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Progress, Prospectives and Challenges in Machine Learning

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BIO-SKETCH: Michael I. Jordan is the Pehong Chen Distinguished Professor in the Department of Electrical Engineering and Computer Science and the Department of Statistics at the University of California, Berkeley. He received his Masters in Mathematics from Arizona State University, and earned his PhD in Cognitive Science in 1985 from the University of California, San Diego. He was a professor at MIT from 1988 to 1998. His research interests bridge the computational, statistical, cognitive and biological sciences, and have focused in recent years on Bayesian nonparametric analysis, probabilistic graphical models, spectral methods, kernel machines and applications to problems in distributed computing systems, natural language processing, signal processing and statistical genetics. Prof. Jordan is a member of the National Academy of Sciences, a member of the National Academy of Engineering and a member of the American Academy of Arts and Sciences. He is a Fellow of the American Association for the Advancement of Science. He has been named a Neyman Lecturer and a Medallion Lecturer by the Institute of Mathematical Statistics. He received the David E. Rumelhart Prize in 2015 and the ACM/AAAI Allen Newell Award in 2009. He is a Fellow of the AAAI, ACM, ASA, CSS, IEEE, IMS, ISBA and SIAM. In 2016, Jordan was identified as the "most influential computer scientist", based on an analysis of the published literature by the Semantic Scholar project.
Pattern Recognition by the Brain: Neural Circuit

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ABSTRACT: The brain acquires the ability of pattern recognition through learning. Understanding neural circuit mechanisms underlying learning and memory is thus essential for understanding how the brain recognizes patterns. Much progress has been made in this area of neuroscience during the past decades. In this lecture, I will summarize three distinct features of neural circuits that provide the basis of learning and memory of neural information, and pattern recognition. First, the architecture of the neural circuits is continuously modified by experience. This process of experience - induced sculpting (pruning) of connections is most prominent early in development and decreases gradually to a much more limited extent in the adult brain. Second, the efficacy of synaptic transmission could be modified by neural activities associated with experience, in a manner that depends on the pattern (frequency and timing) of spikes in the pre- and postsynaptic neurons. This activity - induced circuit alteration in the form of long - term potentiation (LTP) and long - term depression (LTD) of existing synaptic connections is the predominant mechanism underlying learning and memory of the adult brain. Third, learning and memory of information containing multiple modalities, e.g., visual, auditory, and tactile signals, involves processing of each type of signals by different circuits for different modalities, as well as binding of processed multimodal signals through mechanisms that remain to be elucidated. Two potential mechanisms for binding of multimodal signals will be discussed: binding of signals through converging connections to circuits specialized for integration of multimodal signals, and binding of signals through correlated firing of neuronal assemblies that are established in circuits for processing signals of different modalities. Incorporation of these features into artificial neural networks may help to achieve more efficient pattern recognition, especially for recognition of time - varying multimodal signals.

BIO-SKETCH: Mu-ming Poo is the Director of Institute of Neuroscience, Chinese Academy of Sciences (CAS) and Director of CAS Center for Excellence for Brain Science & Intelligence Technology, and Paul Licht Distinguished Professor Emeritus at University of California at Berkeley. He received BS in physics from Tsinghua University (Taiwan), Ph. D in biophysics from Johns Hopkins University, and was on the faculty of University of California at Irvine, Yale University, Columbia University, University of California at San Diego and at Berkeley. He had received Ameritec Prize (2001), China International Science & Technology Cooperation Award (2005), Qiushi Distinguished Scientist Award (2011), Guerber Neuroscience Prize (2016), and Honorary Doctorates from Ecole Normale Superieure (Paris) and Hong Kong University of Science and Technology. He is a member of Academia Sinica (Taiwan), US National Academy of Sciences, Chinese Academy of Sciences, and Academy of Science of Hong Kong. He is one of the main organizers for China Brain Project, one of China’s major frontier science and technology projects for 2017-2030.
Experience-based cross-modal learning of intelligent robot systems

