectories between symphonies of the same composer, between different composers of the same music period, and composers from different music periods.

Online EM for the Normalized Gaussian Network with Weight-Time-Dependent Updates

Jana Backhus[1], Ichigaku Takigawa[1], Hideyuki Imai[1], Mineichi Kudo[1], Masanori Sugimoto[1]
[1]Hokkaido University

Abstract

In this paper, we propose a weight-time-dependent (WTD) update approach for an online EM algorithm applied to the Normalized Gaussian network (NGnet). WTD aims to improve a recently proposed weight-dependent (WD) update approach by Celaya and Agostini. First, we discuss the derivation of WD from an older time-dependent (TD) update approach. Then, we consider additional aspects to improve WD, and by including them we derive the new WTD approach from TD. The difference between WD and WTD is discussed, and some experiments are conducted to demonstrate the effectiveness of the proposed approach. WTD succeeds in improving the learning performance for a function approximation task with balanced and dynamic data distributions.

Learning Phrase Representations Based on Word and Character Embeddings

Jiangping Huang[1], Donghong Ji[1], Shuxin Yao[2], Wenzhi Huang[1], Bo Chen[1]
[1]Wuhan University [2]Carnegie Mellon University

Abstract

Most phrase embedding methods consider a phrase as a basic term and learn embeddings according to phrases' external contexts, ignoring the internal structures of words and characters. There are some languages such as Chinese, a phrase is usually composed of several words or characters and contains rich internal information. The semantic meaning of a phrase is also related to the meanings of its composing words or characters. Therefore, we propose a joint words and characters embedding model for learning phrase representation. In order to disambiguate the word and character and address the issue of non-compositional phrases, we present multiple-prototype word and character embeddings and an effective phrase selection method. We evaluate the effectiveness of the proposed model on phrase similarities computation and analogical reasoning. The empirical result shows that our model outperforms other baseline methods which ignore internal word and character information.

A Mobile-Based Obstacle Detection Method: Application to the Assistance of Visually Impaired People

Manal Alshehri[1], Salma Kammoun Jarraya[2], Hanene Ben-Abdallah[2]
[1]Faculty of Computing and Information Technology, King Abdulaziz University, Jeddah, Saudi Arabia [2]Faculty of Computing and Information Technology, King Abdulaziz University, Jeddah, Saudi Arabia, MIRACL Laboratory

Abstract

Visual impairments suffer many difficulties when they navigate from one place to another in their daily life. The biggest problem is obstacle detection. In this work, we propose a new smartphone-based method for obstacle detection. We aim to detect static and dynamic obstacles in unknown environments while offering maximum flexibility to the user and using the least expensive equipment possible. Detecting obstacles is based on the analysis of different regions of video frames and using a new decision algorithm. The analysis uses prediction model for each region that generated by a supervised learning process. The user is notified about the existing of an obstacle by alert message. The efficiency of the work is measured by many experiments studies on different complex scenes. It records low false alarm rate in the range of [0.2 percent to 11 percent], and high accuracy in the range of [86 percent to 94 percent].

t-SNE based Visualisation and Clustering of Geological Domain

Mehala Balamurali[1], Arman Melkumyan[1]
[1]University of Sydney

Abstract

Identification of geological domains and their boundaries plays a vital role in the estimation of mineral resources. Geologists are often interested in exploratory data analysis and visualization of geological data in two or three dimensions in order to detect quality issues or to generate new hypotheses. We compare PCA and some other linear and non-linear methods with a newer method, t-Distributed Stochastic Neighbor Embedding (t-SNE) for the visualization of large geochemical assay datasets. The t-SNE based reduced dimensions can then be used with clustering algorithm to extract well clustered geological regions using exploration and production datasets. Significant differences between the nonlinear method t-SNE and the state of the art methods were observed in two dimensional target spaces.

Data-based Optimal Tracking Control of Nonaffine Nonlinear Discrete-time Systems

Biao Luo[1], Derong Liu[2], Tingwen Huang[3], Chao Li[1]
[1]Institute of Automation, Chinese Academy of Sciences [2]University of Science and Technology Beijing [3]Texas A&M University at Qatar

Abstract

The optimal tracking control problem of nonaffine nonlinear discrete-time systems is considered in this paper. The problem relies on the solution of the so-called tracking Hamilton-Jacobi-Bellman equation, which is extremely difficult to be solved even for simple systems. To overcome this difficulty, the data-based Q-learning algorithm is proposed by learning the optimal tracking control policy from data of the practical system. For its implementation purpose, the critic-only neural network structure is developed, where only critic neural network is required to estimate the Q-function and the least-square scheme is employed to update the weight of neural network.

Parallel Learning for Combined Knowledge Acquisition Model

Kohei Henmi[1], Motonobu Hattori[1]
[1]University of Yamanashi

Abstract

In this paper, we propose a novel learning method for the combined knowledge acquisition model. The combined knowledge acquisition model is a model for knowledge acquisition in which an agent heuristically find new knowledge by integrating existing plural knowledge. In the conventional model, there are two separate phases for combined knowledge acquisition: (a) solving a task with existing knowledge by trial and error and (b) learning new knowledge based on the experience in solving the task. However, since these two phases are carried out serially, the efficiency of learning was poor. In this paper, in order to improve this problem, we propose a novel knowledge acquisition method which realizes two phases simultaneously. Computer simulation results show that the proposed method much improves the efficiency of learning new knowledge.

Time series classification based on multi-codebook important time subsequence approximation algorithm

Zhiwei Tao[1], Li Zhang[1], Bangjun Wang[1], Fanzhang Li[1]
[1]Soochow University

Abstract

This paper proposes a multi-codebook important time subsequence approximation (MCITSA) algorithm for time series classification. MCITSA generates a codebook using important time subsequences for each class on con-sidering the difference of categories. In this way, each codebook contains the class information itself. To predict the class label of an unseen time series, MCITSA needs to compare the similarities between important time subse-quences extracted from the unseen time series and codewords of each class. Ex-perimental results on time series datasets demonstrate that MCITSA is more powerful to classify time series than PVQA.

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16-21 October 2016
Kyoto, Japan

Performance Improvement via Bagging in Ensemble Prediction of Chaotic Time Series Using Similarity of Attractors and LOOCV Predictable Horizon

Mitsuki Toidani[1], Kazuya Matsuo[1], Shuichi Kurogi[1]
[1]Kyushu Institute of Technology

Abstract

Recently, we have presented a method of ensemble prediction of chaotic time series. The method employs strong learners capable of making predictions with small error and usual ensemble mean does not work for long term prediction owing to the long term unpredictability of chaotic time series. Thus, the method uses similarity of attractors to select plausible predictions from original predictions generated by strong leaners, and then calculates LOOCV (leave-one-out cross-validation) measure to estimate predictable horizons. Finally, it provides representative prediction and an estimation of the predictable horizon. We have used CAN2s (competitive associative nets) for learning piecewise linear approximation of nonlinear function as strong learners in the previous study, and this paper employs bagging of them to improve the performance, and shows the validity and the effectiveness of the method.

A review of EEG Signal Simulation methods

Ibrahima Faye[1], Muhammad Izhan Noorzi[1]
[1]Universiti Teknologi PETRONAS

Abstract

This paper describes EEG signal simulation methods. Three main methods have been included in this study: Markov Process Amplitude (MPA), Artificial Neural Network (ANN), and Autoregressive (AR) models. Each method is described procedurally, along with mathematical expressions. By the end of the description of each method, the limitations and benefits are described in comparison with other methods. MPA comprises of three variations; first-order MPA, nonlinear MPA, and adaptive MPA. ANN consists of two variations; feed forward back-propagation NN and multilayer feed forward with error back-propagation NN with embedded driving signal. AR model based filtering has been considered with its variation, genetic algorithm based on autoregressive moving average (ARMA) filtering.

A New Blind Image Quality Assessment Based on Pairwise

Jianbin Jiang[1], Yue Zhou[1], Liming He[1]
[1]Institude of Image Processing and Pattern Recognition, Shanghai Jiao Tong University

Abstract

Recently, the algorithms of general purpose blind image quality assessment (BIQA) have been an important research area in the field of image processing, but the previous approaches usually depend on human scores image for training and using the regression methods to predict the image quality. In this paper, we first apply the full-reference image quality measure to obtain the image quality scores for training to let our algorithm independent of the judgment of human. Then, we abstract features using an NSS model of the image DCT coefficient which is indicative of perceptual quality, and subsequently, we import Pairwise approach of Learning to rank (machine-learned ranking) to predict the perceptual scores of image quality. Our algorithm is tested on LIVE II and CSIQ database and it is proved to perform highly correlate with human judgment of image quality, and better than the popular SSIM index and competitive with the state-of-the-art BIQA algorithms.

Self-organizing maps as feature detectors for supervised neural network pattern recognition

Macario II Cordel[1], Arren Matthew Antioquia[1], Arnulfo Azcarraga[1]
[1]De La Salle University

Abstract

Convolutional neural network (CNN)-based works show that learned features, rather than handpicked features, produce more desirable performance in pattern recognition. This learning approach is based on higher organisms visual system which are developed based on the input environment. However, the feature detectors of CNN are trained using an error-correcting teacher as opposed to the natural competition to build node connections. As such, a neural network model using self-organizing map (SOM) as feature detector is proposed in this work. As proof of concept, the handwritten digits dataset is used to test the performance of the proposed architecture. The size of the feature detector as well as the different arrangement of receptive fields are considered to benchmark the performance of the proposed network. The performance for the proposed architecture achieved comparable performance to vanilla MLP, being 96.93

A Review of Electroencephalogram-based Analysis and Classification Frameworks for Dyslexia

Harshani Perera[1], Mohd Fairuz Shiratuddin[1], Kok Wai Wong[1]
[1]Murdoch University

Abstract

Dyslexia is a hidden learning disability that causes difficulties in reading and writing despite average intelligence. Electroencephalogram (EEG) is one of the upcoming methods being researched for identifying unique brain activation patterns in dyslexics. This paper examines pros and cons of existing EEG-based analysis and classification frameworks for dyslexia and recommends optimizations through the findings to assist future research

Rule-Based Grass Biomass Classification for Roadside Fire Risk Assessment

Ligang Zhang[1], Brijesh Verma[1]
[1]Central Queensland University

Abstract

Roadside grass fire is a major hazard to the security of drivers and vehicles. However, automatic assessment of roadside grass fire risk has not been fully investigated. This paper presents an approach, for the first time to our best knowledge, that automatically estimates and classifies grass biomass for determining the fire risk level of roadside grasses from video frames. A major novelty is automatic measurement of grass coverage and height for predicting the biomass. For a sampling grass region, the approach performs two-level grass segmentation using class-specific neural networks. The brown grass coverage is then calculated and an algorithm is proposed that uses continuously connected vertical grass pixels to estimate the grass height. Based on brown grass coverage and grass height, a set of threshold based rules are designed to classify grasses into low, medium or high risk. Experiments on a challenging real-world dataset demonstrate promising results of our approach.

Efficient Recognition of Attentional Bias using EEG data and the NeuCube Evolving Spatio-Temporal Data Machine

Zohreh Gholami Doborjeh[1], Maryam Gholami Doborjeh[1], Nikola Kasabov[1]
[1]Auckland University of Technology

Abstract

Modelling of dynamic brain activity for better understanding of human decision making processes becomes an important task in many areas of study. Inspired by importance of the attentional bias principle in human choice behaviour, we proposed a Spiking Neural Network (SNN) model for efficient recognition of attentional bias. The model is based on the evolving spatio-temporal data machine NeuCube. The proposed model is tested on a case study experimental EEG data collected from a group of subjects exemplified here on a group of moderate drinkers when they were presented by different product features (in this case different features of drinks). The results showed a very high accuracy of discriminating attentional bias to non-target objects and their features when compared with a poor performance of traditional machine learning methods. Potential applications in neuromarketing and cognitive studies are also discussed.

