

ELM 2016

The 7th International Conference on Extreme Learning Machines

Marina Bay Sands, Singapore

December 13 – 15, 2016

Conference Program



SUPPORT

ELM2016 is organized by:

- Nanyang Technological University, Singapore
- University of Oxford, UK
- Tsinghua University, China

Technical Co-Sponsor:

- Memetic Computing Society, Singapore

FOREWORD

Two years ago, we had ELM2014 in Singapore, which was followed by ELM2015 in Hangzhou, China. It is always nice to come back to Singapore, same place same venue, where a group of friends shared fond memories of ELM2014. As before, ELM2016 conference will serve as a platform for us to share and discuss meaningful technical issues since most of us have some common interests in terms of our research focus. It is also a platform for old friends to meet, chatting and exchanging notes on things beyond the scope of work. At the same time, it is almost certain that ELM2016 will be memorable because it will be a starting point for many new acquaintances and friendships.

Over the last year or so, there have been many developments in the field of extreme learning machines. As we make further progress in this field of research, it becomes more evident that there is greater potential for machine learning to chart new grounds if we learn to draw upon the enhanced understanding of neural networks from the perspective brain science. While there may be differing and diverse opinions, it is important that all of us as professionals would very much cherish the freedom to share and express our thoughts in an environment of cordiality and mutual respects. The phrase “agree to disagree” aptly characterize the spirit of ELM conferences. As such, no matter how controversial one may perceive an issue or idea to be, being researchers committed to a certain technical ideology or orientation, we should always uphold and maintain an atmosphere of mutual respect.

As organizers of this conference, we owe the success of this conference to a group of dedicated individuals who took care of the technical review of the papers submitted. It is always a privilege and honor to work with a capable team of colleagues who volunteered their time and effort to ensure that the technical quality of the conference is maintained. To the authors of the papers accepted for this conference, we are glad that you are using ELM2016 as a channel to share your research findings. We hope that this conference will provide you the opportunity to tap on the network of researchers in the field, benefiting from the sharing of ideas and opinions in order to further enhance your future research. Especially for the young researchers attending this conference, do make use of this opportunity to broaden your outlook in the field of machine learning. This way, your work will take on greater significance as you mature as a researcher, daring and confident to explore and expand the horizon of your research orientation.

We thank all the delegates for taking time off to attend this conference. While in Singapore, do feel free to explore the many interesting sites and experience the local culture. If this is the first ELM conference you are attending, we hope that after the conference, you will be making plans to attend the next ELM conference.

ELM2016 General Chairs

Guang-Bin Huang



M. Brandon Westover



ELM2016 Organizing Chairs

Meng-Hiot Lim



Newton Howard



Fuchun Sun



PROGRAM CHAIRS' MESSAGE

The 2016 International Conference on Extreme Learning Machines (ELM2016) will be held in Singapore, December 13–15, 2016. This conference aims to bring together the researchers and practitioners of extreme learning machines to promote research and scientific discussions of “learning without iterative tuning hidden neurons”. The ELM2016 received submissions from 13 countries and regions, including Australia, Canada, China, Finland, India, Italy, Macau, Netherlands, Singapore, South Korea, Spain, United Kingdom, and United States. The topics addressed by the submitted papers cover theory, algorithm and practical application.

The conference features 7 distinguished keynote speeches given by Erol Gelenbe (Imperial College, UK), M. Brandon Westover (Harvard Medical School, USA), Fuchun Sun (Tsinghua University, China), Guang-Bin Huang (Nanyang Technological University, Singapore), Amaury Lendasse (University of Iowa, USA), Donald C. Wunsch II (Missouri University of Science & Technology, USA), and Zhaoyang Dong (University of Sydney, Australia). In addition, the conference will be concluded by one panel discussion. Their talks will be of great interest to the attendees.

All papers were peer reviewed by at least three program committee members, and 98 papers have been selected for presentation at the conference. Selected papers (after major revisions) have been recommended to reputed international journals including *Neurocomputing*, *International Journal of Machine Learning and Cybernetics*, *Cognitive Computation*, *Memetic Computing*, and *Multidimensional Systems and Signal Processing*. Most papers are included in the specially edited ELM2016 Conference Proceedings published by Springer-Verlag.

We would like to thank all authors who submitted papers. We also would like to thank the members of the program committee and other reviewers for their time and efforts in carefully reviewing the papers.

Special thanks are given to Nanyang Technological University, University of Oxford, Tsinghua University, and Memetic Computing Society of Singapore for providing all the strong supports to the conference and related activities.

See you at the conference!

ELM 2016 Program Chairs

Erik Cambria



Amaury Lendasse



Yoan Miche



Chi Man Vong



CONFERENCE INFORMATION

Registration fees for conference

Early Bird rate, payment must be received by September 30 2016 (Singapore local time)

Full registration for one accepted paper	SGD\$980
Registration without paper (participants from academic/research institutions, attending full events)	SGD\$490
Registration without paper (participants NOT from academic/research institutions)	SGD\$1200

<i>Additional tickets</i>	
Additional banquet ticket	SGD\$100

Standard rate, payment received after September 30 2016 (Singapore local time)

Full registration for one accepted paper	SGD\$1080
Registration without paper (participants from academic/research institutions, attending full events)	SGD\$540
Registration without paper (participants NOT from academic/research institutions)	SGD\$1200

<i>Additional tickets</i>	
Additional banquet ticket	SGD\$100

For each accepted paper, at least one of the authors needs to register and present the paper.

Conference venue

The conference venue is the Expo & Convention Centre, Marina Bay Sands, Singapore.

Language

All presentations need to be made in English. English is the only official language of this conference.

Publications

All submitted papers will be thoroughly reviewed to maintain a good quality and standard in order to be considered for ELM2016. Accepted papers need to be presented at the conference. Accepted papers will be published in special edited ELM Proceedings volumes by Springer-Verlag. No additional conference proceedings are provided. Selected accepted papers with significant extensions will be recommended for further review for publication consideration in special issues of reputable ISI indexed international journals (*Neurocomputing* and *Mathematical Problems in Engineering*).

Conference welcome reception, lunches, dinners, and social activities

A welcome reception will be arranged on December 12, 2016. Registration fees include lunches on the 13th and 14th December, 2016, and conference banquet on December 14, 2016. To promote interactions among participants, interactive networking activities will arranged on December 15, 2016.