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BIO-SKETCH: Prof. ZHANG Jianwei is the Professor and Director of TAMS Institute of the University of Hamburg, member of the Academy of Sciences in Hamburg, Germany. He joined the Recruitment Program of Global Experts by the Organization Department of the CPC Central Committee. He received his PhD (1994) at the Institute of Real-Time Process Techniques and Robotics, Department of Computer Science, University of Karlsruhe, Germany. His research interests are service robotics, sensor fusion, service robotics and multimodal machine learning, cognitive computing of Industry4.0, etc. In these areas, he has published over 300 journal and conference papers, and possessed more than 40 patents. Prof. ZHANG Jianwei also received numerous awards, including the IEEE ROMAN 2001 Award, Best Vision Paper Finalist ICRA 2001 and the IEEE AIM Best Paper Award 2008. He was the General Chairs of IEEE MFI 2012, IROS 2015 and HCR 2016.
Interactive Granular Computing: 
Toward Computing Model for Turing Test

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The Turing test, as originally conceived, focused on language and reasoning; problems of perception and action were conspicuously absent. 
---- Ch. L. Ortiz Jr. Why we need a physically embodied Turing test and what it might look like, AI Magazine 37(1) 55-62 (2016).

ABSTRACT: We extended Granular Computing (GrC) to Interactive Granular Computing (IGrC) by introducing complex granules (c-granules or granules, for short). They are grounded in the physical reality and are responsible for generation of the information systems (data tables) through interactions with the physical objects. These information systems are next aggregated as a part of networks of information systems (decision systems) in the search of relevant computational building blocks (patterns or classifiers) for initiating actions or plans or understanding behavioral patterns of swarms of c-granules (in particular, agents) satisfying the user's needs to a satisfactory degree. Agents performing computations based on interaction with the physical environment learn rules of behavior, representing knowledge not known a priori by agents. Numerous tasks of agents may be classified as control tasks performed by agents aiming at achieving the high quality computational trajectories relative to the considered quality measures over the trajectories. Here, e.g., new challenges are related to developing strategies for predicting and controlling the behavior of agents. We propose to investigate these challenges using the IGrC framework. The reasoning used for controlling of computations is based on adaptive judgment. The adaptive judgment is more than a mixture of reasoning based on deduction, induction and abduction. IGrC is based on perception of situations in the physical world with the use of experience. Hence, the theory of judgment has a place not only in logic but also in psychology and phenomenology. This reasoning deals with c-granules and computations over them. Due to the uncertainty the agents generally cannot predict exactly the results of actions (or plans). Moreover, the approximations of the complex vague concepts, e.g., initiating actions (or plans) are drifting with time. Hence, adaptive strategies for evolving approximations of concepts are needed. In particular, the adaptive judgment is very much needed in the efficiency management of granular computations, carried out by agents, for risk assessment, risk treatment, and cost/benefit analysis.

Keywords: (Interactive) Granular Computing, Complex Granule, Adaptive Judgment, Interaction Rule, Rough Sets, Adaptive Approximation of Complex Vague Concepts and Games, Risk Management

BIO-SKETCH: ECCA and IRSS Fellow, received the Ph. D. and D. Sci. (habilitation) from the University of Warsaw in Poland. In 1991 he received the Scientific Title of Professor. He is Full Professor in the Faculty of Mathematics, Computer Science and Mechanics at the University of Warsaw and in
Andrzej Skowron is the (co)author of more than 400 scientific publications and editor of many books. His areas of expertise include reasoning with incomplete information, approximate reasoning, soft computing methods and applications, rough sets, rough mereology, granular computing, intelligent systems, knowledge discovery and data mining, decision support systems, adaptive and autonomous systems, perception based computing, and interactive computational systems. He was the supervisor of more than 20 PhD Theses. In the period 1995-2009 he was the Editor-in-Chief of Fundamenta Informaticae journal. He is on Editorial Boards of many international journals. Andrzej Skowron was the President of the International Rough Set Society from 1996 to 2000. He has delivered numerous invited talks at international conferences including a plenary talk at the 16th IFIP World Computer Congress (Beijing, 2000). He was serving as (co-)program chair, advisory board member, and PC member of more than 200 international conferences. He was involved in numerous research and commercial projects including dialog-based search engine (Nutech), fraud detection for Bank of America (Nutech), logistic project for General Motors (Nutech), algorithmic trading (Adgam), control of UAV (Linköping University), and medical decision support (Polish-American Pediatric Clinic in Cracow). Andrzej Skowron was on the ICI Thomson Reuters list of the mostly cited researchers in Computer Science (globally) in 2012 and 2016.
Optimal Mass Transportation Theory Applied for Machine Learning