October 20 (Thursday)

Plenary 4	Clock Tower Centennial Hall	9:30	–	10:20
chair:	Shin Ishii			

Neural nets and the connectome
Sebastian Seung
Neuroscience Institute and Computer Science Dept. Princeton University

ThuAM-1 **Reinforcement learning**
Chair: Derong Liu, Junichiro Yoshimoto
Room: International Conference Hall I

10:40	-	11:00	Decentralized Stabilization for Nonlinear Systems with Unknown Mismatched Interconnections Bo Zhao[1], Ding Wang[1], Guang Shi[1], Derong Liu[2], Yuanchun Li[3] [1]Institute of Automation, Chinese Academy of Sciences [2]University of Science and Technology Beijing [3]Changchun University of Technology
11:00	-	11:20	Optimal Constrained Neuro-Dynamic Programming Based Self-Learning Battery Management in Microgrids Qinglai Wei[1], Derong Liu[2] [1]Institute of Automation, Chinese Academy of Sciences [2]University of Science and Technology Beijing
11:20	-	11:40	Risk sensitive reinforcement learning scheme is suitable for learning on a budget Kazuyoshi Kato[1], Koichiro Yamauchi[1] [1]Chubu University
11:40	-	12:00	A Kernel-Based Sarsa(λ) Algorithm with Clustering-Based Sample Sparsification Haijun Zhu[1] Fei Zhu[2] Yuchen Fu[2] Quan Liu[2] Jianwei Zhai[2] Cijia Sun[3] Peng Zhang[2] [1]school of computer science&technology, soochow university [2]school of computer science&thechnology, soochow university [3]School of Computer Science and Technology, Soochow University
12:00	-	12:20	Sparse Kernel-based Least Squares Temporal Difference with Prioritized Sweeping Cijia Sun[1] Xinghong Ling[1] Yuchen Fu[1] Quan Liu[1] Haijun Zhu[1] Jianwei Zhai[1] Peng Zhang[1] [1]School of Computer Science & Technology, Soochow University

ThrAM-2			Applications
Chair:	Hiroaki Gomi, Nojun Kwak		
Room:	International Conference Hall II		

10:40	-	11:00	Classifying Human Activities with Temporal Extension of Random Forest Shih Yin Ooi[1], Shing Chiang Tan[1], Wooi Ping Cheah[1] [1]Multimedia University
11:00	-	11:20	Echo State Network Ensemble for Human Motion Data Temporal Phasing: A Case Study on Tennis Forehands Boris Bacic[1] [1]Auckland University of Technology
11:20	-	11:40	Unregistered Bosniak Classification with Multi-phase Convolutional Neural Networks Myunggi Lee[1], Hyeogjin Lee[1], Jiyong Oh[1], Hak Jong Lee[1], Seung Hyup Kim[1], Nojun Kwak[1] [1]Seoul National University
11:40	-	12:00	Direct Estimation of Wrist Joint Angular Velocities from Surface EMGs by Using an SDNN Function Approximator F Kazumasa Horie[1], Atsuo Suemitsu[2], Tomohiro Tanno[1], Masahiko Morita[1] [1]University of Tsukuba [2]Sapporo University of Health Sciences

ThuAM-3 Computational Intelligence 1
Chair: Teijiro Isokawa, Laizhong Cui
Room: International Conference Hall III

10:40	-	11:00	Vietnamese POS Tagging for Social Media Text Ngo Xuan Bach[1], Nguyen Dieu Linh[1], Tu Minh Phuong[1] [1]Posts and Telecommunications Institute of Technology, Vietnam
11:00	-	11:20	Scaled Conjugate Gradient Learning for Quaternion-Valued Neural Networks Calin-Adrian Popa[1] [1]Polytechnic University Timisoara
11:20	-	11:40	Performance of Qubit Neural Network in Chaotic Time Series Forecasting Taisei Ueguchi[1], Nobuyuki Matsui[1], Teijiro Isokawa[1] [1]University of Hyogo
11:40	-	12:00	The Evolutionary Process of Image Transition in Conjunction with Box and Strip Mutation Aneta Neumann[1], Bradley Alexander[1], Frank Neumann[1] [1]The University of Adelaide, School of Computer Science, Faculty of Engineering, Computer and Mathematical Science
12:00	-	12:20	A preliminary model for understanding how life experiences generate human emotions and behavioural responses Irosh Fernando[1] [1]University of Newcastle

ThuAM-4 **Data Mining 1**
Chair: Tetsuo Furukawa
Room: Conference Room III

10:40	-	11:00	Semi-Supervised Classification by Nuclear-norm based Transductive Label Propagation Lei Jia[1], Zhao Zhang[1], Yan Zhang[1] [1]Soochow University
11:00	-	11:20	Effective and Efficient Multi-label Feature Selection Approaches via Modifying Hilbert-Schmidt Independence Criterion Jianhua Xu[1] [1]Nanjing Normal University
11:20	-	11:40	Storm Surge Prediction for Louisiana Coast Using Artificial Neural Networks Qian Wang[1], Jianhua Chen[1], Kelin Hu[1] [1]Louisiana State University
11:40	-	12:00	Factorization of Multiple Tensors for Supervised Feature Extraction Wei Liu[1] [1]UTS
12:00	-	12:20	A Non-linear Label Compression Coding Method Based on Five-layer Auto-encoder for Multi-label Classification Jiapeng Luo[1], Lei Cao[1], Jianhua Xu[1] [1]Nanjing Normal University

ThuAM-5 **Deep Neural Networks 1**
Chair: Yuki Maruno
Room: Conference Room IV

10:40	-	11:00	Unsupervised Video Hashing by Exploiting Spatio-Temporal Feature Chao Ma[1], Yun Gu[1], Wei Liu[1], Jie Yang[1], Xiangjian He[2] [1]Shanghai Jiao Tong University [2]University of Technology, Sydney, Australia
11:00	-	11:20	Selective Dropout for Deep Neural Networks Erik Barrow[1], Mark Eastwood[1], Chrisina Jayne[2] [1]Coventry University [2]Robert Gordon University
11:20	-	11:40	Real-time action recognition in surveillance videos using ConvNets Sheng Luo[1], Haojin Yang[1], Cheng Wang[1], Xiaoyin Che[1], Christoph Meinel[1] [1]Hasso Plattner Institute
11:40	-	12:00	An Architecture Design Method of Deep Convolutional Neural Network Satoshi Suzuki[1], Hayaru Shouno[1] [1]Graduate School of Informatics and Engineering, The University of Electro-Communications
12:00	-	12:20	Investigation of the Efficiency of Unsupervised Learning for Multi-task Classification in Convolutional Neural Network Jonghong Kim[1], Gil-Jin Jang[1], Minho Lee[1] [1]Kyungpook National University

ThuPM1-1	**Novel Approaches of Systems Neuroscience to Sports and Rehabilitation Workshop 1**
Chair:	Yasuharu Koike, Eiichi Naito, Toshitaka Kimura
Room:	International Conference Hall I

13:00	-	13:40	Special talk Understanding complex sports behavior: interpersonal competition and cooperation Yuji Yamamoto[1] [1]Research Center of Health, Physical Fitness & Sports, Nagoya University
13:40	-	14:00	Talk 1 Evaluation of sports performance with novel measurement techniques Toshitaka Kimura[1] [1]NTT Communication Science Laboratories
14:00	-	14:20	Talk 2 Hitting the sweet spot: investigating the neuroscience behind impact control by humans Ganesh Gowrishankar[1] [1] CNRS-AIST Joint Robotics Laboratory
14:20	-	14:40	Talk 3 Brain plasticity in artificial leg athletes Kento Nakagawa[1] [1]Graduate School of Arts and Sciences, The University of Tokyo

ThuPM1-2 **Machine Learning 7**
Chair: Toshisada Mariyama, Hiroaki Sasaki
Room: International Conference Hall II

13:20	-	13:40	Analytical Incremental Learning: Fast Constructive Learning Method for Neural Network Syukron Ishaq Alfarozi[1], Noor Akhmad Setiawan[2], Teguh Bharata Adji[2], Kuntpong Woraratpanya[1], Kitsuchart Pasupa[1], Masanori Sugimoto[3] [1]Faculty of Information Technology, King Mongkut's Institute of Technology Ladkrabang [2]Department of Electrical Engineering and Information Technology, Universitas Gadjah Mada [3]Hokkaido University
13:40	-	14:00	Acceleration of word2vec using GPUs Seulki Bae[1], Youngmin Yi[1] [1]University of Seoul
14:00	-	14:20	Automatic design of neural network structures using AiS Toshisada Mariyama[1], Kunihiko Fukushima[1], Wataru Matsumoto[1] [1]Mitsubishi Electric
14:20	-	14:40	Sequential Collaborative Ranking Using (No-)Click Implicit Feedback Frédéric Guillou[1], Romaric Gaudel[1], Philippe Preux[1] [1]Inria, Univ. Lille, CNRS, France [2]Univ. Lille, CNRS, Centrale Lille, Inria, UMR 9189 - CRIStAL, Lille, France
14:40	-	15:00	Group Information-based Dimensionality Reduction via Canonical Correlation Analysis Haiping Zhu[1], Hongming Shan[1], Youngjoo Lee[2], Yiwei He[1], Qi Zhou[1], Junping Zhang[1] [1]Fudan University [2]Samsung Electronics

ThuPM1-3 Computational Intelligence 2
Chair: Kazushi Ikeda, Nobuyuki Matsui
Room: International Conference Hall III

13:20	-	13:40	Artificial Bee Colony Algorithm Based on Neighboring Information Learning Laizhong Cui[1], Genghui Li[1], Qiuzhen Lin[1], Jianyong Chen[1], Nan Lu[1], Guanjing Zhang[2] [1]Shenzhen University [2]E-Techco Information Technologies Co., Ltd
13:40	-	14:00	Data-driven Design of Type-2 Fuzzy Logic System by Merging Type-1 Fuzzy Logic Systems Chengdong Li[1], Li Wang[1], Zixiang Ding[1], Guiqing Zhang[1] [1]Shandong Jianzhu university
14:00	-	14:20	Memetic cooperative neuro-evolution for chaotic time series prediction Gary Wong[1], Rohitash Chandra[2], Anuraganand Sharma[3] [1]Software Foundation Fiji [2]Nanyang Technological University [3]The University of the South Pacific
14:20	-	14:40	SLA Management Framework to Avoid Violation in Cloud Walayat Hussain[1], Farookh Hussain[1], Omar Hussain[2] [1]University of Technology Sydney [2]University of New South Wales
14:40	-	15:00	Pattern Retrieval by Quaternionic Associative Memory with Dual Connections Toshifumi Minemoto[1], Teijiro Isokawa[1], Masaki Kobayashi[2], Haruhiko Nishimura[1], Nobuyuki Matsui[1] [1]University of Hyogo [2]University of Yamanashi

ThuPM1-4 Data Mining 2
Chair: Jianhua Xu
Room: Conference Room III

13:20	-	13:40	Fast Agglomerative Information Bottleneck based Trajectory Clustering Yuejun Guo[1], Qing Xu[1], Yang Fan[1], Sheng Liang[1], Mateu Sbert[2] [1]Tianjin University [2]Universitat de Girona
13:40	-	14:00	Anomaly Detection using Correctness Matching through a Neighborhood Rough Set Pey Yun Goh[1], Shing Chiang Tan[1], Wooi Ping Cheah[1] [1]Multimedia University
14:00	-	14:20	Learning Class-informed Semantic Similarity Tinghua Wang[1], Wei Li[1] [1]Gannan Normal University
14:20	-	14:40	Aggregated Temporal Tensor Factorization Model for Point-of-interest Recommendation Shenglin Zhao[1], Michael Lyu[1], Irwin King[1] [1]The Chinese University of Hong Kong
14:40	-	15:00	Multilevel-Multigroup Analysis by the Hierarchical Tensor SOM Network Hideaki Ishibashi[1], Ryota Shinriki[1], Hirohisa Isogai[1], Tetsuo Furukawa[1] [1]Kyushu Institute of Technology