ORGANIZATION COMMITTEE

<p>Honorary Chair</p> <p>Bernard Widrow <i>Stanford University, USA</i></p> <p>International Advisory Committee Chair</p> <p>Soon Fatt Yoon <i>Nanyang Technological University, Singapore</i></p> <p>General Chair</p> <p>Guang-Bin Huang <i>Nanyang Technological University, Singapore</i></p> <p>M. Brandon Westover <i>Harvard Medical University, USA</i></p> <p>Organizing Chairs</p> <p>Meng-Hiot Lim <i>Nanyang Technological University, Singapore</i></p> <p>Newton Howard <i>University of Oxford, UK</i></p> <p>Fuchun Sun <i>Tsinghua University, China</i></p> <p>Program Chairs</p> <p>Erik Cambria <i>Nanyang Technological University, Singapore</i></p> <p>Amaury Lendasse <i>University of Iowa, USA</i></p> <p>Yoan Miche <i>Nokia Solutions and Networks, Finland</i></p> <p>Chi Man Vong <i>University of Macau, Macau</i></p> <p>Local Arrangement Chair</p> <p>Hao Yu <i>Nanyang Technological University, Singapore</i></p> <p>Publication Chairs</p> <p>Jiuwen Cao <i>Hangzhou Dianzi University, China</i></p> <p>Award Committee Chairs</p> <p>Lei Zhang <i>Chongqing University, China</i></p> <p>Area Chairs</p> <p>Aryaz Baradarani <i>University of Windsor, Canada</i></p> <p>Kaj-Mikael Björk <i>Arcada University of Applied Sciences, Finland</i></p> <p>Huajun Chen <i>Zhejiang University, China</i></p> <p>Yiqiang Chen <i>Chinese Academy of Science, China</i></p>	<p>Jin Seo Cho <i>Yonsei University, Korea</i></p> <p>Chenwei Deng <i>Beijing Institute of Technology, China</i></p> <p>Zhao Yang Dong <i>University of Sydney, Australia</i></p> <p>Qing He <i>Chinese Academy of Science, China</i></p> <p>Vijay Manikandan Janakiraman <i>NASA Ames Research Center, USA</i></p> <p>Nan Liu <i>Singapore General Hospital, Singapore</i></p> <p>Bao-Liang Lu <i>Shanghai Jiaotong University, China</i></p> <p>Muhammad Rizwan <i>George Institute of Technology, USA</i></p> <p>Emilio Soria <i>University of Valencia, Spain</i></p> <p>Xi-Zhao Wang <i>Shenzhen University, China</i></p> <p>Zhu Liang Yu <i>South China University of Technology, China</i></p> <p>Financial Chair</p> <p>Qi Cao <i>Nanyang Technological University, Singapore</i></p> <p>International Advisory Committee</p> <p>Bir Bhanu <i>University of California, Riverside, USA</i></p> <p>Amir Hussain <i>University of Stirling, UK</i></p> <p>Hisao Ishibuchi <i>Osaka Prefecture University, Japan</i></p> <p>Yoshifusa Ito <i>Aichi Medical University, Japan</i></p> <p>Yaochu Jin <i>University of Surrey, UK</i></p> <p>Vincenzo Piuri <i>Universita' degli Studi di Milano, Italy</i></p> <p>Kay Chen Tan <i>National University of Singapore, Singapore</i></p> <p>Michel Verleysen <i>Université catholique de Louvain, Belgium</i></p> <p>Jun Wang <i>City University of Hong Kong, China</i></p> <p>Zidong Wang <i>Brunel University, UK</i></p>
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Zong-Ben Xu
Xi'an Jiaotong University, China

Min Yao
Zhejiang University, China

Xin Yao
University of Birmingham, UK

Zhengyou Zhang
Microsoft Research, Redmond, USA

ELM2016 CONFERENCE SCHEDULE

December 12 2016, Monday				
7:00pm – 9:30pm	Welcome Reception Venue: <i>Stewards Riverboat, 31 Marina Coastal Drive, Berth 1 Marina South Pier 1</i>			
December 13 2016, Tuesday				
Venue	<i>Cassia Junior Ballroom 3211-3212, 3311-3312, Expo & Convention Centre, Marina Bay Sands</i>			
8:30am – 8:40am	Opening Ceremony Honorary Speech by Bernard Widrow, Stanford University, USA			
8:40am – 9:30am	Keynote 1:	Deep and Extreme Learning with Densely Clustered Random Neural Networks Speaker: Erol Gelenbe, Imperial College, UK Chair: Donald C. Wunsch II, Missouri University of Science & Technology, USA		
9:30am – 10:20am	Keynote 2:	Extreme Learning Machines (ELM): Enabling Pervasive Learning and Pervasive Intelligence Speaker: Guang-Bin Huang, Nanyang Technological University, Singapore Chair: Erol Gelenbe, Imperial College, UK		
10:20am – 10:40am	Coffee Break and Discussions Venue: <i>Heliconia Junior Ballroom: Foyer</i>			
10:40am – 11:30pm	Keynote 3:	ELM Methods for Robot Dexterous Operations Using Vision and Tactile Sensing Speaker: Fuchun Sun, Tsinghua University, China Chair: Yoan Miche, Nokia Solutions and Networks, Finland		
Venues	Cassia Junior Ballroom	Heliconia Junior Ballroom: 3412	Heliconia Junior Ballroom: 3413	Heliconia Junior Ballroom: 3513
11:30am – 1:10pm	Session TM1: ELM in Social Network	Session TM2: ELM Algorithms (I)	Session TM3: ELM in Imbalanced and Stream Data	Session TM4: ELM Theory (I)
1:10pm – 2:30pm	Lunch Venue: <i>Heliconia Junior Ballroom: 3410AB-1, 3510-1</i>			
Venues	Cassia Junior Ballroom	Heliconia Junior Ballroom: 3412	Heliconia Junior Ballroom: 3413	Heliconia Junior Ballroom: 3513
2:30pm – 4:30pm	Session TA1: ELM Algorithm (II)	Session TA2: ELM in Unsupervised Learning	Session TA3: Hierarchical ELM and Deep Learning	Session TA4: ELM Applications
4:30pm – 4:50pm	Coffee Break and Discussions Venue: <i>Heliconia Junior Ballroom: Foyer</i>			
4:50pm – 6:30pm	Session TA5: ELM Theory (II)	Session TA6: ELM in Web/Text Mining	Session TA7: ELM in Clustering/Transfer Learning	Session TA8: ELM in Detection and Estimation
December 14 2016, Wednesday				
Venue	<i>Cassia Junior Ballroom 3211-3212, 3311-3312, Expo & Convention Centre, Marina Bay Sands</i>			
8:30am – 9:20am	Keynote 4:	Why Brains Need Computers: How Big Data and Machine Learning can Improve Neurology Speaker: M. Brandon Westover, Harvard Medical School, USA Chair: Guang-Bin Huang, Nanyang Technological University, Singapore		
9:20am – 10:10am	Keynote 5:	ELM for Big Incomplete Data Speaker: Amaury Lendasse, University of Iowa, USA Chair: Qing He, Chinese Academy of Science, China		
10:10am – 10:30am	Coffee Break and Discussions Venue: <i>Heliconia Junior Ballroom: Foyer</i>			
Venues	Cassia Junior Ballroom	Heliconia Junior Ballroom: 3412	Heliconia Junior Ballroom: 3413	Heliconia Junior Ballroom: 3513
10:30am – 12:30pm	Session WM1:	Session WM2: ELM	Session WM3: ELM in	Session WM4: ELM in

	ELM in Biomedical Engineering	with Optimization	Image Processing	Prediction
12:30pm – 2:00pm	Lunch Venue: <u>Heliconia Junior Ballroom: 3410AB-1,3510-1</u>			
Venue	<u>Cassia Junior Ballroom 3211-3212, 3311-3312, Expo & Convention Centre, Marina Bay Sands</u>			
2:00pm – 2:50pm	Keynote 6: Speaker: Chair:	Extreme Learning Machines for Energy Applications Donald C. Wunsch II, Missouri University of Science & Technology, USA Amaury Lendasse, University of Iowa, USA		
2:50pm – 3:40pm	Keynote 7: Speaker: Chair:	Smart Grid Dynamic Security Assessment with ELM Zhaoyang Dong, University of Sydney, Australia Chi Man Vong, University of Macau, Macau		
3:40pm – 4:00pm	Coffee Break and Discussions Venue: <u>Heliconia Junior Ballroom: Foyer</u>			
4:00pm – 5:00pm	Panel Discussions – Big Data, Hierarchical Machine Learning and Biological Learning <i>Panel members -</i> Matt Travis Bianchi, Harvard Medical School, USA Zhaoyang Dong, University of Sydney, Australia Erol Gelenbe, Imperial College, UK Amaury Lendasse, University of Iowa, USA Fuchun Sun, Tsinghua University, China M. Brandon Westover, Harvard Medical School, USA Donald C. Wunsch II, Missouri University of Science & Technology, USA <i>Chair:</i> Guang-Bin Huang, Nanyang Technological University, Singapore			
6:30pm – 7:00pm	Banquet Cocktail			
7:00pm – 10:00pm	Conference Banquet Venue: <u>Cassia Junior Ballroom 3211-3212, 3311-3312, Expo & Convention Centre, Marina Bay Sands</u> Guest-of-Honour Tsuhan Chen, Dean of College of Engineering, Nanyang Technological University, Singapore			

December 15 2016, Thursday	
9:00am – 5:00pm	Social and Interactive Networking Activities (Only for confirmed registered participants) Meeting Time: 9:00am Meeting Venue: <u>Coach Bay (Hotel Tower 1, Level B1), Expo & Convention Centre, Marina Bay Sands</u>

HONORARY SPEECH

by Bernard Widrow, Stanford University, USA

Biography



Bernard Widrow received the S.B., S.M., and Sc.D. degrees in Electrical Engineering from the Massachusetts Institute of Technology in 1951, 1953, and 1956, respectively. He joined the MIT faculty and taught there from 1956 to 1959. In 1959, he joined the faculty of Stanford University, where he is currently Professor of Electrical Engineering, Emeritus.