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ABSTRACT: Optimal mass transportation (OMT) theory bridges geometry and probability, it offers a powerful tool for modeling probability distributions and measuring the distance between distributions. Recently, the concepts and method of optimal mass transportation theory have been adapted into the field of Machine Learning. It interprets the principle of machine learning from different perspective and points out new direction for improving machine learning algorithms. This work introduces the fundamental concepts and principles of optimal mass transportation, explains how to use OMT framework to represent probability distributions, measure the distance among the distributions, reduce dimensions, and approximate the distributions. In general, the machine learning principles and characteristics are explained from the point of view of OMT.

BIO-SKETCH: Dr. Gu got his B.S. from Computer Science Department of Tsinghua University in 1994, PhD from Division of Engineering and Applied Science of Harvard University in 2002, supervised by a Fields medalist: Prof. Shing-Tung Yau. Dr. Gu is a tenured professor in Computer Science Department and Applied Mathematics Department of State University of New York at Stony brook. Dr. Gu won US NSF Career award in 2005, Chinese NSF outstanding offsea scholar award in 2006, Morningside Gold medal in applied mathematics in the 6th International Congress of Chinese Mathematician 2013. Dr. Gu and Prof. Yau founded an emerging interdisciplinary field: computational conformal geometry, which applies modern geometry in engineering and medicine fields. He has published more than 270 articles in top level journals and conferences in graphics, vision, visualization, medical imaging and networking fields; three monographs in mathematics and computer science. He has obtained several international patents, some of them have been licensed to Simens and GE.

Dr. Gu has long term collaborations with scholars in China. He is a visiting professor in Mathematics Science Center, Tsinghua university in the last 10 years; sea-sky scholar in Dalian University of Technology in the last 6 years. He has severer as the editor of several international journals, including “Graphical Models” and “Geometry, Imaging and Computation”. Dr. Gu has served on the program committees of SIGGRAPH Asia, Pacific Graphics, IEEE Vis, CVPR, ICCV and many conferences in the past years. Dr. Gu has hosted visiting scholars/students from China during the last 10 years, and gave summer courses in Tsinghua and other universities from 2005, more than 1000 Chinese students have taken his courses on computational conformal geometry.
Quantifying your Brain and Identifying Brain Disease Roots

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ABSTRACT: With the available data of huge samples for the whole spectrum of scales both for healthy controls and patients including depression, autism and schizophrenia etc, we are in the position to quantify human brain activities such as creativity, happiness, IQ and EQ etc and search the roots of various mental disorders. With novel machine learning approaches, we first introduced functional entropy and entropy rate of resting state to characterize the dynamic behaviour of our brain. It is further found that the functional entropy is an increasing function of age, but a decreasing function of creativity and IQ. Its biological mechanisms are explored. With the brain wide associate study approach, for the first time in the literature we are able to identify the roots of a few mental disorders. For example, for depression, we found that the most altered regions are located in the lateral and medial orbitofrontal cortex for punishment and reward. Follow up rTMS at the lateral orbitofrontal cortex demonstrated significant outcomes of the treatments.

BIO-SKETCH: Jianfeng Feng is a thousand-talent program (second round) professor, the chair professor of Shanghai National Centre for Mathematic Sciences, and the Dean of Brain-inspired AI Institute in Fudan University. He has been developing new mathematical, statistical and computational theories and methods to meet the challenges raised in neuroscience and mental health researches. Recently, his research interests are mainly in big data analysis and mining for neuroscience and brain diseases. He was awarded the Royal Society Wolfson Research Merit Award in 2011, as a scientist "being of great achievements or potentials". He has made considerable contributions on modelling single neurons and neuronal networks, machine learning, and causality analysis with publications on Molecular Psychiatry, Brain, PNAS, PRL, J Neuroscience etc. He has proposed and developed BWAS method (Brain-wide association study), and successfully applied it to search the roots in depression, schizophrenia and autism; developed functional entropy method and applied it to the study of ageing, IQ and creativity etc.
Multi-objective Ensemble Learning and Its Applications