ThuPM1-5 **Deep Neural Networks 2**
Chair: Hayaru Shouno, Minho Lee
Room: Conference Room IV

13:20	-	13:40	Sparse Auto-encoder with Smoothed l1 Regularization Li Zhang[1], Yaping Lu[1], Zhao Zhang[1], Bangjun Wang[1], Fanzhang Li[1] [1]Soochow University
13:40	-	14:00	Encoding Multi-resolution Two-stream CNNs for Action Recognition Xue Weichen[1], Zhao Haohua[1], Zhang Liqing[1] [1]Shanghai Jiao Tong University
14:00	-	14:20	Improving Neural Network Generalization by Combining Parallel Circuits with Dropout Kien Tuong Phan[1], Tomas Henrique Maul[1], Tuong Thuy Vu[1], Weng Kin Lai[2] [1]University of Nottingham Malaysia Campus [2]Tunku Abdul Rahman University College
14:20	-	14:40	Predicting Multiple Pregrasping Poses Prediction Using Combining Deep Convolutional Neural Network and Mixture Density Network Youngbin Park[1], Sungphill Moon[1], Il-Hong Suh[1] [1]Hanyang university
14:40	-	15:00	Recurrent Neural Networks for Adaptive Feature Acquisition Gabriella Contardo[1], Ludovic Denoyer[1], Thierry Artieres[2] [1]Sorbonne Universites, UPMC Univ Paris 06, UMR 7606, LIP6, F-75005, Paris [2]Aix Marseille Univ, CNRS, Centrale Marseille, LIF, Marseille, France

ThuPM2-1	**Novel Approaches of Systems Neuroscience to Sports and Rehabilitation Workshop 2**
Chair:	Yasuharu Koike, Eiichi Naito, Toshitaka Kimura
Room:	International Conference Hall I

15:00	-	15:20	Talk 4 Imaging human central motor system in children Eiichi Naito[1] [1]Center for Information and Neural Networks (CiNet), National Institute of Information and Communications Technology (NICT)
15:20	-	15:40	Talk 5 Development of VR platform for cloud-based neurorehabilitation Tetsunari Inamura[1] [1] National Institute of Informatics; The Graduate University for Advanced Studies
15:40	-	16:00	Talk 6 Function of the meso-limbic system in motor control Michiaki Suzuki[1] [1]Graduate school of Medicine, Kyoto University; School of Life Science, SOKENDAI
16:00	-	16:20	Talk 7 Induction of embodiment of a prosthesis into the body Noritaka Kawashima[1] [1]Research Institute, National Rehabilitation Center for Persons with Disabilities
16:20	-	16:40	Talk 8 Muscle synergy analysis for motor control Yasuharu Koike[1] [1]Institute of Innovative Research, Tokyo Institute of Technology

ThuPM2-2 **Computer Vision 4**
Chair: Liang Wang
Room: International Conference Hall II

15:20	-	15:40	Compound PDE-based Image Restoration Algorithm using Second-order and Fourth-order Diffusions Tudor Barbu[1] [1]Institute of Computer Science of the Romanian Academy
15:40	-	16:00	Multi-Swarm Particle Grid Optimization for Object Tracking Feng Sha[1], Henry Fung Yeung[1], Yuk Ying Chung[2], Guang Liu[1], Prof. Wei-Chang Yeh[3] [1]University of Sydney [2]the University of Sydney [3]National Tsing Hua University, Taiwan
16:00	-	16:20	Energy-based multi-plane detection from 3D point clouds Liang Wang[1], Chao Shen[1], Fuqing Duan[2], Ping Guo[2] [1]Beijing University of Technology [2]Beijing Normal University
16:20	-	16:40	Bi-Lp-Norm Sparsity Pursuiting Regularization for Blind Motion Deblurring Wanlin Gan[1], Yue Zhou[2], Liming He[1] [1]Shanghai Jiao Tong University [2]Institude of Image Processing and Pattern Recognition, Shanghai Jiao Tong University

ThuPM2-3 Computational Intelligence 3
Chair: Kazushi Ikeda, Nobuyuki Matsui
Room: International Conference Hall III

15:20	-	15:40	A GPU Implementation of a Bat Algorithm Trained Neural Network Amit Roy Choudhury[1], Rishabh Jain[1], Kapil Sharma[1] [1]Delhi Technological University
15:40	-	16:00	Investigating a dictionary-based non-negative matrix factorization in superimposed digits classification tasks Somnuk Phon-Amnuaisuk[1], Soo-Young Lee[2] [1]Universiti Teknologi Brunei [2]Korea Advanced Institute of Science and Technology
16:00	-	16:20	A Swarm Intelligence Algorithm Inspired by Twitter Lv Zhihui[1], Furao Shen[2], Jinxi Zhao[2], Tao Zhu[1] [1]Nanjing University [2]Department of Computer Science and Technology, Nanjing University
16:20	-	16:40	Collaborative Filtering, Matrix Factorization & Population Based Search: The Nexus Unveiled Ayang Laishram[1], Satya Prakash Sahu[1], Vineet Padmanabhan[1], Siba Kumar Udgata[1] [1]University of Hyderabad
16:40	-	17:00	Adaptive Hausdorff Distances and Tangent Distance Adaptation for Transformation Invariant Classification Learning Sascha Saralajew[1], David Nebel[2], Thomas Villmann[2] [1]Dr. Ing. h.c. Porsche AG [2]Hochschule Mittweida

ThuPM2-4 **Data Mining 3**
Chair: Jianhua Xu
Room: Conference Room III

15:20	-	15:40	A Wavelet Deep Belief Network-based Classifier for Medical Images Amin Khatami[1], Abbas Khosravi[1], Chee Peng Lim[1], Saeid Nahavandi[1] [1]Deakin University
15:40	-	16:00	Bayesian Neural Networks Based Bootstrap Aggregating for Tropical Cyclone Tracks Prediction in South China Sea Lei Zhu[1], Jin Jian[1], Alex Cannon[2], William Hsieh[2] [1]East China Normal University [2]University of British Columbia
16:00	-	16:20	Credit Card Fraud Detection Using Convolutional Neural Networks Kang Fu[1], Dawei Cheng[1], Yi Tu[1], Zhang Liqing[1] [1]Shanghai Jiao Tong University
16:20	-	16:40	An Efficient Data Extraction Framework for Mining Wireless Sensor Networks Md. Mamunur Rashid[1], Iqbal Gondal[2], Joarder Kamruzzaman[1] [1]Monash University [2]Federation University and Monash University, Australia
16:40	-	17:00	Incorporating Prior Knowledge Into Context-Aware Recommendation Mao Xiaoxi[1], Zheng Haitao[1] [1]Tsinghua University

ThuPM2-5 Deep Neural Networks 3
Chair: Hayaru Shouno, Minho Lee
Room: Conference Room IV

15:20	-	15:40	Stacked Robust Autoencoder for Classification Janki Mehta[1], Kavya Gupta[1], Anupriya Gogna[1], Angshul Majumdar[1], Saket Anand[1] [1]Indraprastha Institute of Information Technology Delhi
15:40	-	16:00	Pedestrian Detection using deep channel features in monocular image sequences Zhao Liu[1,2], Yang He[1], Yi Xie[1,2], Hongyan Gu[1] , Chao Liu[1] and Mingtao Pei[1] [1]Beijing Lab of Intelligent Information, School of Computer Science, Beijing Institute of Technology, Beijing 100081, P.R.China [2]People's Public Security University of China, Beijing 100038, P.R.China
16:00	-	16:20	Heterogeneous Multi-task Learning on Non-Overlapping Datasets for Facial Landmark Detection Takayuki Semitsu[1], Xiongxin Zhao[1], Wataru Matsumoto[1] [1]Mitsubishi Electric Corporation.
16:20	-	16:40	Fuzzy string matching using sentence embedding algorithms Yu Rong[1], Xiaolin Hu[1] [1]Tsinghua University
16:40	-	17:00	Initializing Deep Learning based on Latent Dirichlet Allocation for Document Classification Hyung-Bae Jeon[1], Soo-Young Lee[2] [1]ETRI [2]KAIST

Plenary 4 (abstract)

Plenary 4 Clock Tower Centennial Hall

Neural nets and the connectome

Sebastian Seung[1]
[1] Neuroscience Institute and Computer Science Dept. Princeton University

Abstract

Since the dawn of AI in the 1950s, inspiration from the brain has helped researchers make computers more intelligent. In turn, AI is now helping to accelerate research on understanding the brain. A prime example is the application of artifical neural networks to brain images from 3D electron microscopy. It is starting to become possible to reconstruct the brain's wiring diagram, or "connectome." This approach has already yielded discoveries concerning the first steps of visual perception in the retina. Further progress is expected to yield connectomic information from the cerebral cortex, regarded by many neuroscientists as the brain region most crucial for human intelligence.

Biography

Sebastian Seung is Anthony B. Evnin Professor in the Neuroscience Institute and Department of Computer Science at Princeton University. Seung has done influential research in both computer science and neuroscience. Over the past decade, he has helped pioneer the new field of connectomics, developing new computational technologies for mapping the connections between neurons. His lab created EyeWire.org, a site that has recruited over 200,000 players from 150 countries to a game to map neural connections. His book Connectome: How the Brain's Wiring Makes Us Who We Are was chosen by the Wall Street Journal as Top Ten Nonfiction of 2012. Before joining the Princeton faculty in 2014, Seung studied at Harvard University, worked at Bell Laboratories, and taught at the Massachusetts Institute of Technology. He is External Member of the Max Planck Society, and winner of the 2008 Ho-Am Prize in Engineering.

Thursday AM (abstract)

ThuAM-1 Reinforcement learning

Decentralized Stabilization for Nonlinear Systems with Unknown Mismatched Interconnections

Bo Zhao[1], Ding Wang[1], Guang Shi[1], Derong Liu[2], Yuanchun Li[3]
[1]Institute of Automation, Chinese Academy of Sciences [2]University of Science and Technology Beijing [3]Changchun University of Technology

Abstract
This paper establishes a neural network and policy iteration based decentralized control scheme to stabilize large-scale nonlinear systems with unknown mismatched interconnections. For relaxing the common assumption of upper boundedness on interconnections when designing the decentralized optimal control, interconnections are approximated by neural networks with local signals of isolated subsystem and replaced reference signals of coupled subsystems. By using the adaptive estimation term, the performance index function is constructed to reflect the replacement error. Hereafter, it is proven that the developed decentralized optimal control policies can guarantee the closed-loop large-scale nonlinear system to be uniformly ultimately bounded. The effectiveness of the developed scheme is verified by a simulation example.

Optimal Constrained Neuro-Dynamic Programming Based Self-Learning Battery Management in Microgrids

Qinglai Wei[1], Derong Liu[2]
[1]Institute of Automation, Chinese Academy of Sciences [2]University of Science and Technology Beijing

Abstract
In this paper, a novel optimal self-learning battery sequential control scheme is investigated for smart home energy systems. Using the iterative adaptive dynamic programming (ADP) technique, the optimal battery control can be obtained iteratively. Considering the power constraints of the battery, a new non-quadratic form performance index function is established, which guarantees that the value of the iterative control law cannot exceed the maximum charging/discharging power of the battery to extend the service life of the battery. Simulation results are given to illustrate the performance of the presented method.

Risk sensitive reinforcement learning scheme is suitable for learning on a budget

Kazuyoshi Kato[1], Koichiro Yamauchi[1]
[1]Chubu University

Abstract

This paper show how to realize the reinforcement learning on embedded systems. The reinforcement learning on an bounded learning resource usually fails the learning. This is because the learning machine usually has to forget a part of memory to make a space to record a new instance. To overcome this problem, this paper introduces a risk-sensitive reinforcement learning to proceed the learning. Therefore, the utility function is modified by using the prospect-method, which is a computational model of human value function. We have checked the system performances by applying the method into an actor-critic model, which uses incremental learning method on a budget. The results suggests that risk-sensitive reinforcement learning is suitable for such learning on a budget.