He began research on adaptive filters, learning processes, and artificial neural models in 1957. Together with M.E. Hoff, Jr., his first doctoral student at Stanford, he invented the LMS algorithm in the autumn of 1959. Today, this is the most widely used learning algorithm, used in every MODEM in the world. He has continued working on adaptive signal processing, adaptive controls, and neural networks since that time.

Dr. Widrow is a Life Fellow of the IEEE and a Fellow of AAAS. He received the IEEE Centennial Medal in 1984, the IEEE Alexander Graham Bell Medal in 1986, the IEEE Signal Processing Society Medal in 1986, the IEEE Neural Networks Pioneer Medal in 1991, the IEEE Millennium Medal in 2000, and the Benjamin Franklin Medal for Engineering from the Franklin Institute of Philadelphia in 2001. He was inducted into the National Academy of Engineering in 1995 and into the Silicon Valley Engineering Council Hall of Fame in 1999.

Dr. Widrow is a past president and member of the Governing Board of the International Neural Network Society. He is associate editor of several journals and is the author of over 125 technical papers and 21 patents. He is co-author of Adaptive Signal Processing and Adaptive Inverse Control, both Prentice-Hall books. A new book, Quantization Noise, was published by Cambridge University Press in June 2008.

KEYNOTE I

Title

Deep and Extreme Learning with Densely Clustered Random Neural Networks

by Erol Gelenbe, Imperial College, UK

Abstract

The Random Neural Network (RNN) is a spiking model for neuronal ensembles that has been used for both modeling and understanding the behaviour of natural systems such as the somatosensory system of rats, and learning based engineering applications in computer vision, image compression, packet network routing and Software Defined Networks, and for combinatorial optimisation. It is a recurrent network with a highly efficient and fast exact solution based on the product form, and has a fast $O(n^3)$ recurrent network learning algorithm. It has also been used for Reinforcement Learning in the design of the patented Cognitive Packet Network routing system. This talk will discuss our recent work in using the RNN for Deep and Extreme Learning. In particular we will show how dense clusters of soma to soma interactions can be modeled with the RNN and demonstrate the results obtained with such multiple layer deep networks that are applied to a variety of instances of classification problems, as well as to the dynamic control of task assignment in the Cloud.

Biography



Erol Gelenbe pioneered new stochastic network methods to predict the performance of computer systems and networks, including neural computation. He was elected Fellow of both the IEEE and of ACM. He is also a Fellow of five National Academies of Science or Engineering, and of Academia Europaea. He has graduated 73 PhD students, over 45 of whom work in Europe, with many others working in Australia, China, the USA, Canada and Singapore.

He invented G-networks (1991) to model the performance of computer networks that undergo self or external control. He also invented the Random Neural Network (1989) that models the spiking behaviour of neuronal systems, and showed for the first time (1992) that recurrent networks learn in $O(n^3)$ time-complexity.

His engineering contributions include the FLEXSIM approach to Flexible Manufacturing System Simulation, and the training and leadership of the team that created the QNAP performance engineering software package. His papers have appeared in the top journals in several areas: in computer science such as JACM and CACM, in Physics such as the Physical Review and the Proc. of the Royal Society A, in Electrical Engineering such as the Proceedings of IEEE, IEEE Trans. Computers, IEEE Trans. Comms., and in Bio and Neuro Informatics such as the IEEE Trans. Neural Networks, Neural Computation and ACM/IEEE Trans. Bioinformatics and Computational Biology. For his contributions he was made Knight of the Legion of Honour (France) and Commander of Merit (Italy), and awarded three Doctorates Honoris Causa.

KEYNOTE II

Title

Extreme Learning Machines (ELM): Enabling Pervasive Learning and Pervasive Intelligence

by Guang-Bin Huang, Nanyang Technological University, Singapore

Abstract

Although many researchers consider that machine learning (ML) is part of artificial intelligence (AI), this talk will articulate the differences between AI and machine learning (ML) has been becoming more and more significant. With the dramatically increased data and complexity of the applications, instead of AI, machine learning (ML) will most possibly play dominant roles in the end. This talk will also analyze more and more biological evidences found in animals, which have been pointed out by Extreme Learning Machine (ELM) theories. This talk also wishes to share with audiences the trends of machine learning: 1) turning point from machine learning engineering to machine learning science; 2) convergence of machine learning and biological learning; 3) from human and (living) thing intelligence to machine intelligence; 4) from Internet of Things (IoT) to Internet of Intelligent Things and Society of Intelligent Things; 5) pervasive learning and pervasive intelligence will come true; 6) convergence of machine intelligence and Darwinism.

Biography



Guang-Bin Huang a Full Professor (with tenure) in the School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore. He serves as an Associate Editor of Neurocomputing, Cognitive Computation, neural networks, and IEEE Transactions on Cybernetics. He was awarded “Highly Cited Researcher” (in both Engineering and Computer Science fields) (2014, 2015), and listed in “The World's Most Influential Scientific Minds” by Thomson Reuters for both 2014 and 2015. He received the best paper award from IEEE Transactions on Neural Networks and Learning Systems (2013). He was nominated for Singapore President Science Award (2016). He is a member of Elsevier's Research Data Management Advisory Board.

His current research interests include big data analytics, human computer interface, brain computer interface, image processing/understanding, machine learning theories and algorithms, extreme learning machine, and pattern recognition.

He is Principal Investigator of BMW-NTU Joint Future Mobility Lab on Human Machine Interface and Assisted Driving, Principal Investigator (data and video analytics) of Delta – NTU Joint Lab, Principal Investigator (Scene Understanding) of ST Engineering – NTU Corporate Lab, and Principal Investigator (Marine Data Analysis and Prediction for Autonomous Vessels) of Rolls Royce – NTU Corporate Lab. He has led/implemented several key industrial projects (e.g., Chief architect/designer and technical leader of Singapore Changi Airport Cargo Terminal 5 Inventory Control System (T5 ICS) Upgrading Project, etc).

One of his main works is to propose a new machine learning theory and learning techniques called Extreme Learning Machines (ELM), which fills the gap between traditional feedforward neural networks, support vector machines, clustering and feature learning techniques. ELM theories have recently been confirmed with biological learning evidence directly, and filled the gap between machine learning and biological learning. ELM theories have also addressed “Father of Computers” J. von Neumann’s concern on why “an imperfect neural network, containing many random connections, can be made to perform reliably those functions which might be represented by idealized wiring diagrams.”