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ABSTRACT: Multi-objective learning might be a strange concept as some people thought that the only objective in learning would be to maximise the generalisation ability of a learner. What else do you need, one might ask. It turns out that there are different perspectives and aspects to learning. First, machine learning is almost always formulated as an optimisation problem by defining a cost function, an energy function, an error function, or whatever-it-is-called function. Once this function is defined, the rest is the development (or the direct application) of an optimisation algorithm. Interestingly, most of such functions have more than one term. For example, it is not uncommon for such a function to include a loss term and a regularisation term, which then have to be balanced by a parameter (hyper-parameter). Much research work in the literature has been devoted to the setting and tuning of such a hyper-parameter. However, loss and regularisation are clearly two conflicting objectives from the perspective of multi-objective optimisation. Why not treat these two objectives separately so that we do not have to tune the hyper-parameter? The first part of this talk explains how this is done [1,2] and what the potential advantages and disadvantages are. Second, measuring the error of a machine learner is not always as straightforward as one might think. Different people may use different metrics. It is not always clear how different metrics relate to each other and whether a learner performs well under one metric would look very poor according to a different metric. The second part of this talk gives an example in software effort estimation, where a more robust learner is trained using multi-objective learning, which performs well under different metrics [3]. The third and last part of this talk is devoted to two important areas in machine learning, i.e., online learning with concept drift [4] and class imbalance learning [5,6]. Multi-objective learning in these two areas will be introduced.

References:


**BIO-SKETCH:** Xin Yao is a Chair Professor of Computer Science at the Southern University of Science and Technology (SUSTech), Shenzhen, China. He is an IEEE Fellow and a Distinguished Lecturer of IEEE Computational Intelligence Society (CIS). He served as the Editor-in-Chief (2003-08) of IEEE Transactions on Evolutionary Computation and the President (2014-15) of IEEE CIS. His main research interests include evolutionary computation, ensemble learning, and their applications, especially in software engineering. His papers won the 2001 IEEE Donald G. Fink Prize Paper Award, 2010, 2016 and 2017 IEEE Transactions on Evolutionary Computation Outstanding Paper Awards, 2010 BT Gordon Radley Award for Best Author of Innovation (Finalist), 2011 IEEE Transactions on Neural Networks Outstanding Paper Award, and many other best paper awards. He won the prestigious Royal Society Wolfson Research Merit Award in 2012 and the IEEE CIS Evolutionary Computation Pioneer Award in 2013. He was given the honour of an Overseas Assessor of Chinese Academy of Sciences, a Changjiang Scholar (Chair Professor) of the Ministry of Education, and a "1000 Talents" Scholar.
The Crazy Artificial Intelligence

Shelley Lai Xu

World Bank, Senior Data Scientist & Director of Data Sharing Platform
George Mason University Business School, guest lecturer
Columbia University, guest lecturer
International Applied Science & Technology Institute, Vice President
Guangdong province Administrative Technology School, guest lecturer
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ABSTRACT: Until quite recently we still think of artificial intelligence as something existed only in scientific fictions, now it is indeed a part of our lives. Whether it is manufacturing and home appliances, smart city or governance, when you integrate big data and artificial intelligence (AI), you can see how AI has left a mark on every aspect of life. Artificial intelligence can be applied to a wide range of industries, including computer science, financial trade, medical diagnosis, heavy industry, transportation, telecommunication, online and telephone call centers, law, game, and music. Before long, artificial intelligence will bring us enormous changes that completely revolutionize the way we approach the world. Let’s do this!

BIO-SKETCH: Ms. Shelley Lai Xu was one of the first Chinese nationals to join the World Bank in Washington D.C. and during her 30 years of service, she was appointed by the World Bank to visit countries such as China, Mongolia, and Angora to provide technical assistance and economic assessment as a part of the United Nations aid program for developing countries. Recent years, she has led and participated in multiple large-scale big data analysis projects; she was also invited to work as a technical advisor to assist and educate information processing top management at NASA, U.S. governments, and central banks, etc.