A Kernel-Based Sarsa(λ) Algorithm with Clustering-Based Sample Sparsification

Haijun Zhu[1], Fei Zhu[2], Yuchen Fu[2], Quan Liu[2], Jianwei Zhai[2], Cijia Sun[3] Peng Zhang[2]
[1]school of computer science&technology, soochow university [2]school of computer science&thechnology, soochow university [3]School of Computer Science and Technology, Soochow University

Abstract

In the past several decades, as a significant class of solutions to the large scale or continuous space control problems, kernel-based reinforcement learning (KBRL) methods have been a research hotspot. While the existing sample sparsification methods of KBRL exist the problems of low time efficiency and poor effect. For this problem, we propose a new sample sparsification method, clustering-based novelty criterion (CNC), which combines a clustering algorithm with a distance-based novelty criterion. Besides, we propose a clustering-based selective kernel Sarsa(λ) (CSKS(λ)) on the basis of CNC, which applies Sarsa(λ) to learning parameters of the selective kernel-based value function based on local validity. Finally, we illustrate that our CSKS(λ) surpasses other state-of-the-art algorithms by Acrobot experiment.

Sparse Kernel-based Least Squares Temporal Difference with Prioritized Sweeping

Cijia Sun[1], Xinghong Ling[1], Yuchen Fu[1], Quan Liu[1], Haijun Zhu[1], Jianwei Zhai[1], Peng Zhang[1]
[1]School of Computer Science & Technology, Soochow University

Abstract

How to improve the efficiency of the algorithms to solve the large scale or continuous space reinforcement learning (RL) problems has been a hot research. Kernel-based least squares temporal difference(KLSTD) algorithm can solve continuous space RL problems. But it has the problem of high computational complexity because of kernel-based and complex matrix computation. For the problem, this paper proposes an algorithm named sparse kernel-based least squares temporal difference with prioritized sweeping (PS-SKLSTD). PS-SKLSTD consists of two parts: learning and planning. In the learning process, we exploit the ALD-based sparse kernel function to represent value function and update the parameter vectors based on the Sherman-Morrison equation. In the planning process, we use prioritized sweeping method to select the current updated state-action pair. The experimental results demonstrate that PS-SKLSTD has better performance on convergence and calculation efficiency than KLSTD.

ThuAM-2 Applications

Classifying Human Activities with Temporal Extension of Random Forest

Shih Yin Ooi[1], Shing Chiang Tan[1], Wooi Ping Cheah[1]
[1]Multimedia University

Abstract

Sensor-Based Human Activity Recognition (HAR) is a study of recognizing the human's activities by using the data captured from wearable sensors. Avail the temporal information from the sensors, a modified version of ran-dom forest is proposed to preserve the temporal information, and harness them in classifying the human activities. The proposed algorithm is tested on 7 public HAR datasets. Promising results are reported, with an average classification accuracy of 98%.

Echo State Network Ensemble for Human Motion Data Temporal Phasing: A Case Study on Tennis Forehands

Boris Bacic[1]
[1]Auckland University of Technology

Abstract

Temporal phasing analysis is integral to ubiquitous/"smart" coaching devices and sport science. This study presents a novel approach to autonomous temporal phasing of human motion from captured tennis activity (3D data, 66 time-series). Compared to the optimised Echo State Network (ESN) model achieving 85% classification accuracy, the ESN ensemble system demonstrates improved classification of 95% and 100% accurate phasing state transitions for previously unseen motions without requiring ball impact information. The ESN ensemble model is robust to low-sampling rates (50 Hz) and unbalanced data sets containing incomplete data time-series. The demonstrated achievements are applicable to exergames, augmented coaching and rehabilitation systems advancements by enabling automated qualitative analysis of motion data and generating feedback to aid motor skill and technique improvements.

Unregistered Bosniak Classification with Multi-phase Convolutional Neural Networks

Myunggi Lee[1], Hyeogjin Lee[1], Jiyong Oh[1], Hak Jong Lee[1], Seung Hyup Kim[1], Nojun Kwak[1]
[1]Seoul National University

Abstract

In this paper, we study on convolutional neural network (CNN) architectures applied to a Bosniak classification problem to classify Computed Tomography images into five Bosniak classes. We use a new medical image dataset called as the Bosniak classification dataset which will be fully introduced in this paper. For this data set, we employ a multi-phase CNN approach to predict classification accuracy. We also discuss the representation power of CNN compared to previously developed features (Garbor features) in medical image. In our experiment, we use data combination method to enlarge the data set to avoid overfitting problem in multi-phase medical imaging system. Using multi-phase CNN and data combination method we proposed, we have achieved 48.9% accuracy on our test set, which improves the hand-crafted features by 11.9%.

Direct Estimation of Wrist Joint Angular Velocities from Surface EMGs by Using an SDNN Function Approximator F

Kazumasa Horie[1], Atsuo Suemitsu[2], Tomohiro Tanno[1], Masahiko Morita[1]
[1]University of Tsukuba [2]Sapporo University of Health Sciences

Abstract

The present paper proposes a method for estimating joint angular velocities from multi-channel surface electromyogram (sEMG) signals. This method uses a selective desensitization neural network (SDNN) as a function approximator that learns the relation between integrated sEMG signals and instantaneous joint angular velocities. A comparison experiment with a Kalman filter model shows that this method can estimate wrist angular velocities in real time with high accuracy, especially during rapid motion.

ThuAM-3 Computational intelligence 1

Vietnamese POS Tagging for Social Media Text

Ngo Xuan Bach[1], Nguyen Dieu Linh[1], Tu Minh Phuong[1]
[1]Posts and Telecommunications Institute of Technology, Vietnam

Abstract

This paper presents an empirical study on Vietnamese part-of-speech (POS) tagging for social media text, which shows several challenges compared with tagging for general text. Social media text does not always conform to formal grammars and correct spelling. It also uses abbreviations, foreign words, and icons frequently. A POS tagger developed for conventional, edited text would perform poorly on such noisy data. We address this problem by proposing a tagging model based on Conditional random fields with various kinds of features for Vietnamese social media text. We introduce a corpus for POS tagging, which consists of more than four thousands sentences from Facebook, the most popular social network in Vietnam. Using this corpus, we performed a series of experiments to evaluate the proposed model. Our model achieved 88.26% tagging accuracy, which is 11.27% improvement over a state-of-the-art Vietnamese POS tagger developed for general, conventional text.

Scaled Conjugate Gradient Learning for Quaternion-Valued Neural Networks

Calin-Adrian Popa[1]
[1]Polytechnic University Timisoara

Abstract

This paper presents the deduction of the scaled conjugate gradient method for training quaternion-valued feedforward neural networks, using the framework of the HR calculus. The performances of the scaled conjugate algorithm in the real- and complex-valued cases lead to the idea of extending it to the quaternion domain, also. Experiments done using the proposed training method on time series prediction applications showed a significant performance improvement over the quaternion gradient descent and quaternion conjugate gradient algorithms.

Performance of Qubit Neural Network in Chaotic Time Series Forecasting

Taisei Ueguchi[1], Nobuyuki Matsui[1], Teijiro Isokawa[1]
[1]University of Hyogo

Abstract

In recent years, quantum inspired neural networks have been applied to various practical problems since the proposal. Here we investigate if our qubit neural network(QNN) leads to an advantage over the conventional (real-valued) neural networks(NNs) in the forecasting of chaotic time series. QNN is constructed from a set of qubit neuron, of which internal state is a coherent superposition of qubit states. In this paper, we evaluate the performance of QNN through a prediction of well-known Lorentz attractor, which produces chaotic time series by three dynamical systems. The experimental results show that QNN can forecast time series more precisely, compared with the conventional NNs. In addition, we found that QNN outperforms the conventional NNs by reconstructing the trajectories of Lorentz attractor.

The Evolutionary Process of Image Transition in Conjunction with Box and Strip Mutation

Aneta Neumann[1], Bradley Alexander[1], Frank Neumann[1]
[1]The University of Adelaide, School of Computer Science, Faculty of Engineering, Computer and Mathematical Science

Abstract

Evolutionary algorithms have been used in many ways to generate digital art. We study how evolutionary processes are used for evolutionary art and present a new approach to the transition of images. Our main idea is to define evolutionary processes for digital image transition, combining different variants of mutation and evolutionary mechanisms. We introduce box and strip mutation operators which are specifically designed for image transition. Our experimental results show that the process of an evolutionary algorithm in combination with these mutation operators can be used as a valuable way to produce unique generative art.

A preliminary model for understanding how life experiences generate human emotions and behavioural responses

Irosh Fernando[1]
[1]University of Newcastle

Abstract

Whilst human emotional and behaviour responses are generated via a complex mechanism, understanding this process is important for a broader range of applications that span over clinical disciplines including psychiatry and psychology, and computer science. Even though there is a large body of literature and established findings in clinical disciplines, these are under-utilised in developing more realistic computational models. This paper presents a preliminary model based on the integration of a number of established theories in clinical psychology and psychiatry through an interdisciplinary research effort

ThuAM-4 Data mining 1

Semi-Supervised Classification by Nuclear-norm based Transductive Label Propagation

Lei Jia[1], Zhao Zhang[1], Yan Zhang[1]
[1]Soochow University

Abstract

In this paper, we propose a new transductive label propagation method, Nuclear-norm based Transductive Label Propagation (N-TLP). To encode the neighborhood reconstruction error more accurately and reliably, we use the nuclear norm that has been proved to be more robust to noise and more suitable to model the reconstruction error than both L1-norm or Frobenius norm for characterizing the manifold smoothing degree. During the optimizations, the Nuclear-norm based reconstruction error term is transformed into the Frobenius norm based one for pursuing the solution. To enhance the robustness in the process of encoding the difference between initial labels and predicted ones, we propose to use a weighted L2,1-norm regularization on the label fitness error so that the resulted measurement would be more accurate. Promising results on several benchmark datasets are delivered by our N-TLP compared with several other related methods.

Effective and Efficient Multi-label Feature Selection Approaches via Modifying Hilbert-Schmidt Independence Criterion

Jianhua Xu[1]
[1]Nanjing Normal University

Abstract

Hilbert-Schmidt independence criterion is a nonparametric dependence measure to depict all modes of dependencies between all variables via matrix trace. When this criterion with linear feature and label kernels is directly applied to multi-label feature selection, an efficient feature ranking is achieved using diagonal elements, which considers feature-label relevance. But non-diagonal elements characterize feature-feature redundancy. In this paper, two new criteria are defined by all matrix elements. For a candidate feature, we maximize its relevance and minimize its redundancy. Then a fast hybrid strategy combining simple feature ranking and sequential forward selection is implemented, where the former sorts all features using their relevance and the latter finds out the top discriminative features with maximal relevance and minimal redundancy. Experiments on four data sets illustrate that our proposed methods are effective and efficient, compared with several existing techniques.

Storm Surge Prediction for Louisiana Coast Using Artificial Neural Networks

Qian Wang[1], Jianhua Chen[1], Kelin Hu[1]
[1]Louisiana State University

Abstract

Abstract. Storm surge, an offshore rise of water level caused by hurricanes, often results in flooding which is a severe devastation to human lives and properties in coastal regions. It is imperative to make timely and accurate prediction of storm surge levels in order to mitigate the impacts of hurricanes. Traditional process-based numerical models for storm surge prediction suffer from the limitation of high computational demands making timely forecast difficult. In this work, an Artificial Neural Network (ANN) based system is developed to predict storm surge in coastal areas of Louisiana. Simulated and historical storm data are collected for model training and testing, respectively. Experiments are performed using historical hurricane parameters and surge data at tidal stations during hurricane events from the National Oceanic and Atmospheric Administration (NOAA). Analysis of the results show that our ANN-based storm surge predictor produces accurate predictions efficiently.