KEYNOTE III

Title

ELM Methods for Robot Dexterous Operations Using Vision and Tactile Sensing

by Fuchun Sun, Tsinghua University, China

Abstract

Generally speaking, robot is the last mile of automation, and dexterous hand is the last centimeter of the robot! Therefore it is highly expected that the next generation of robots should have better dexterous operation capability as compared with traditional ones, and hopefully, they will be broken from the aspects of perception, representation and fusion of cross-modal sensing information like human being.

In this talk, the recent development of the robot dexterous operations will be reviewed and the big data structure of the next generation of robots will be analyzed. We will introduce how to use Extreme Learning Machine (ELM), for representation and fusion of tactile and visual sensing, and present some experiment results. Furthermore, some key techniques for dexterous operations used in IROS 2016 robotic grasping and manipulation competition, where Tsinghua Team got the first place, will be introduced. Finally, we will present some future directions.

Biography



Fuchun Sun is professor of Department of Computer Science and Technology and President of Academic Committee of the Department, deputy director of State Key Lab. on Intelligent Technology & Systems, Tsinghua University, Beijing, China. His research interests include intelligent control, robot precise operation and teleoperation using visual and tactile sensing.

Dr. Sun is the recipient of the excellent Doctoral Dissertation Prize of China in 2000 by MOE of China and the Choon-Gang Academic Award by Korea in 2003, and was recognized as a Distinguished Young Scholar in 2006 by the Natural Science Foundation of China. He served as an associated editor of IEEE Trans. on Neural Networks during 2006-2010, IEEE Trans. on Fuzzy Systems since 2011 and IEEE Trans. on Systems, Man and Cybernetics: Systems since 2011.

KEYNOTE IV

Title

Why Brains Need Computers: How Big Data and Machine Learning can Improve Neurology

by M. Brandon Westover, Harvard Medical School, USA

Abstract

Beyond-human-level GO and chess are here, while self driving cars and human-level computer vision are rapidly becoming reality. Meanwhile, despite hype about "precision medicine" and "big medical data", the day-to-day practice of neurology continues to rely almost entirely on human expertise. In this talk I will introduce a range of real-world clinical problems in which data science and machine learning are beginning to improve neurology. These problems include: predicting which patients with brain injuries will have seizures; detecting seizures and seizure-like patterns in brain monitoring (electroencephalography, EEG) streaming data; diagnosing epilepsy in patients who have it, and avoiding mis-diagnosing epilepsy in patients who don't; predicting which patients with epilepsy will benefit from available drugs and which patients will not; predicting whether a comatose patient will eventually recover consciousness; detecting impending cerebral infarction (stroke) in patients with brain aneurysms; automating the delivery of anesthesia to patients with acute brain swelling or life-threatening seizures; computing a patient's level of consciousness from the EEG and EKG signals; diagnosing delirium; and tracking sleep stages. I will show how my laboratory has been using machine learning, and Extreme Learning Machines (ELM) specifically, to begin solving several of these problems. Along the way, I will point out areas where there is opportunity for members of the ELM community to make important contributions to improving care for patients with neurological problems.

Biography



Dr. M. Brandon Westover, MD, PhD, completed medical training and a PhD degree in Physics at Washington University School of Medicine in St. Louis. He is currently an Assistant Professor of Neurology at Harvard Medical School and a neurologist specializing in epilepsy and clinical neurophysiology at the Massachusetts General Hospital (MGH) where he directs the MGH Critical Care EEG Monitoring Service. Clinically, he is interested in applying electroencephalography (EEG) to help care for patients with acute neurological conditions such as delirium, anoxic brain injury, status epilepticus, and delayed cerebral ischemia following subarachnoid hemorrhage.

His research interests include automated methods for interpreting clinical EEG data, closed-loop control of sedation and analgesia, biomedical informatics, probabilistic analysis of medical decisions, and the neurophysiology of pain, sedation, delirium, and sleep in critically ill patients. Dr. Westover's overarching research goal is to improve neurology and particularly neurocritical care through the application of engineering principles, applied mathematics, and computational approaches.

KEYNOTE V

Title

ELM for Big Incomplete Data

by Amaury Lendasse, University of Iowa, USA

Abstract

Traditionally, Big Data refers to technologies and initiatives that involve data that is too diverse, fast-changing or massive for conventional technologies, skills and infrastructure to address efficiently. Said differently, the volume, velocity or variety of data is too great.

In this talk, we will extend this definition of Big Data in order to add the incompleteness attribute to the existing volume, velocity and variety attributes. We will introduce the traditional methods to deal with incomplete (or missing) data and we will present novel approaches using ELM to deal with Big Data. Several real examples from industry and from the medical field will be presented in order to illustrate the different methods.

Biography



Amaury Lendasse was born in 1972, in Belgium. He received a M.S. degree in Mechanical Engineering from the Universite Catholique de Louvain (Belgium) in 1996, a M.S. in Control in 1997 and a Ph.D. in Applied Mathematics in 2003 from the same university.

In 2003, he was a Postdoctoral Researcher in the Computational Neurodynamics Lab at the University of Memphis. From 2004 to 2014, he was a Senior Researcher and an Adjunct Professor in the Adaptive Informatics Research Centre in the Aalto University School of Science (better known as the Helsinki University of Technology) in Finland.

He has created and lead the Environmental and Industrial Machine Learning at Aalto. He is now an Associate Professor at The University of Iowa (USA) and a visiting Professor at Arcada University of Applied Sciences in Finland. He was the Chairman of the annual ESTSP conference (European Symposium on Time Series Prediction) and member of the editorial board and program committee of several journals and conferences on machine learning. He is the author or coauthor of more than 200 scientific papers in international journals, books or communications to conferences with reviewing committee. His research includes Big Data, time series prediction, chemometrics, variable selection, noise variance estimation, determination of missing values in temporal databases, nonlinear approximation in financial problems, functional neural networks and classification.

KEYNOTE VI

Title

Extreme Learning Machines for Energy Applications

by Donald C. Wunsch II, Missouri University of Science & Technology, USA

Abstract

Energy applications are a fascinating source of prediction and other problems that exhibit nonlinearities, time delays, and nonstationary statistics. This makes them an ideal testbed for Extreme Learning Machines approaches. Some illustrative examples are reviewed, and some novel regulation approaches to condition data for ELM are also discussed.

Biography



Donald Wunsch is the Mary K. Finley Missouri Distinguished Professor at Missouri University of Science and Technology (Missouri S&T). Earlier employers were: Texas Tech University, Boeing, Rockwell International, and International Laser Systems. His education includes: Executive MBA - Washington University in St. Louis, Ph.D., Electrical Engineering - University of Washington (Seattle), M.S., Applied Mathematics (same institution), B.S., Applied Mathematics - University of New Mexico, and Jesuit Core Honors Program, Seattle University.

Key research contributions are: Clustering / Unsupervised Learning; Adaptive Resonance and Reinforcement Learning architectures, hardware and applications; Neurofuzzy regression; Traveling Salesman Problem heuristics; Robotic Swarms; and Bioinformatics.

He is an IEEE Fellow and previous INNS President, INNS Fellow and Senior Fellow 2007-2013, NSF CAREER Award winner, and winner of the 2015 INNS Gabor Award. He served as IJCNN General Chair, and on several Boards, including the St. Patrick's School Board, IEEE Neural Networks Council, International Neural Networks Society, and the University of Missouri Bioinformatics Consortium, Chaired the Missouri S&T Information Technology and Computing Committee as well as the Student Design and Experiential Learning Center Board. He has produced 18 Ph.D. recipients in Computer Engineering, Electrical Engineering, and Computer Science; has attracted over \$10 million in sponsored research; and has over 400 publications including nine books. His research has been cited over 11,000 times.