Shelley’s major accomplishments include leading the compilation of World Bank’s annual World Development Indicators, which collects and assesses international data submitted by organizations under the United Nations system. The report was published in the six U.N. official languages and studied by governments and organizations around the world. Those statistics and index analysis are accessed over a million times every week.

Shelley specializes in big data collection, analysis, and application. Over the years, her knowledge and dedication has earned the applause and recognition of the United Nations, World financial institutions and governments. She is currently in charge of building the World Bank’s open database and R & D work on technology application. Her work in data search & sharing, global finance inclusiveness, social security tenacity, equity indicator and other relevant sustainable energy development and analysis has earned her multiple World Bank Vice President Awards, as well as the recognition of the White House Chief Information Technology Officer.
On Intelligence: Symbiotic, Holonic, and Immunological Agents

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ABSTRACT: Currently, Artificial Intelligence has become a focal point of interest in the development of new and innovative applications in modern technology. The presentation will discuss and compare symbiotic, holonic, and immunological agents. Immunological agency will be considered in the context of biologically inspired Artificial Intelligence techniques as it is based on the advantageous adaptive properties of the vertebrate immune system. Furthermore, the discussion will explore how these types of agent can contribute to realizing intelligence in applications such as mentioned above.

BIO-SKETCH: Prof Ehlers started her research career in the discipline of formal languages and automata theory. Prof Ehlers holds a PhD. in Computer Science awarded by the former Rand Afrikaans University with a thesis titled: A Hierarchy of Random Grammars and Automata. Currently her main research interests are agent architectures and interesting applications there-of. This includes multi-agent systems, Artificial Intelligence and specifically AI applications. She has been full professor in the Academy of Computer Science and Software Engineering at the University of Johannesburg since 1992. She was appointed Head of Department of the Academy of Computer Science and Software Engineering in 2007. Secretary of IFIP TC 12.
Entanglement of Inner Product, Topos Induced by Opposition and Transformation of Contradiction, and Tensor Flow

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ABSTRACT: The question "Can machines think?" not only involves the basic contradiction between "material" and "spirit" in philosophy, but also induces a secondary contradiction chain from "general material" to "living", "conscious" and "intelligent". The law of unity of opposites, the mechanism of mutual change of quality and quantity, and the rule of dialectical transformation have become the key fundamental problems that need to be addressed in Intelligence Science. The spatial-time position of object u is the attribute describing where u is existing, the distance between u and its contradiction v is the expressing relation distinguishing that u from v. It is shown in this paper that by the mechanism of distance vary with position change, which was controlled by the law of unity of opposites, the philosophy question can be transformed into a physical problem, and it can be not only transformed as a mathematical problem by the three definitions of distance, but some of mathematical construction, Polarization Vector of Inner Product, Entangled Vector, Entangled Circle and Entangled Coordinates, and so on, can be induced. It is also shown that a Category with cone and limit can be induced by time and displacement arrows. The mechanism that in quality is maintaining the same, during the quantity varies with time change in its qualitative criterion, can be abstracted to be a Qualitative Mapping and a Degree Function of Conversion from a quantity into its corresponding quality, such that a Cartesian Closed Category can be gotten. A subobject classifier can be induced by the mechanism of a quality is changing to a simple (or non-essential) quality, so an Attribute Topos can be achieved by them. A Sheaf and a Heyting Algebra can be constructed by quality converted into its contradicting quality, such that an object become its contradiction, and an entanglement system of both contradictions can be created when distance small than Planck Constant. Because a Hilbert Space H can be expanded by the Family of Qualitative Mappings, such that not only the degree of conversion function can be represented by a linear combination of base, but also a Tensor Flow can be induced by a functor F from the Base of H to Base of H’ with the time stream. A Fixation Image Operator, and an approach for Image Thought has been presented, some of applications in Noetic Science and Intelligent Science are discussed.

BIO-SKETCH: Jiali Feng was born in China, in 1948.12.1, he get his B.S in Mathematics in the Mathematics Department at Guangxi Normal University, in Guilin, Guangxi, China, in 1982. He was a visiting scholar in Mathematics Department at Beijing Normal University from 1988 to 1989. He get his PhD in radioprotection at China Institute of Atomic Energy in 2001. His research is focused on the attribute theory method in Noetic Science and Intelligence Science.