Factorization of Multiple Tensors for Supervised Feature Extraction

Wei Liu[1]
[1]UTS

Abstract

Tensors are effective representations for complex and time-varying networks. Many existing tensor factorization (TF) methods assume there is one tensor that needs to be decomposed to low-rank factors. However in practice, data are usually generated from different time periods or by different class labels, which are represented by a sequence of multiple tensors associated with different labels. When one needs to analyse and compare multiple tensors, existing TF methods are unsuitable for discovering all potentially useful patterns, as they usually fail to discover either common or unique factors among the tensors. To tackle this problem, we design a novel probabilistic tensor factorization model that takes both features and class labels of tensors into account, and produces informative common and unique factors of all tensors simultaneously. Experiment results on feature extraction in classification problems demonstrate the effectiveness of the factors discovered by our method.

A Non-linear Label Compression Coding Method Based on Five-layer Auto-encoder for Multi-label Classification

Jiapeng Luo[1], Lei Cao[1], Jianhua Xu[1]
[1]Nanjing Normal University

Abstract

In multi-label classification, high-dimensional and sparse binary label vectors usually make existing multi-label classifiers perform unsatisfactorily, which induces a group of label compression coding (LCC) techniques particularly. So far, several linear LCC methods have been introduced via considering linear relations among labels. In this paper, we extend traditional three-layer auto-encoder to construct a five-layer one (i.e., five-layer symmetrical neural network), and then apply the training principle in extreme learning machine to determine all network weights. Therefore, a non-linear LCC approach is proposed to capture non-linear relations of labels, where the first three-layer network is regarded as a encoder and the last two layers act as a decoder. The experimental results on three benchmark data sets show that our proposed method performs better than four existing linear LCC methods according to five performance measures.

ThuAM-5 Deep neural networks 1

Unsupervised Video Hashing by Exploiting Spatio-Temporal Feature

Chao Ma[1], Yun Gu[1], Wei Liu[1], Jie Yang[1], Xiangjian He[2]
[1]Shanghai Jiao Tong University [2]University of Technology, Sydney, Australia

Abstract
Video hashing is a common solution for content-based video retrieval by encoding high-dimensional feature vectors into short binary codes. Videos not only have spatial structure inside each frame but also have temporal correlation structure between frames, while the latter has been largely neglected by many existing methods. Therefore, in this paper we propose to perform video hashing by incorporating the temporal structure as well as the conventional spatial structure. Specifically, the spatial features of videos are obtained by utilizing CNN, and the temporal features are established via LSTM. The proposed spatio-temporal feature learning framework can be applied to many existing unsupervised hashing methods. Experimental results on the UCF-101 dataset indicate that by simultaneously employing the temporal features and spatial features, our hashing method is able to significantly improve the performance of existing methods which only deploy the spatial feature.

Selective Dropout for Deep Neural Networks

Erik Barrow[1], Mark Eastwood[1], Chrisina Jayne[2]
[1]Coventry University [2]Robert Gordon University

Abstract
Dropout has been proven to be an effective method for reducing overfitting in deep artificial neural networks. We present 3 new alternative methods for performing dropout on a deep neural network which improves the effectiveness of the dropout method over the same training period. These methods select neurons to be dropped through statistical values calculated using a neurons change in weight, the average size of a neuron's weights, and the output variance of a neuron. We found that increasing the probability of dropping neurons with smaller values of these statistics and decreasing the probability of those with larger statistics gave an improved result in training over 10,000 epochs. The most effective of these was found to be the Output Variance method, giving an average improvement of 1.17% accuracy over traditional dropout methods.

Real-time action recognition in surveillance videos using ConvNets

Sheng Luo[1], Haojin Yang[1], Cheng Wang[1], Xiaoyin Che[1], Christoph Meinel[1]
[1]Hasso Plattner Institute

Abstract

The explosive growth of surveillance cameras and its 7*24 recording period brings massive surveillance videos data. Therefore how to efficiently retrieve the rare but important event information inside the videos is eager to be solved. Recently deep convolutinal networks shows its outstanding performance in event recognition on general videos. Hence we study the characteristic of surveillance video context and propose a very competitive ConvNets approach for real-time event recognition on surveillance videos. Our approach adopts two-steam ConvNets to respectively recognition spatial and temporal information of one action. In particular, we propose to use fast feature cascades and motion history image as the template of spatial and temporal stream. We conducted our experiments on UCF-ARG and UT-interaction dataset. The experimental results show that our approach acquires superior recognition accuracy and runs in real-time.

An Architecture Design Method of Deep Convolutional Neural Network

Satoshi Suzuki[1], Hayaru Shouno[1]
[1]Graduate School of Informatics and Engineering, The University of Electro- Communications

Abstract

Deep Convolutional Neural Network (DCNN) is a kind of multi layer neural network models. In these years, the DCNN is attracting the attention since it shows the state of the arts performance in the image and speech recognition tasks. However, the design for the architecture of the DCNN has not so much discussed since we have not found effective guideline to construct. In this research, we focus on within-class variance of SVM histogram proposed in our previous work. We try to apply it as a clue for modifying the architecture of a DCNN, and confirm the modified DCNN shows better performance than that of the original one.

Investigation of the Efficiency of Unsupervised Learning for Multi-task Classification in Convolutional Neural Network

Jonghong Kim[1], Gil-Jin Jang[1], Minho Lee[1]
[1]Kyungpook National University

Abstract

In this paper, we analyze the efficiency of unsupervised learning features in multi-task classification, where the unsupervised learning is used as initialization of Convolutional Neural Network (CNN) which is trained by a supervised learning for multi-task classification. The proposed method is based on Convolution Auto Encoder (CAE), which maintains the original structure of the target model including pooling layers for the proper comparison with supervised learning case. Experimental results show the efficiency of the proposed feature extraction method based on unsupervised learning in multi-task classification related with facial information. The unsupervised learning can produce more discriminative features than those by supervised learning for multi-task classification.

Thursday PM1 (abstract)

ThuPM1-1 Novel Approaches of Systems Neuroscience to Sports and Rehabilitation Workshop 1

Special Talk

Understanding complex sports behavior: interpersonal competition and cooperation

Yuji Yamamoto[1]
[1] Research Center of Health, Physical Fitness & Sports, Nagoya University

Abstract
Interpersonal competition and coordination in sports can manifest complex behaviors. We present examples demonstrating that common regularities underlie these sports behaviors, as well as certain physical phenomena from dynamical systems. In one-on-one sports such as kendo, practitioners exhibit abrupt phase transitions corresponding to 0.1-m differences in the distance from their opponent, which was used as a control parameter. We classified competitive movements into six coordination patterns, using a return map analysis. Coordination patterns involving more than two people were modeled as coupled oscillators with symmetry breaking. Expert soccer players maintain high symmetry during three-on-one ball possession. Furthermore, the 'pass' behavior in football games exhibits network dynamics that is characteristic of other huge networks. Finally, the real-time dynamics of football games possesses self-similarity characteristics, similar to those found in the laws of physics, regardless of players' psychological status or level of training.

Talk 1

Evaluation of sports performance with novel measurement techniques

Toshitaka Kimura[1]
[1]NTT Communication Science Laboratories

Abstract
Knowledge about sports performance is limited because most available data were obtained in the laboratory where the target action may differ somewhat from the actual sports action. In this talk I will introduce novel measurement techniques that involve using wearable sensors and virtual reality (VR) technology that can compensate for the above conventional reality problem. Wearable sensing is expected to provide novel findings for sports performance in actual sports environments. VR will prove useful as a novel measurement tool with which to purposely configure a visual environment that is inconceivable in the real world.

Talk 2

Hitting the sweet spot: investigating the neuroscience behind impact control by humans

Ganesh Gowrishankar[1]
[1] CNRS-AIST Joint Robotics Laboratory

Abstract

Most ball sports require players to impact, and transfer momentum from their limbs to the ball. How humans control these impacts and whether and how they optimize energy transfer during impacts remains largely unclear. Arguably, endpoint impedance plays a crucial role in energy transfer during impacts. However, in interesting contrast to traditionally investigated motor control tasks such as arm reaching, the role of impedance control during impacts is not to attenuate energy transfers (perturbations) from the environment but to maximize the energy transfer to the environment. I will speak about our recent work where we used a novel experiment paradigm and computational modelling to quantify impedance regulation by humans during impacts. Our results suggest that humans utilize perceived jerk and force during impacts to modulate their impedance, and equalize the resonant frequency of their limbs to that of the impacted object. This may help optimize energy transfer during impacts. These results were used to develop human like impact behavior in a robotic baseball hitter that could utilize haptic sensory feedback to automatically locate the sweet spot on a baseball bat while hitting balls.

Talk 3

Brain plasticity in artificial leg athletes

Kento Nakagawa[1]
[1]Graduate School of Arts and Sciences, The University of Tokyo

Abstract

We investigated brain plasticity in a long jumper top athlete with an artificial lower limb prosthesis (R.M.) in order to examine the mechanisms of dexterous control the artificial leg. In the study, three participant groups were recruited and compared: 1) RM, 2) healthy long jumper athletes and 3) non-athletes with artificial lower limb prosthesis. We recorded the brain activity of participants using fMRI during rhythmic muscle contraction involved in lower limb joints (ankle, knee and hip) in both right and left sides. In RM's brain activity during contraction of intact knee muscles with artificial leg side, we observed prominent large and bilateral activations in motor-related areas compared to other participants. The observed bilateral activations in the cortical motor area during knee muscle contraction of the affected side likely resulted from long-term training of the long jump, and are probably related to the improved ability to fine tune the artificial limb.

ThuPM1-2 Machine learning 7

Analytical Incremental Learning: Fast Constructive Learning Method for Neural Network

Syukron Ishaq Alfarozi[1], Noor Akhmad Setiawan[2], Teguh Bharata Adji[2], Kuntpong Woraratpanya[1], Kitsuchart Pasupa[1], Masanori Sugimoto[3]
[1]Faculty of Information Technology, King Mongkut's Institute of Technology Ladkrabang [2]Department of Electrical Engineering and Information Technology, Universitas Gadjah Mada [3]Hokkaido University

Abstract
Extreme learning machine (ELM) is a fast learning algorithm for single hidden layer feed-forward neural network (SLFN) based on random input weights which usually requires large number of hidden nodes. Recently, novel constructive and destructive parsimonious (CP and DP)-ELM which provide the effectiveness generalization and compact hidden nodes have been proposed. However, the performance might be unstable due to the randomization either in ordinary ELM or CP and DP-ELM. In this study, analytical incremental learning (AIL) algorithm is proposed in which all weights of neural network are calculated analytically without any randomization. The hidden nodes of AIL are incrementally generated based on residual error using least square (LS) method. The results show the effectiveness of AIL which has not only smallest number of hidden nodes and more stable but also good generalization than those of ELM, CP and DP-ELM based on seven benchmark data sets evaluation.

Acceleration of word2vec using GPUs

Seulki Bae[1], Youngmin Yi[1]
[1]University of Seoul

Abstract
Word2vec is a widely used word embedding toolkit which generates word vectors by training input corpus. Since word vector can represent an exponential number of word cluster and enables reasoning of words with simple algebraic operations, it has become a widely used representation for the subsequent NLP tasks. In this paper, we present an efficient parallelization of word2vec using GPUs that preserves the accuracy. With two K20 GPUs, the proposed acceleration technique achieves 1.7M words/sec, which corresponds to about 20x of speedup compared to a single-threaded CPU execution.

Automatic design of neural network structures using AiS

Toshisada Mariyama[1], Kunihiko Fukushima[1], Wataru Matsumoto[1]
[1]Mitsubishi Electric

Abstract

Structures of neural networks are usually designed by experts to fit target problems. This study proposes a method to automate small network design for a regression problem based on the Add-if-Silent (AiS) function used in the neocognitron. Because the original AiS is designed for image pattern recognition, this study modifies the intermediate function to be Radial Basis Function (RBF). This study shows that the proposed method can determine an optimized network structure using the Bike Sharing Dataset as one case study. The generalization performance is also shown.