KEYNOTE VII

Title

Smart Grid Dynamic Security Assessment with ELM

by Zhaoyang Dong, University of Sydney, Australia

Abstract

Dynamic security assessment of smart grids has been increasingly important given the increasing grid connections of stochastic renewable power sources and complicated demand response. The ability to perform security assessment with real time data from grid operations can provide highly useful information to reduce the risks of instability or even blackout of the grid. In this presentation, an intelligent early-warning system to achieve reliable online detection of risky operating conditions will be presented. The proposed intelligent system (IS) consists of an ensemble learning model based on extreme learning machine (ELM) and a decision-making process under a multi-objective programming (MOP) framework. The randomness existing in individual ELM training is generalized and reliable classification results can be obtained. The decision-making is designed for ELM ensemble with optimized parameters capable of searching for the optimal outcome of the security assessment system. The model can provide multiple and switchable performances to system operators to satisfy different local dynamic security assessment (DSA) requirements.

Biography



Zhaoyang Dong (M'99–SM'06–F'17) obtained his Ph.D. degree from the University of Sydney, Australia in 1999, where he is now Professor and Head of School of Electrical and Information Engineering. He is an IEEE Fellow. He was previously Ausgrid Chair and Director of the Ausgrid Centre of Excellence for Intelligent Electricity Networks (CIEN), the University of Newcastle, Australia. He also held academic and industrial positions with the Hong Kong Polytechnic University and Transend Networks (now TASNetworks), Tasmania, Australia. His research interest includes Smart Grid, power system planning, power system security, load modeling, renewable energy systems, electricity market, and computational intelligence and its application in power engineering.

He is an editor of IEEE TRANSACTIONS ON SMART GRID, IEEE TRANSACTIONS ON SUSTAINABLE ENERGY, IEEE POWER ENGINEERING LETTERS and IET Renewable Energy Generation.

TECHNICAL PROGRAM

Dec 13 2016, Tuesday

11:30am – 01:10pm	Session TM1: ELM in Social Network Chair: Soujanya Poria Venue: Cassia Junior Ballroom
11:30am	<i>Friend Recommendation in Location-Based Social Networks Using ELM</i> Zhen Zhang, Xiangguo Zhao and Guoren Wang <i>Northeastern University, China</i>
11:50am	<i>A Novel Recommendation System in Location-Based Social Networks Using Distributed ELM</i> Xiangguo Zhao, Zhongyu Ma and Zhen Zhang <i>Northeastern University, China</i>
12:10am	<i>A Dynamic Graph-based Model User-centered Recommendation Method Using US-ELM</i> Linlin Ding, Baishuo Han and Baoyan Song <i>Liaoning University, China</i>
12:30am	<i>Aspect-Sentiment Embeddings for Company Profiling and Employee Opinion Mining</i> Rajiv Bajpai ¹ , Devamanyu Hazarika ² , Kunal Singh ³ , Prateek Vij ³ , Soujanya Poria ¹ and Erik Cambria ¹ ¹ <i>Nanyang Technological University, Singapore</i> ² <i>National Institute of Technology, India</i> ³ <i>Indian Institute of Technology, India</i>
12:50am	<i>Geolocating Microblog Users via Extreme Learning Machine</i> Zhenyu Chen ^{1,2} , Xingyu Gao ² , Juan Cao ² , Fangchun Di ¹ and Lixin Li ¹ ¹ <i>China Electric Power Research Institute, China</i> ² <i>Chinese Academy of Sciences, China</i>

11:30am – 01:10pm	Session TM2: ELM Algorithms (I) Chair: Norbert Jankowski Venue: Heliconia Junior Ballroom: 3412
11:30am	<i>Orthogonal Super Greedy Algorithm for Sparse Extreme Learning Machine</i> Lin Xu, Xia Liu and Xiangyong Cao <i>Xi'an Jiaotong University, China</i>
11:50am	<i>Prototype-based kernels for Extreme Learning Machines</i> Norbert Jankowski <i>Nicolaus Copernicus University, Poland</i>

12:10am	<i>Extreme Learning Machine for Joint Embedding and Clustering</i> Tianchi Liu, Liyanaarachchi Kasun, Guang-Bin Huang and Zhiping Lin Nanyang Technological University, Singapore
12:30am	<i>Improving The Multimodal Probabilistic Semantic Model by ELM Classifiers</i> Yu Zhang, Ye Yuan, Yishu Wang and Guoren Wang Northeastern University, China
12:50am	<i>Reinforcement Extreme Learning Machine for Mobile Robot Navigation</i> Hongjie Geng ¹ , Huaping Liu ² and Bowen Wang ¹ ¹ Hebei University of Technology, China ² Tsinghua University, China

11:30am – 01:10pm	Session TM3: ELM in Imbalanced and Stream Data Chair: Chi Man Vong Venue: Heliconia Junior Ballroom: 3413
11:30am	<i>A Vehicle Detection Method based on Online Sequential ELM with Deep ConvNet Features</i> Jiarong Han, Xin Xu, Kun Zhao and Yujun Zeng National University of Defense Technology Changsha, China
11:50am	<i>Self-Adaptive Framework for Efficient Stream Data Classification on Storm</i> Shizhuo Deng, Botao Wang, Shan Huang, Chuncheng Yue, Jianpeng Zhou and Guoren Wang Northeastern University, China
12:10am	<i>A refined framework of weighted extreme learning machine for imbalance learning</i> Chengbo Lu ¹ , Haifeng Ke ² , Gaoyan Zhang ² and Ying Mei ¹ ¹ Lishui University, China ² Zhejiang University City College, China
12:30am	<i>Kernel based online learning for imbalance multiclass classification</i> Shuya Ding ¹ , Bilal Mirza ² , Zhiping Lin ¹ , Jiuwen Cao ³ , Xiaoping Lai, Tam V. Nguyen ² and Jose Sepulveda ² ¹ Nanyang Technological University, Singapore ² Singapore Polytechnic, Singapore ³ Hangzhou Dianzi University, China
12:50am	<i>Online Sequential Extreme Learning Machine with Under-sampling and Over-sampling for Imbalanced Big Data Classification</i> Jie Du, Chi Man Vong, Yajie Chang and Yang Jiao University of Macau, Macau

11:30am – 01:10pm	Session TM4: ELM Theory (I) Chair: Yoan Miche Venue: Heliconia Junior Ballroom: 3513
11:30am	<i>Kernel Extreme Learning Machine based on Fuzzy Set Theory for Multi-Label Classification</i> Yanika Kongsorot, Punyaphol Horata and Pakarat Musikawan Khon Kaen University, Thailand

11:50am	<i>Complexity and Stability Optimization for ELM Based on Parameter Diversity</i> Jingchao Cao, Yuheng Jia and Sam Kwong City University of Hong Kong, Hong Kong
12:10am	<i>Per-sample Prediction Intervals for Extreme Learning Machines</i> Anton Akusok ¹ , Yoan Miche ² , Kaj-Mikael Björk ³ and Amaury Lendasse ⁴ ¹ Arcada University of Applied Sciences, Finland ² Nokia Solutions and Networks Group, Finland ³ Risklab at Arcada University of Applied Sciences, Finland ⁴ The University of Iowa, USA
12:30am	<i>Marginal Fisher Analysis Dimensionality Reduction Algorithm via Extreme Learning Machine and Spectral Regression</i> Liu Bing, Yong Zhou, Zhan-guo Xia, Peng Liu and Qiu-yan Yan China University of Mining and Technology, China
12:50am	<i>Probabilistic GNN Query Optimization Based on Classification Using ELM</i> Jiajia Li ¹ , Xiufeng Xia ¹ , Xiangyu Liu ¹ , Botao Wang ² , Dahai Zhou ¹ and Yunzhe An ¹ ¹ Shenyang Aerospace University, China ² Northeastern University, China