Sequential Collaborative Ranking Using (No-)Click Implicit Feedback

Frédéric Guillou[1], Romaric Gaudel[2], Philippe Preux[2]
[1]Inria, Univ. Lille, CNRS, France [2]Univ. Lille, CNRS, Centrale Lille, Inria, UMR 9189 - CRIStAL, Lille, France

Abstract

We study Recommender Systems in the context where they suggest a list of items to users. Several crucial issues are raised in such a setting: first, identify the relevant items to recommend; second, account for the feedback given by the user after he clicked and rated an item; third, since new feedback arrive into the system at any moment, incorporate such information to improve future recommendations. In this paper, we take these three aspects into consideration and present an approach handling click/no-click feedback information. Experiments on real-world datasets show that our approach outperforms state of the art algorithms.

Group Information-based Dimensionality Reduction via Canonical Correlation Analysis

Haiping Zhu[1], Hongming Shan[1], Youngjoo Lee[2], Yiwei He[1], Qi Zhou[1], Junping Zhang[1]
[1]Fudan University [2]Samsung Electronics

Abstract

As an effective way of avoiding the curse of dimensionality and leveraging the predictive performance in high-dimensional regression analysis, dimension reduction suffers from small sample size. We proposed to utilize group information generated from pairwise data, to learn a low-dimensional representation highly correlated with target value. Experimental results on four public datasets imply that the proposed method can reduce regression error by effective dimension reduction.

ThuPM1-3 Computational intelligence 2

Artificial Bee Colony Algorithm Based on Neighboring Information Learning

Laizhong Cui[1], Genghui Li[1], Qiuzhen Lin[1], Jianyong Chen[1], Nan Lu[1], Guanjing Zhang[2]
[1]Shenzhen University [2]E-Techco Information Technologies Co., Ltd

Abstract
Artificial bee colony (ABC) algorithm is one of the most effective and efficient swarm intelligence algorithms for global numerical optimization, which is inspired by the intelligent foraging behavior of honey bees and has shown good performance in most case. In this paper, we propose a novel artificial bee colony algorithm based on neighboring information learning (called NILABC), in which the employed bees and onlooker bees search candidate food source by learning the valuable information from the best food source among their neighbors. Furthermore, the size of the neighbors is linearly increased with the evolutionary process. Through the comparison of NILABC with the basic ABC and some other variants of ABC on 22 benchmark functions, the experimental results demonstrate that NILABC is better than the compared algorithms on most cases in terms of solution quality, robustness and convergence speed.

Data-driven Design of Type-2 Fuzzy Logic System by Merging Type-1 Fuzzy Logic Systems

Chengdong Li[1], Li Wang[1], Zixiang Ding[1], Guiqing Zhang[1]
[1]Shandong Jianzhu university

Abstract
Type-2 fuzzy logic systems (T2 FLSs) have shown their superiorities in many real-world applications. With the exponential growth of data, it is a time consuming task to directly design a satisfactory T2 FLS through data-driven methods. This paper presents an ensembling approach based data-driven method to construct T2 FLS through merging type-1 fuzzy logic systems (T1 FLSs) which are generated using the popular ANFIS method. Firstly, T1FLSs are constructed using the ANFIS method based on the sub-data sets. Then, an ensembling approach is proposed to merge the constructed T1 FLSs in order to generate a T2 FLS. Finally, the constructed T2 FLS is applied to a wind speed prediction problem. Simulation and comparison results show that, compared with the well-known BPNN and ANFIS, the proposed method have similar performance but greatly reduced training time.

Memetic cooperative neuro-evolution for chaotic time series prediction

Gary Wong[1], Rohitash Chandra[2], Anuraganand Sharma[3]
[1]Software Foundation Fiji [2]Nanyang Technological University [3]The University of the South Pacific

Abstract

Cooperative neuro-evolution has shown to be promising for chaotic time series problem as it provides global search features using evolutionary algorithms. Back-propagation features gradient descent as a local search method that has the ability to give competing results. A synergy between the methods is needed in order to exploit their features and achieve better performance. Memetic algorithms incorporate local search methods for enhancing the balance between diversification and intensification. We present a memetic cooperative neuro-evolution method that features gradient descent for chaotic time series prediction. The results show that the proposed method utilizes lower computational costs while achieving higher prediction accuracy when compared to related methods. In comparison to related methods from the literature, the proposed method has favorable results for highly noisy and chaotic time series problems.

SLA Management Framework to Avoid Violation in Cloud

Walayat Hussain[1], Farookh Hussain[1], Omar Hussain[2]
[1]University of Technology Sydney [2]University of New South Wales

Abstract

Cloud computing is an emerging technology that have a broad scope to offers a wide range of services to revolutionize the existing IT infrastructure. Because of the elastic nature of a cloud it is very critical of a service provider specially for a small/medium cloud provider to form a viable SLA with a consumer to avoid any service violation. In this paper we propose our viable SLA management framework that comprise of two time phases — pre-interaction time phase and post-interaction time phase. Our viable SLA framework help a service provider in making a decision of a consumer request, offer the amount of resources to consumer, predict QoS parameters, monitor run time QoS parameters and take an appropriate action to mitigate risks when there is a variation between a predicted and an agreed QoS parameters.

Pattern Retrieval by Quaternionic Associative Memory with Dual Connections

Toshifumi Minemoto[1], Teijiro Isokawa[1], Masaki Kobayashi[2], Haruhiko Nishimura[1], Nobuyuki Matsui[1]
[1]University of Hyogo [2]University of Yamanashi

Abstract

An associative memory based on Hopfield-type neural network, called Quaternionic Hopfield Associative Memory with Dual Connection (QHAMDC), is presented and analyzed in this paper. The state of a neuron, input, output, and connection weights are encoded by quaternion, a class of hypercomplex number systems with non-commutativity for its multiplications. In QHAMDC, calculation for an internal state of a neuron is conducted by two types of multiplications for neuron ' s output and connection weight. This makes robustness of the proposed associative memory for retrieval of patterns. The experimental results show that the performances of retrieving patterns by QHAMDC are superior to those by the previous QHAM.

ThuPM1-4 Data mining 2

Fast Agglomerative Information Bottleneck based Trajectory Clustering

Yuejun Guo[1], Qing Xu[1], Yang Fan[1], Sheng Liang[1], Mateu Sbert[2]
[1]Tianjin University [2]Universitat de Girona

Abstract
Clustering is an important data mining technique for trajectory analysis. The agglomerative Information Bottleneck (aIB) principle is efficient for obtaining an optimal number of clusters without the direct use of a trajectory distance measure. In this paper, we propose a novel approach to trajectory clustering, fast agglomerative Information Bottleneck (faIB), to speed up aIB by two strategies. The first strategy is to do "clipping" based on the so-called feature space, calculating information losses only on fewer cluster pairs. The second is to select and merge more candidate clusters, reducing iterations of clustering. Remarkably, faIB considerably runs above 10 times faster than aIB achieving almost the same clustering performance. In addition, extensive experiments on both synthetic and real datasets demonstrate that faIB performs better than the clustering approaches widely used in practice.

Anomaly Detection using Correctness Matching through a Neighborhood Rough Set

Pey Yun Goh[1], Shing Chiang Tan[1], Wooi Ping Cheah[1]
[1]Multimedia University

Abstract
Abnormal information patterns are signals retrieved from a data source that could contain erroneous or reveal faulty behavior. Despite which signal it is, this abnormal information could affect the distribution of a real data. An anomaly detection method, i.e. Neighborhood Rough Set with Correctness Matching (NRSCM) is presented in this paper to identify abnormal information (outliers). Two real-life data sets, one mixed data and one categorical data, are used to demonstrate the performance of NRSCM. The experiments positively show good performance of NRSCM in detecting anomaly.

Learning Class-informed Semantic Similarity

Tinghua Wang[1], Wei Li[1]
[1]Gannan Normal University

Abstract

Exponential kernel, which models semantic similarity by means of a diffusion process on a graph defined by lexicon and co-occurrence information, has been successfully applied to the task of text categorization. However, the diffusion is an unsupervised process, which fails to exploit the class information in a supervised classification scenario. To address the limitation, we present a class-informed exponential kernel to make use of the class knowledge of train-ing documents in addition to the co-occurrence knowledge. The basic idea is to construct an augmented term-document matrix by encoding class information as additional terms and appending to training documents. Diffusion is then per-formed on the augmented term-document matrix. In this way, the words be-longing to the same class are indirectly drawn closer to each other, hence the class-specific word correlations are strengthened. The proposed approach was demonstrated with several variants of the popular 20Newsgroup data set.

Aggregated Temporal Tensor Factorization Model for Point-of-interest Recommendation

Shenglin Zhao[1], Michael Lyu[1], Irwin King[1]
[1]The Chinese University of Hong Kong

Abstract

Temporal influence is important for point-of-interest (POI) recommendation that recommends POIs for users in location-based social networks (LBSNs). Previous studies observe user mobility in LBSNs exhibits distinct temporal features: periodicity, consecutiveness, and non-uniformness. By capturing the temporal features, a variety of systems are proposed to enhance POI recommendation. However, previous work does not model the three features together. More importantly, we observe the temporal influence exists at different time scales, which cannot be modeled in prior work. In this paper, we propose an Aggregated Temporal Tensor Factorization (ATTF) model for POI recommendation to capture the three temporal features together, as well as at different time scales. Experiments on two real life datasets show that the ATTF model achieves better performance than models capturing temporal influence at single scale. In addition, our proposed ATTF model outperforms the state-of-the-art methods.

Multilevel-Multigroup Analysis by the Hierarchical Tensor SOM Network

Hideaki Ishibashi[1], Ryota Shinriki[1], Hirohisa Isogai[1], Tetsuo Furukawa[1]
[1]Kyushu Institute of Technology

Abstract

This paper describes a method of multilevel-multigroup analysis based on a nonlinear multiway dimensionality reduction. To analyze a set of groups in terms of the probabilistic distribution of their constituent member data, the proposed method uses a hierarchical pair of tensor self-organizing maps (TSOMs), one for the member analysis and the other for the group analysis. This architecture enables more flexible analysis than ordinary parametric multilevel analysis, as it retains a high level of translatability supported by strong visualization. Furthermore, this architecture provides a consistent and seamless computation method for multilevel–multigroup analysis by integrating two different levels into a hierarchical tensor SOM network. The proposed method is applied to a dataset of football teams in a university league, and successfully visualizes the types of players that constitute each team as well as the differences or similarities between the teams.

ThuPM1-5 Deep neural networks 2

Sparse Auto-encoder with Smoothed l1 Regularization

Li Zhang[1], Yaping Lu[1], Zhao Zhang[1], Bangjun Wang[1], Fanzhang Li[1]
[1]Soochow University

Abstract

To obtain a satisfying deep network, it is important to improve the per- formance on data representations of an auto-encoder. One of the strategies to en- hance the performance is to incorporate sparsity into an auto-encoder. Fortunate- ly, sparsity for the auto-encoder has been achieved by adding a Kullback-Leibler (KL) divergence term to the risk functional. In compressive sensing and machine learning, it is well known that the l1 regularization is widely used technique which can induce sparsity. Thus, this paper introduces a smoothed l1 regularization in- stead of the mostly used KL divergence to enforce sparsity for auto-encoders. Experimental results show that the smoothed l1 regularization works better than the KL divergence.

Encoding Multi-resolution Two-stream CNNs for Action Recognition

Xue Weichen[1], Zhao Haohua[1], Zhang Liqing[1]
[1]Shanghai Jiao Tong University

Abstract

This paper deals with automatic human action recognition in videos. Rather than considering traditional hand-craft features such as HOG, HOF and MBH, we explore how to learn both static and motion features from CNNs trained on large-scale datasets such as ImagNet and UCF101. We propose a novel method named multi-resolution latent concept descriptor(mLCD) to encode two-stream CNNs. Entensive experiments are conducted to demonstrate the performance of the proposed model. By combining our mLCD features with the improved dense trajectory features, we can achieve comparable performance with state-of-the-art algorithms on both Hollywood2 and Olympic Sports datasets.