02:30pm – 04:30pm	Session TA1: ELM Algorithm (II) Chair: Anton Akusok Venue: Cassia Junior Ballroom
02:30pm	<i>Improved Bidirectional Extreme Learning Machine Based on Enhanced Random Search</i> Cao Weipeng, Ming Zhong, Wang Xizhao and Cai Shubin Shenzhen University, China
02:50pm	<i>A Novel Multimodal Retrieval Model based on ELM</i> Yu Zhang, Ye Yuan, Yishu Wang and Guoren Wang Northesatern University, China
03:10pm	<i>A Multi-Valued Neuron ELM with Complex-Valued Inputs for System Identification using FRA</i> Francesco Grasso, Antonio Luchetta and Stefano Manetti University of Florence, Italy
03:30pm	<i>Quaternion Extreme Learning Machine</i> Hui Lv and Huisheng Zhang Dalian Maritime University, China
03:50pm	<i>ELMVIS++R - Mastering Visualization with Target Variables</i> Andrey Gritsenko ¹ , Anton Akusok ² , Stephen Baek ¹ and Amaury Lendasse ^{1,2} ¹ The University of Iowa, USA ² Risklab at Arcada University of Applied Sciences, Finland
04:10pm	<i>Storages are not forever</i> Erik Cambria ¹ , Anupam Chattopadhyay ¹ , Eike Linn ² , Bappaditya Mandal ³ and Bebo White ⁴ ¹ Nanyang Technological University, Singapore ² RWTH Aachen University, Germany

	³ A*STAR, Singapore ⁴ Stanford University, USA
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02:30pm – 04:30pm	Session TA2: ELM in Unsupervised Learning Chair: Shuang Li Venue: Heliconia Junior Ballroom: 3412
02:30pm	<i>A Unified Distributed ELM Framework with Supervised, Semi-supervised and Unsupervised Learning</i> Junchang Xin, Hongxu Yang, Luxuan Qu and Xiaosong Gao <i>Northeastern University, China</i>
02:50pm	<i>Unsupervised Online Sequential Extreme Learning Machine Based on Fuzzy Theory</i> Xiaodong Yang ^{1,2,3,4} , Yiqiang Chen ^{1,2} , Hanchao Yu ^{1,2,4} , Xi Zhong ^{1,2,3,4} and Ziang Hu ^{1,2,3,4} ¹ Chinese Academy of Sciences, China ² The Beijing Key Laboratory of Mobile Computing and Pervasive Device, China ³ University of Chinese Academy of Sciences, China ⁴ Beijing Key Laboratory for Parkinson's Disease, China
03:10pm	<i>Semi-Supervised Multi-Graph Classification Using Extreme Learning Machine</i> Jun Pang ^{1,2,3} , Yu Gu ³ , Jia Xu ⁴ and Ge Yu ³ ¹ Wuhan University of Science and Technology, China ² Hubei Province Key Laboratory of Intelligent Information Processing and Real-time Industrial System ³ Northeastern University, China ⁴ Guangxi University, China
03:30pm	<i>Incremental ELMVIS for unsupervised learning</i> Anton Akusok ¹ , Emil Eirola ¹ , Yoan Miche ^{2,3} , Ian Oliver ² , Kaj-Mikael Björk ⁴ , Andrey Gritsenko ^{5,6} , Stephen Baek ⁵ and Amaury Lendasse ^{1,5} ¹ Arcada University of Applied Sciences, Finland ² Nokia Solutions and Networks Group, Finland ³ Aalto University, Finland ⁴ Risklab at Arcada University of Applied Sciences, Finland ⁵ The University of Iowa, USA
03:50pm	<i>Domain Mean Matching Extreme Learning Machine for Unsupervised Domain Adaptation</i> Shuang Li, Shiji Song, and Gao Huang <i>Tsinghua University, China</i>

02:30pm – 04:30pm	Session TA3: Hierarchical ELM and Deep Learning Chair: Huaping Liu Venue: Heliconia Junior Ballroom: 3413
02:30pm	<i>Haptic Recognition Using Hierarchical Local-Receptive-Field-Based Extreme Learning Machine</i> Fengxue Li ¹ , Xinying Xu ¹ , Huaping Liu ² and Fuchun Sun ² ¹ Taiyuan University of Technology, China ² Tsinghua University, China
02:50pm	<i>Multi-layer Extreme Learning Machine With Enhancing the Local Significant Region</i>

	Xiaobo Li, Xibin Jia and Ya Jin <i>Beijing University of Technology, China</i>
03:10pm	<i>Hierarchical Local-Receptive-Field-Based Extreme Learning Machine For Active Object Recognition</i> Fengxue Li ¹ , Xinying Xu ¹ , Huaping Liu ² and Fuchun Sun ² ¹ Taiyuan University of Technology, China ² Tsinghua University, China
03:30pm	<i>Towards Enhancing Stacked Extreme Learning Machine With Sparse Autoencoder by Correntropy</i> Xiong Luo ^{1,2} , Yang Xu ^{1,2} , Weiping Wang ^{1,2} , Manman Yuan ^{1,2} , Xiaojuan Ban ^{1,2} and Yueqin Zhu ³ ¹ University of Science and Technology Beijing, China ² Beijing Key Laboratory of Knowledge Engineering for Materials Science, China. ³ China Geological Survey, China
03:50pm	<i>Motor Imagery EEG Classification Based on Hierarchical Extreme Learning Machine</i> Lijuan Duan ^{1,2} , Menghu Bao ^{1,2} , Song Cui ^{1,2} and Yuanhua Qiao ¹ ¹ Beijing University of Technology, China ² National Engineering Laboratory for Critical Technologies of Information Security Classified Protection, China
04:10pm	<i>Deep-Learned and Hand-Crafted Features Fusion Network for Pedestrian Gender Recognition</i> Lei Cai, Jianqing Zhu, Huanqiang Zeng, Jing Chen and Canhui Cai <i>Huaqiao University, China</i>

02:30pm – 04:30pm	Session TA4: ELM Applications Chair: Amaury Lendasse Venue: Heliconia Junior Ballroom: 3513
02:30pm	<i>Earthen Archaeological Site Monitoring Data Analysis Using Kernel-based ELM and Non-uniform Sampling TFR</i> Yue Qi ¹ , Mingzhe Zhu ¹ , Xinliang Zhang ¹ and Fei Fu ² ¹ Xidian University, China ² Northwest University, China
02:50pm	<i>OKRELM: Online Kernelized and Regularized Extreme Learning Machine for Wearable-based Activity Recognition</i> Lisha Hu ^{1,2,3} , Yiqiang Chen ^{1,2} , Shuangquan Wang ^{1,2} , Jindong Wang ^{1,2,3} , Chunyu Hu ^{1,2,3} and Xinlong Jiang ^{1,2,3} ¹ Chinese Academy of Sciences, China ² The Beijing Key Laboratory of Mobile Computing and Pervasive Device, China ³ University of Chinese Academy of Sciences, China
03:10pm	<i>Extreme Learning Machine for Room Recognition based on Laser Scanning</i> Xing Weng ¹ , Huaping Liu ² and Bowen Wang ¹ ¹ Hebei University of Technology, China ² Tsinghua University, China
03:30pm	<i>FSELM: Fusion Semi-supervised Extreme Learning Machine for Indoor Localization with Wi-Fi and Bluetooth Fingerprints</i>

	<p>Xinlong Jiang^{1,2,3}, Yiqiang Chen^{1,2}, Junfa Liu^{1,2}, Zhengyu Huang^{1,2,4}, Yang Gu^{1,2} and Lisha Hu^{1,2,3} ¹<i>Chinese Academy of Sciences, China</i> ²<i>Beijing Key Laboratory of Mobile Computing and Pervasive Device, China</i> ³<i>University of Chinese Academy of Sciences, China</i> ⁴<i>Xiangtan University, China</i></p>
03:50pm	<p><i>3D human gesture capturing and recognition by the IMMU-based data glove</i></p> <p>Bin Fang, Fuchun Sun and Huaping Liu <i>Tsinghua University, China</i></p>
04:10pm	<p><i>Parameter-Free Image Segmentation with SLIC</i></p> <p>Fabian Boemer¹, Ed Ratner¹ and Amaury Lendasse² ¹<i>Lyrical Labs, USA</i> ²<i>The University of Iowa, USA</i></p>

04:50pm – 06:30pm	<p>Session TA5: ELM Theory (II) Chair: Jiuwen Cao Venue: Cassia Junior Ballroom</p>
04:50pm	<p><i>Extreme Learning Machine for Huge Hypotheses Re-ranking in Statistical Machine Translation</i></p> <p>Yan Liu, Chi Man Vong and Pak-Kin Wong <i>University of Macau, Macau</i></p>
05:10pm	<p><i>Shared Subspace Learning via Cross-domain Extreme Learning Machine</i></p> <p>Yan Liu and Lei Zhang <i>Chongqing University, China</i></p>
05:30pm	<p><i>Quasi-curvature Local Linear Projection and Extreme Learning Machine for Nonlinear Dimensionality Reduction</i></p> <p>Shenglan Liu, Jun Wu, Lin Feng and Sen Luo <i>Dalian University of Technology, China</i></p>
05:50pm	<p><i>Robotic Grasp Stability Analysis using Extreme Learning Machine</i></p> <p>Peng Bai^{1,2}, Huaping Liu², Fuchun Sun² and Meng Gao¹ ¹<i>Shijiazhuang Tiedao University, China</i> ²<i>Tsinghua University, China</i></p>
06:10pm	<p><i>Back Propagation Convex Extreme Learning Machine</i></p> <p>Weidong Zou, Fenxi Yao, Baihai Zhang and Zixiao Guan <i>Beijing Institute of Technology, China</i></p>

04:50pm – 06:30pm	<p>Session TA6: ELM in Web/Text Mining Chair: Yuanlong Yu Venue: Heliconia Junior Ballroom: 3412</p>
04:50pm	<p><i>Extreme Learning Machine for Intent Classification of Web data</i></p> <p>Yogesh Parth¹ and Zhaoxia Wang² ¹<i>Space Applications Centre (SAC), India</i> ²<i>A*STAR, Singapore</i></p>

05:10pm	<i>Hot News Click Rate Prediction Based on Extreme Learning Machine and Grey Verhulst Model</i> Jingting Xu, Jun Feng, Xia Sun, Lei Zhang and Xiaoning Liu Northwest University, China
05:30pm	<i>Adaptive Network Intrusion Detection System using Extreme Learning Machines</i> Setareh Roshan ^{1,2} , Yoan Miche ³ , Aapo Kalliola ³ , Amaury Lendasse ⁴ and Anton Akusok ⁵ ¹ F-Secure Corporation, Finland ² Aalto University, Finland ³ Bell Labs, Nokia, Finland ⁴ The University of Iowa, USA ⁵ Arcada University of Applied Sciences, Finland
05:50pm	<i>Chinese Text Sentiment Classification based on Extreme Learning Machine</i> Fangye Lin and Yuanlong Yu Fuzhou University, China
06:10pm	<i>Gaussian Derivative Models and Extreme Learning Machine for Texture Classification</i> Yan Song ¹ , Shujing Zhang ² , Bo He ¹ , Qixin Sha ¹ , Yue Shen ¹ , Tianhong Yan ³ , Rui Nian ¹ and Amaury Lendasse ⁴ ¹ Ocean University of China, China ² Hebei Normal University, China ³ China Jiliang University, China ⁴ The University of Iowa, USA

04:50pm – 06:30pm	Session TA7: ELM in Clustering/Transfer Learning Chair: Qing He Venue: Heliconia Junior Ballroom: 3413
04:50pm	<i>Two Birds with One Stone: Classifying Positive and Unlabeled Examples on Uncertain Data Streams</i> Donghong Han ^{1,3} , Shuoru Li ¹ , Fulin Wei ¹ , Yuying Tang ¹ , Feida Zhu ² and Guoren Wang ^{1,3} ¹ Northeastern University, China ² Singapore Management University, Singapore ³ Key Laboratory of Medical Image Computing (NEU), China
05:10pm	<i>ELM-based Large-Scale Genetic Association Study via Statistically Significant Pattern</i> Yuan Li, Yuhai Zhao, Guoren Wang, Zhanghui Wang and Min Gao Northeastern University, China
05:30pm	<i>Multi-Kernel Transfer Extreme Learning Classification</i> Xiaodong Li ¹ , Weijie Mao ² , Wei Jiang ² and Ye Yao ¹ ¹ Hangzhou Dianzi University, China ² Zhejiang University, China
05:50pm	<i>A Novel Clustering Method based on Extreme Learning Machine</i> Jinhong Huang and Zhu Liang Yu South China University of Technology, China
06:10pm	<i>A Fast Algorithm for Sparse ELM via a New Clipping Scheme</i> Zhihong Miao ¹ and Qing He ² ¹ Chinese People's Armed Police Forces Academy, China

	² Chinese Academy of Sciences, China
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04:50pm – 06:30pm	Session TA8: ELM in Detection and Estimation Chair: Zhiping Lin Venue: Heliconia Junior Ballroom: 3513
04:50pm	<i>Learning Flow Characteristics Distributions with ELM for Distributed Denial of Service Detection and Mitigation</i> Aapo Kalliola ^{1,2} , Yoan Miche ¹ , Amaury Lendasse ⁴ , Kaj-Mikael Björk ³ , Anton Akusok ³ and Tuomas Aura ² ¹ Bell Labs, Nokia, Finland ² Aalto University, Finland ³ Arcada University of Applied Sciences, Finland ⁴ The University of Iowa, USA
05:10pm	<i>Discovering Emergence and Bidding Behaviour in Competitive Electricity Market using Agent-Based Simulation</i> Ly Fie Sugianto and Zhigang Liao Monash University, Australia
05:30pm	<i>Excavation Devices Localization with the Focusing Matrix based MUSIC Algorithm and Extreme Learning Machine</i> Kai Ye ¹ , Jianzhong Wang ¹ , Jiuwen Cao ¹ , Tianlei Wang ¹ , Anke Xue ¹ , Yuhua Cheng ² and Chun Yin ² ¹ Hangzhou Dianzi University, China ² University of Electronic Science and Technology of China, China
05:50pm	<i>Design of the MOI Method with an Improved PCNN Model for Crack Detection</i> Yuhua Cheng ¹ , Chun Yin ¹ , Lulu Tian ¹ , Xuegang Huang ² , Jiuwen Cao ³ and Libing Bai ¹ ¹ University of Electronic Science and Technology of China, China ² China Aerodynamics Research & Development Center, China ³ Hangzhou Dianzi University, China
06:10pm	<i>Room Occupancy Estimation using Sparse Linear Discriminant Analysis and Extreme Learning Machine</i> Yue Li, Tianchi Liu and Guang-Bin Huang Nanyang Technological University, Singapore

Dec 14 2016, Wednesday

10:30am – 12:30pm	Session WM1: ELM in Biomedical Engineering Chair: Muhammad Rizwan Venue: Cassia Junior Ballroom
10:30am	<i>Detection of Cellular Spikes and Classification of Cells from Raw Nanoscale Biosensor Data</i> Muhammad Rizwan ¹ , Abdul Hafeez ² , Ali R. Butt ³ and Samir M. Iqbal ^{4,5} ¹ Georgia Institute of Technology, USA ² KP University of Engineering & Tech, Pakistan ³ Virginia Polytechnic Institute and State University, USA ⁴ University of Texas at Arlington, USA ⁵ University of Texas Southwestern Medical Center at Dallas, USA