Improving Neural Network Generalization by Combining Parallel Circuits with Dropout

Kien Tuong Phan[1], Tomas Henrique Maul[1], Tuong Thuy Vu[1], Weng Kin Lai[2]
[1]University of Nottingham Malaysia Campus [2]Tunku Abdul Rahman University College

Abstract

In an attempt to solve the lengthy training times of neural networks, we proposed Parallel Circuits (PCs), a biologically inspired architecture. Previous work has shown that this approach fails to maintain generalization performance in spite of achieving sharp speed gains. To address this issue, and motivated by the way Dropout prevents node co-adaption, in this paper, we suggest an improvement by extending Dropout to the PC architecture. The paper provides multiple insights into this combination, including a variety of fusion approaches. Experiments show promising results in which improved error rates are achieved in most cases, whilst maintaining the speed advantage of the PC approach.

Predicting Multiple Pregrasping Poses Prediction Using Combining Deep Convolutional Neural Network and Mixture Density Network

Youngbin Park[1], Sungphill Moon[1], Il-Hong Suh[1]
[1]Hanyang university

Abstract

In this paper, we propose a deep neural network to predict pregrasp poses of a 3D object. Specifically, a single RGB-D image is used to determine multiple 3D positions of three fingers which can provide suitable pregrasp for a known or an unknown object in various poses. Multiple pregrasping pose prediction is typically complex multi-valued functions where standard regression models fail. To this end, we proposed a deep neural network that contains a variant of traditional deep convolutional neural network, followed by a mixture density network. Additionally, to overcome the difficulty in learning with insufficient data for the first part of the proposed network we develop a supervised learning technique to pretrain the variant of convolutional neural network.

Recurrent Neural Networks for Adaptive Feature Acquisition

Gabriella Contardo[1], Ludovic Denoyer[1], Thierry Artieres[2]
[1]Sorbonne Universites, UPMC Univ Paris 06, UMR 7606, LIP6, F-75005, Paris
[2]Aix Marseille Univ, CNRS, Centrale Marseille, LIF, Marseille, France

Abstract

We propose to tackle the cost-sensitive learning problem, where each feature is associated to a particular acquisition cost. We propose a new model with the following key properties: (i) it acquires features in an adaptive way, (ii) features can be acquired "per block" (several at a time) so that this model can deal with high dimensional data, and (iii) it relies on representation-learning ideas. The effectiveness of this approach is demonstrated on several experiments considering a variety of datasets and with different cost settings.

Thursday PM2 (abstract)

ThuPM2-1 Novel Approaches of Systems Neuroscience to Sports and Rehabilitation Workshop 2

Talk 4

Imaging human central motor system in children

Eiichi Naito[1]
[1]Center for Information and Neural Networks (CiNet), National Institute of Information and Communications Technology (NICT)

Abstract
In human motor systems neuroscience, most of the knowledge is established based on the data obtained from the adult's brain. Yet, the knowledge about how human central motor system develops is still limited. In this talk, among various motor coordination abilities, I will focus on the timing motor control ability in 8- to 11-years old children, and provide behavioral and neuroimaging evidence that greater variance in timing control in children is likely due to the immaturity in functional and anatomical cerebro-cerebellar connections.

Talk 5

Development of VR platform for cloud-based neurorehabilitation

Tetsunari Inamura[1]
[1] National Institute of Informatics; The Graduate University for Advanced Studies

Abstract
In this talk, I propose a cloud based immersive virtual reality system which enables advanced neurorehabilitation towards understanding and utilizing body representation in the brain. Collecting huge number of clinical rehabilitation results are required to understand the mechanism of the neurorehabilitation especially for phantom limb pain and hemiplegia. In these disorders, imitation therapy and mirror therapy are well adopted that use correspondence between visual stimulus of limb motion and actual limb motion. In the VR system, virtual limbs' motions are determined in a server system and sent to a client system that connects to immersive VR interfere. Using this system visual stimulus can be distributed to many patients from the server, and the reaction of the patients can be collected automatically. Such a system has a potential to collect huge scale of clinical database and to realize a real-time distribution of appropriate motion for each patient according to the progress of the rehabilitation.

Talk 6

Function of the meso-limbic system in motor control

Michiaki Suzuki[1]

[1] Graduate school of Medicine, Kyoto University; School of Life Science, SOKENDAI

Abstract

In competitive sports and rehabilitation, motivation might be a key issue for improving motor performance. However, the neural substrate that linking the motivation system and motor system remains largely unclear. It is generally thought that the meso-limbic system including nucleus accumbens (NAc) and ventral tegmental area (VTA) regulates motivation-driven effort but is not involved in the direct control of movement. Recently, we clarified that the NAc has a causal role for motor control during recovery after spinal cord injury (Sawada et al., Sicence, 2015). In this workshop, I will propose the neural substrate for motivational regulation of motor control.

Talk 7

Induction of embodiment of a prosthesis into the body

Noritaka Kawashima[1]

[1]Research Institute, National Rehabilitation Center for Persons with Disabilities

Abstract

Interpersonal competition and coordination in sports can manifest complex behaviors. We present examples demonstrating that common regularities underlie these sports behaviors, as well as certain physical phenomena from dynamical systems. In one-on-one sports such as kendo, practitioners exhibit abrupt phase transitions corresponding to 0.1-m differences in the distance from their opponent, which was used as a control parameter. We classified competitive movements into six coordination patterns, using a return map analysis. Coordination patterns involving more than two people were modeled as coupled oscillators with symmetry breaking. Expert soccer players maintain high symmetry during three-on-one ball possession. Furthermore, the 'pass' behavior in football games exhibits network dynamics that is characteristic of other huge networks. Finally, the real-time dynamics of football games possesses self-similarity characteristics, similar to those found in the laws of physics, regardless of players' psychological status or level of training.

Talk 8

Muscle synergy analysis for motor control

Yasuharu Koike[1]
[1]Institute of Innovative Research, Tokyo Institute of Technology

Abstract

When we learn the new skill, it is hard to control our body to adaptive new environment. There are many muscles in our body, and usually each muscle activities are unconscious. Synergy is a concept for motor control by many muscles activate same timing for tasks, and is activation pattern of muscles. Recently, this concept is used for analysis of motor control and motor learning. In this study, the synergies were calculated using data which was recorded during motion task. The results show that the similar synergies were acquired for same task of different subjects. These synergies were corresponding to the motion characteristics and it would be useful for analyzing the motion data.

ThuPM2-2 Computer vision 4

Compound PDE-based Image Restoration Algorithm using Second-order and Fourth-order Diffusions

Tudor Barbu[1]
[1]Institute of Computer Science of the Romanian Academy

Abstract
A hybrid nonlinear diffusion-based image restoration technique is proposed in this article. The novel compound PDE denoising model combines nonlinear second-order and fourth-order diffusions to achieve a more effective image enhancement. The weak solution of the combined PDE, representing the restored digital image, is determined by developing a robust explicit numerical approximation scheme using the finite-difference method. The performed denoising tests and method comparison are also described in this paper.

Multi-Swarm Particle Grid Optimization for Object Tracking

Feng Sha[1], Henry Fung Yeung[1], Yuk Ying Chung[2], Guang Liu[1], Wei-Chang Yeh[3]
[1]University of Sydney [2]the University of Sydney [3]National Tsing Hua University, Taiwan

Abstract
In recent years, one of the popular swarm intelligence algorithm Particle Swarm Optimization has demonstrated to have efficient and accurate outcomes for tracking different object movement. But there are still problems of multiple interferences in object tracking need to overcome. In this paper, we propose a new multiple swarm approach to improve the efficiency of the particle swarm optimization in object tracking. This proposed algorithm will allocate multiple swarms in separate frame grids to provide higher accuracy and wider search domain to overcome some interferences problem which can produce a stable and precise tracking orbit. It can also achieve better quality in target focusing and retrieval. The results in real environment experiments have been proved to have better performance when compare to other traditional methods like Particle Filter, Genetic Algorithm and traditional PSO.

Energy-based multi-plane detection from 3D point clouds

Liang Wang[1], Chao Shen[1], Fuqing Duan[2], Ping Guo[2]
[1]Beijing University of Technology [2]Beijing Normal University

Abstract

Detecting multi-plane from 3D point clouds can provide concise and meaningful abstractions of 3D data and give users higher-level interaction possibilities. However, existing algorithms are deficient in accuracy and robustness, and highly dependent on thresholds. To overcome these deficiencies, a novel method is proposed, which detects multi-plane from 3D point clouds by labeling points instead of greedy searching planes. It first generates initial models. Second, it computes energy terms and constructs the energy function. Third, the point labeling problem is solved by minimizing the energy function. Then, it refines the labels and parameters of detected planes. This process is iterated until the energy does not decrease. Finally, multiple planes are detected. Experimental results validate the proposed method. It outperforms existing algorithms in accuracy and robustness. It also alleviates the high dependence on thresholds and the unknown number of planes in 3D point clouds.

Bi-Lp-Norm Sparsity Pursuiting Regularization for Blind Motion Deblurring

Wanlin Gan[1], Yue Zhou[2], Liming He[1]
[1]Shanghai Jiao Tong University [2]Institude of Image Processing and Pattern Recognition, Shanghai Jiao Tong University

Abstract

Blind motion deblurring from a single image is essentially an ill-posed problem that requires regularization to solve. In this paper, we introduce a new type of an efficient and fast method for the estimation of the motion blur-kernel, through a bi-lp-norm regularization applied on both the sharp image and the blur kernel in the MAP framework. Without requiring any prior information of the latent image and the blur kernel, our proposed approach is able to restore high-quality images from given blurred images. Moreover a fast numerical scheme is used for alternatingly caculating the sharp image and the blur-kernel, by combining the split Bregman method and look-up table trick. Experiments on both sythesized and real images revealed that our algorithm can compete with much more sophisticated state-of-the-art methods.

ThuPM2-3 Computational intelligence 3

A GPU Implementation of a Bat Algorithm Trained Neural Network

Amit Roy Choudhury[1], Rishabh Jain[1], Kapil Sharma[1]
[1]Delhi Technological University

Abstract

In recent times, there has been an exponential growth in the viability of Neural Networks (NN) as a Machine Learning tool. Most standard training algorithms for NNs, like gradient descent and its variants fall prey to local optima. Metaheuristics have been found to be a viable alternative to traditional training methods. Among these metaheuristics the Bat Algorithm (BA), has been shown to be superior. Even though BA promises better results, yet being a population based metaheuristic, it forces us to involve many Neural Networks and evaluate them on nearly every iteration. This makes the already computationally expensive task of training a NN even more so. To overcome this problem, we exploit the inherent concurrent characteristics of both NNs as well as BA to design a framework which utilizes the massively parallel architecture of Graphics Processing Units (GPUs). Our framework is able to offer speed-ups of upto 47x depending on the architecture of the NN.

Investigating a dictionary-based non-negative matrix factorization in superimposed digits classification tasks

Somnuk Phon-Amnuaisuk[1], Soo-Young Lee[2]
[1]Universiti Teknologi Brunei [2]Korea Advanced Institute of Science and Technology

Abstract

Human visual system can recognize superimposed graphical components with ease while sophisticated computer vision systems still struggle to recognize them. This may be attributed to the fact that the image recognition task is framed as a classification task where a classification model is commonly constructed from appearance features. Hence, superimposed components are perceived as a single image unit. Here, the dictionary-based NMF factors a given superimposed digit matrix, V, into the combination of entries in the dictionary matrix W. The H matrix from V = WH can be interpreted as corresponding superimposed digits. This work investigates three different dictionary representations: pixels' intensity, Fourier coefficients and activations from RBM hidden layers. The results show that (i) NMF can be employed as a classifier and (ii) dictionary-based NMF is capable of classifying superimposed digits with only a small set of dictionary entries derived from single digits.