10:50am	<p><i>Kernel Principle Component Analysis based on Rotation Forest for Gene Expression Data Classification</i></p> <p>Huijuan Lu¹, Yaqiong Meng¹, Ke Yan¹, Yu Xue² and Zhigang Gao³ ¹China Jiliang University, China ²Nanjing University of Information Science & Technology, China ³Hangzhou Dianzi University, China</p>
11:10am	<p><i>Ensemble-Based Risk Scoring with Extreme Learning Machine for Prediction of Adverse Cardiac Events</i></p> <p>Nan Liu^{1,2}, Jeffrey Tadashi Sakamoto³, Jiuwen Cao⁴, Zhi Xiong Koh¹, Andrew Fu Wah Ho¹, Zhiping Lin⁵ and Marcus Eng Hock Ong^{1,6} ¹Singapore General Hospital, Singapore ²Duke-NUS Medical School, Singapore ³Duke University School of Medicine, USA ⁴Hangzhou Dianzi University, China ⁵Nanyang Technological University, Singapore ⁶Duke-NUS Medical School, Singapore</p>
11:30am	<p><i>Predicting Huntington's Disease: Extreme Learning Machine with Missing Values</i></p> <p>Emil Eirola¹, Anton Akusok¹, Kaj-Mikael Björk¹ and Amaury Lendasse² ¹Arcada University of Applied Sciences, Finland ²The University of Iowa, USA</p>
11:50am	<p><i>Assessing EEG-Vigilance in Open Eye and Situation-Aware State using Extreme Learning Machine Autoencoder and Restricted Boltzmann Machine</i></p> <p>Haoqi Sun, Olga Sourina and Guang-Bin Huang Nanyang Technological University, Singapore</p>
12:10pm	<p><i>A new similarity analysis of EEG signals for automatic epileptic seizure detection</i></p> <p>Sihui Li, Wenfeng Hu, Jiangling Song, Duo Li and Rui Zhang Northwest University, China</p>

10:30am – 12:10pm	<p>Session WM2: ELM with Optimization Chair: Chi Man Vong Venue: Heliconia Junior Ballroom: 3412</p>
10:30am	<p><i>Multiple Shadows Layered Cooperative Velocity Updating Particle Swarm Optimization</i></p> <p>Hongbo Wang, Kezhen Wang and Xuyan Tu University of Science and Technology Beijing, China</p>
10:50am	<p><i>Reconstruction based Spatiotemporal Fusion via Extreme Learning Machine</i></p> <p>Xun Liu¹, Chenwei Deng¹, Zhenzhen Li¹, Guang-Bin Huang² and Baojun Zhao¹ ¹Beijing Institute of Technology, China ²Nanyang Technological University, Singapore</p>
11:10am	<p><i>ADMM based on l_1-regularized-ELM and Application in Soft Sensor</i></p> <p>Dazi Li, Zhiyin Liu and Qibing Jin Beijing University of Chemical Technology, China</p>
11:30am	<p><i>Online Extreme Learning Machine Based Modeling and Optimization for Point-by-point Engine Calibration</i></p>

	Pak Kin Wong, Xianghui Gao, Ka In Wong and Chi Man Vong <i>University of Macau, Macau</i>
11:50am	<i>Ensemble Application of ELM and GPU for Real-Time Multimodal Sentiment Analysis</i> Ha-Nguyen Tran and Erik Cambria <i>Nanyang Technological University, Singapore</i>

10:30am – 12:10pm	Session WM3: ELM in Image Processing Chair: Lei Zhang Venue: Heliconia Junior Ballroom: 3413
10:30am	<i>Discriminative Extreme Learning Machine for Face Recognition</i> Tan Guo, Xiaoheng Tan and Lei Zhang <i>Chongqing University, China</i>
10:50am	<i>A Multiway Semi-Supervised Online Sequential Extreme Learning Machine for Facial Expression Recognition with Kinect RGB-D Images</i> Xinyuan Chen and Xibin Jia <i>Beijing University of Technology, China</i>
11:10am	<i>Patch-based Sobel Operator Method to detect Seam-Carved Images by Extreme Learning Machines</i> Hui-Jun Cheng, Jin Ye, Jyh-Da Wei and Chun-Yuan Lin <i>Chang Gung University, Taiwan</i>
11:30am	<i>Automatic Detection of Neovascularization in Retinal Images using Extreme Learning Machine</i> He Huang ^{1,2} , He Ma ¹ , Han JW van Triest ¹ , Yinghua Wei ³ , and Wei Qian ¹ ¹ <i>Northeastern University, China</i> ² <i>Jinzhou Medical University, China</i> ³ <i>The Third Affiliated Hospital of Jinzhou Medical University, China</i>
11:50am	<i>Facial Landmark Detection vis ELM feature selection and improved SDM</i> Peng Bian ¹ , Yi Jin ^{2,3} and Jiuwen Cao ⁴ ¹ <i>North China University of Technology, China</i> ² <i>Beijing Jiaotong University, China</i> ³ <i>Beijing Key Lab of Traffic Data Analysis and Mining, China</i> ⁴ <i>Hangzhou Dianzi University, China</i>

10:30am – 12:30pm	Session WM4: ELM in Prediction Chair: Enmei Tu Venue: Heliconia Junior Ballroom: 3513
10:30am	<i>Ocean Wave Height Prediction using Ensemble of Extreme Learning Machine</i> N. Krishna kumar ¹ , R. Savitha ² and Abdullah Al Mamun ¹ ¹ <i>National University of Singapore, Singapore</i> ² <i>Institute of Infocomm Research, Agency for Science, Technology and Research, Singapore</i>
10:50am	<i>Financial Time Series Prediction Using $l_{2,1}$ RF-ELM</i> Jingming Xue ^{1,2} , Sihang Zhou ¹ , Xinwang Liu ¹ , Qiang Liu ¹ and Jianping Yin ¹

	<p>¹<i>College of Computer National University of Defense Technology, China</i> ²<i>Bank of Changsha Co., Ltd., China</i></p>
11:10am	<p><i>Smart Home: Accurate Prediction of Energy Consumption with Extreme Learning Machine Variants</i></p> <p>Sachin Kumar¹, Shobha Rai¹, Rampal Singh¹ and Saibal K Pal² ¹<i>University of Delhi, India</i> ²<i>Defence Research Development Organisation, India</i></p>
11:30am	<p><i>Data Fusion Using OPELM for low-cost sensors in AUV</i></p> <p>Jia Guo¹, Bo He¹, Pengfei Lv¹, Tianhong Yan² and Amaury Lendasse³ ¹<i>Ocean University of China, China</i> ²<i>China Jiliang University, China</i> ³<i>The University of Iowa, USA</i></p>
11:50am	<p><i>An Automatic Identification System (AIS) Database for Maritime Trajectory Prediction and Data Mining</i></p> <p>Shangbo Mao¹, Enmei Tu¹, Guanghao Zhang¹, Lily Rachmawati², Eshan Rajabally³ and Guang-Bin Huang¹ ¹<i>Nanyang Technological University, Singapore</i> ²<i>Advanced Technology Centre, Rolls-Royce Singapore Pte Ltd, Singapore</i> ³<i>Strategic Research Center, Rolls-Royce Plc, Singapore</i></p>
12:10am	<p><i>Short Term Prediction of Continuous Time Series Based on Extreme Learning Machine</i></p> <p>Hongbo Wang, Peng Song, Chengyao Wang and Xuyan Tu <i>University of Science and Technology Beijing, China</i></p>