A Swarm Intelligence Algorithm Inspired by Twitter

Lv Zhihui[1], Furao Shen[2], Jinxi Zhao[2], Tao Zhu[1]
[1]Nanjing University [2]Department of Computer Science and Technology, Nanjing University

Abstract

For many years, evolutionary computation researchers have been trying to extract the swarm intelligence from biological systems in nature. Series of algorithms proposed by imitating animals' behaviours have established themselves as effective means for solving optimization problems. However these bio-inspired methods are not yet satisfactory enough because the behaviour models they reference, such as the foraging birds and bees, are too simple to handle different problems. In this paper, by studying a more complicated behaviour model, human's social behaviour pattern on Twitter which is an influential social media and popular among billions of users, we propose a new algorithm named Twitter Optimization (TO). TO is able to solve most of the real-parameter optimization problems by imitating human's social actions on Twitter: following, tweeting and retweeting. The experiments show that, TO has a good performance on the benchmark functions.

Collaborative Filtering, Matrix Factorization & Population Based Search: The Nexus Unveiled

Ayang Laishram[1], Satya Prakash Sahu[1], Vineet Padmanabhan[1], Siba Kumar Udgata[1]
[1]University of Hyderabad

Abstract

Collaborative Filtering attempts to solve the problem of recommending m items by n users where the data is represented as an n X m matrix. A popular method is to assume that the solution lies in a low dimensional space, and the task then reduces to the one of inferring the latent factors in that space. Matrix Factorization attempts to find those latent factors by treating it as a matrix completion task. The inference is done by minimizing an objective function by gradient descent. While it's a robust technique, a major drawback of it is that gradient descent tends to get stuck in local minima for non-convex functions. In this paper we propose four frameworks which are novel combinations of population-based heuristics with gradient descent. We show results from extensive experiments on the large scale MovieLens dataset and demonstrate that our approach provides better and more consistent solutions than gradient descent alone.

Adaptive Hausdorff Distances and Tangent Distance Adaptation for Transformation Invariant Classification Learning

Sascha Saralajew[1], David Nebel[2], Thomas Villmann[2]
[1]Dr. Ing. h.c. Porsche AG [2]Hochschule Mittweida

Abstract

Tangent distances (TDs) are important concepts for data manifold distance description in machine learning. In this paper we show that the Hausdorff distance is equivalent to the TD for certain conditions. Hence, we prove the metric properties for TDs. Thereafter, we consider those TDs as dissimilarity measure in learning vector quantization (LVQ) for classification learning of class distributions with high variability. Particularly, we plug the TD in the learning scheme of LVQ to obtain a TD adaption during LVQ learning. The TD approach extends the classical prototype concept to affine subspaces. This leads to a high topological richness compared to prototypes as points in the data space. By the manifold theory we can ensure that the affine subspaces are aligned in directions of invariant transformations with respect to class discrimination. We demonstrate the power of this new approach by two examples.

ThuPM2-4 Data mining 3

A Wavelet Deep Belief Network-based Classifier for Medical Images

Amin Khatami[1], Abbas Khosravi[1], Chee Peng Lim[1], Saeid Nahavandi[1]
[1]Deakin University

Abstract
Accurately and quickly classifying high dimensional data using machine learning and data mining techniques is problematic and challenging. This paper proposes an efficient and effective technique to properly extract high level features from medical images using a deep network and precisely classify them using support vector machine. A wavelet filter is applied at the first step of the proposed method to obtain the informative coefficient matrix of each image and to reduce dimensionality of feature space. A four-layer deep belief network is also utilized to extract high level features. These features are then fed to a support vector machine to perform accurate classification. Comparative empirical results demonstrate the strength, precision, and fast-response of the proposed technique.

Bayesian Neural Networks Based Bootstrap Aggregating for Tropical Cyclone Tracks Prediction in South China Sea

Lei Zhu[1], Jin Jian[1], Alex Cannon[2], William Hsieh[2]
[1]East China Normal University [2]University of British Columbia

Abstract
Accurate forecasting of Tropical Cyclone Track (TCT) is very important to cope with the associated disasters. The main objective in the presented study is to develop models to deliver more accurate forecasts of TCT over the South China Sea (SCS) and its coastal regions with 24h lead time. The model proposed in this study is a Bayesian Neural Network (BNN) based committee machine using bagging (bootstrap aggregating). Two layered Bayesian neural networks are employed as committee members in the committee machine. Forecast error is measured by calculating the distance between the real position and forecast position of the tropical cyclone. A decrease of 5.6km in mean forecast error is obtained by our proposed model compared to the stepwise regression model, which is widely used in TCTs forecast. The experimental results indicated that BNN based committee machine using bagging for TCT forecast is an effective approach with improved accuracy.

Credit Card Fraud Detection Using Convolutional Neural Networks

Kang Fu[1], Dawei Cheng[1], Yi Tu[1], Zhang Liqing[1]
[1]Shanghai Jiao Tong University

Abstract

Credit card is becoming more and more popular in financial transactions, at the same time frauds are also increasing. Conventional methods use rule-based expert systems to detect fraud behaviors, neglecting diverse situations, extreme imbalance of positive and negative samples. In this paper, we propose a CNN-based fraud detection framework, to capture the intrinsic patterns of fraud behaviors learned from labeled data. Abundant transaction data is represented by a feature matrix, on which a convolutional neural network is applied to identify a set of latent patterns for each sample. Experiments on real-world massive transactions of a major commercial bank demonstrate its superior performance compared with some state-of-the-art methods.

An Efficient Data Extraction Framework for Mining Wireless Sensor Networks

Md. Mamunur Rashid[1], Iqbal Gondal[2], Joarder Kamruzzaman[1]
[1]Monash University [2]Federation University and Monash University, Australia

Abstract

Behavioral patterns for sensors have received a great deal of attention recently due to their usefulness in capturing the temporal relations between sensors in wireless sensor networks. To discover these patterns, we need to collect the behavioral data that represents the sensor ' s activities over time from the sensor database that attached with a well-equipped central node called sink node for further analysis. However, given the limited resources of sensor nodes, an effective data collection method is required for collecting the behavioral data efficiently. In this paper, we introduce a new framework for behavioral patterns called associated-correlated sensor patterns and also propose a MapReduce based new paradigm for extract data from the wireless sensor network by distributed away. Extensive performance study shows that the proposed method is capable to reduce the number of messages and data size almost 50% compared to the centralized model.

Incorporating Prior Knowledge Into Context-Aware Recommendation

Mao Xiaoxi[1], Zheng Haitao[1]
[1]Tsinghua University

Abstract

In many recommendation applications, like music and movies recommendation, describing the features of items heavily relies on user-generated contents, especially social tags. They suffer from serious problems including redundancy and self-contradiction. Direct exploitation of them in a recommender system leads to reduced performance. However, few systems have taken this problem into consideration. In this paper, we propose a novel framework named as prior knowledge based context aware recommender(PKCAR). We incorporate Dirichlet Forrest priors to encode prior knowledge about item features into our model to deal with the redundancy, and self-contradiction problems. We also develop an algorithm which automatically mine prior knowledge using co-occurrence, lexical and semantic features. We evaluate our framework on two datasets from different domains. Experimental results show that our approach performs better than systems without leveraging prior knowledge about item features.

ThuPM2-5 Deep neural networks 3

Stacked Robust Autoencoder for Classification

Janki Mehta[1], Kavya Gupta[1], Anupriya Gogna[1], Angshul Majumdar[1], Saket Anand[1]
[1]Indraprastha Institute of Information Technology Delhi

Abstract
In this work we propose an lp-norm data fidelity constraint for training the auto-encoder. Usually the Euclidean distance is used for this purpose; we generalize the l2-norm to the lp-norm; smaller values of p make the problem robust to outliers. The ensuing optimization problem is solved using the Augmented Lagrangi-an approach. The proposed lp -norm Autoencoder has been tested on benchmark deep learning datasets — MNIST, CIFAR-10 and SVHN. We have seen that the proposed robust autoencoder yields better results than the standard autoencoder (l2-norm) and deep belief network for all of these problems.

Pedestrian Detection using deep channel features in monocular image sequences

Zhao Liu[1,2], Yang He[1], Yi Xie[1,2], Hongyan Gu[1] , Chao Liu[1] and Mingtao Pei[1]
[1]Beijing Lab of Intelligent Information, School of Computer Science,
Beijing Institute of Technology, Beijing 100081, P.R.China
[2]People's Public Security University of China, Beijing 100038, P.R.China

Abstract
In this paper, we propose the Deep Channel Features as an extension to Channel Features for pedestrian detection. Instead of using hand-crafted features, our method automatically learns deep channel features as a mid-level feature by using a convolutional neural network. The network is pretrained by the unsupervised sparse filtering and a group of filters is learned for each channel. Combining the learned deep channel features with other low-level channel features (i.e. LUV channels, gradient magnitude channel and histogram of gradient channels) as the
final feature, a boosting classifier with depth-2 decision tree as the weak classifier is learned. Our method achieves a significant detection performance on public datasets (i.e. INRIA, ETH, TUD, and CalTech).

Heterogeneous Multi-task Learning on Non-Overlapping Datasets for Facial Landmark Detection

Takayuki Semitsu[1], Xiongxin Zhao[1], Wataru Matsumoto[1]
[1]Mitsubishi Electric Corporation

Abstract

We propose a heterogeneous multi-task learning framework on non-overlapping datasets, where each sample has only part of the labels and the size of each dataset is different. In particular, we propose two batch sampling algorithms for stochastic gradient descent to learn shared CNN representation. First one sets same number of iteration on each dataset while the latter sets same batch size ratio of one task to another. We evaluate the proposed framework by learning the facial expression recognition task and facial landmark detection task. The learned network is memory efficient and able to carry out multiple tasks for one feed forward with the shared CNN. In addition, we analyze the potential ability of generalization of one task to another heterogeneous dataset, which labels are not available at all. We also investigate the effect of weights of each cost function and batch size ratio of one task to another.

Fuzzy string matching using sentence embedding algorithms

Yu Rong[1], Xiaolin Hu[1]
[1]Tsinghua University

Abstract

Fuzzy string matching has many applications. Traditional approaches mainly use the appearance information of characters or words but do not use their semantic meanings. We postulate that the latter information may also be important for this task. To validate this hypothesis, we build a pipeline in which approximate string matching is used to pre-select some candidates and sentence embedding algorithms are used to select the final results from these candidates. The aim of sentence embedding is to represent semantic meaning of the words. Two sentence embedding algorithms are tested, convolutional neural network (CNN) and averaging word2vec. Experiments show that the proposed pipeline can significantly improve the accuracy and averaging word2vec works slightly better than CNN.

Initializing Deep Learning based on Latent Dirichlet Allocation for Document Classification

Hyung-Bae Jeon[1], Soo-Young Lee[2]
[1]ETRI [2]KAIST

Abstract

The gradient-descent learning of deep neural networks is subject to local minima, and good initialization may depend on the tasks. In contrast, for document classification tasks, latent Dirichlet allocation (LDA) was quite successful in extracting topic representations, but its performance was lim-ited by its shallow architecture. In this study, LDA was adopted for efficient layer-by-layer pre-training of deep neural networks for a document classifi-cation task. Two-layer feedforward networks were added at the end of the process, and trained using a supervised learning algorithm. With 10 different random initializations, the LDA-based initialization generated a much lower mean and standard deviation for false recognition rates than other state-of-the-art initialization methods. This might demonstrate that the multi-layer ex-pansion of probabilistic generative LDA model is capable of extracting effi-cient hierarchical topic representations for document classification.

Banquet	Kyoto Hotel Okura (October 20th, Thursday)
17:30 - 18:30	Tea Ceremony & Maiko Greetings
18:30 - 21:30	Banquet & APNNS Regular Meeting of Members

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