After graduation he was engaged as a teacher in Guilin 8th High School from 1982 to 1984. He was a lecturer, an associate professor and a professor at Guangxi Normal University from 1984 to 2000, as the deputy dean of the College of Mathematics and Computer Science from 1999 to 2000. Since 2000 he is a Professor in Department of Mathematics and Computer Science at Shanghai Maritime University, and served as dean of College of Information Engineering at the University from 2003 to 2005. He

Dr. Feng is deputy director of Machine Learning Society, Chinese Association for Artificial Intelligence during 2000-2015. Member of IEEE Shanghai Section. President of the Noetic Science of Shanghai from 2012.
Extreme Learning Machines (ELM) – Filling the Gap between Machine Learning and Biological Learning

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ABSTRACT: One of the most curious in the world is how brains produce intelligence. Brains have been considered one of the most complicated things in the universe. Machine learning and biological learning are often considered separate topics in the years. The objectives of this talk are three-folds: 1) It will analyse the differences and relationships between artificial intelligence and machine learning, and advocates that artificial intelligence and machine learning tend to become different, they have different focus and techniques; 2) There exists some convergence between machine learning and biological learning; 3) Although there exist many different types of techniques for machine learning and also many different types of learning mechanism in brains, Extreme Learning Machines (ELM) as a common learning mechanism may fill the gap between machine learning and biological learning, in fact, ELM theories have been validated by more and more direct biological evidences recently. ELM theories actually show that brains may be globally ordered but may be locally random. ELM theories further prove that such a learning system happens to have regression, classification, sparse coding, clustering, compression and feature learning capabilities, which are fundamental to cognition and reasoning. This talk also shows how ELM unifies SVM, PCA, NMF and a few other learning algorithms which indeed provide suboptimal solutions compared to ELM.

BIO-SKETCH: Full Professor in the School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore. He is a member of Elsevier’s Research Data Management Advisory Board. He is one of three Directors for Expert Committee of China Big Data Industry Ecological Alliance organized by China Ministry of Industry and Information Technology, and a member of International Robotic Expert Committee for China. He was a Nominee of 2016 Singapore President Science Award, was awarded Thomson Reuters’s 2014 “Highly Cited Researcher” (Engineering), Thomson Reuters’s 2015 “Highly Cited Researcher” (in two fields: Engineering and Computer Science), and listed in Thomson Reuters’s “2014 The World's Most Influential Scientific Minds” and “2015 The World's Most Influential Scientific Minds.” He received the best paper award from IEEE Transactions on Neural Networks and Learning Systems (2013). He serves as an Associate Editor of Neurocomputing, Cognitive Computation, Neural Networks, and IEEE Transactions on Cybernetics. He was invited to give keynotes on numerous international conferences.

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.”
How can we effectively analyze big data in terabytes or even petabytes?

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Abstract: The big values in big data can only be dug out through deep analysis of data. In the era of big data, datasets with hundreds of millions objects and thousands of features become a phenomenon rather than an exceptional case. The internet and telecom companies in China have over hundred million customers. Such datasets are often in the size of terabytes and can easily exceed the size of the memory of the cluster system. Current big data analysis technologies are not scalable to such data sets because of the memory limitation. How can we effectively analyze such big data? In this talk, I will present a statistical-aware strategy to divide big data into data blocks which are distributed among the nodes of the cluster or even in different data centers. I will propose a random sample partition data model to represent a big data set as a set of distributed random sample data blocks. Each random sample data block is a random sample of the big data so it can be used to estimate the statistics of the big data and build a classification or prediction model for the big data. I will also introduce an asymptotic ensemble learning framework that stepwise builds ensemble models from selected random sample data blocks to model the big data. Using this set of new technologies, we will be able to analyze big data effectively without the memory limit. With this new architecture for big data, we are able to separate data analysis engines from data centers and make the data centers more accessible to big data analysis.

BIO-SKETCH: Dr. Joshua Zhexue Huang is a distinguished professor at College of Computer Science and Software in Shenzhen University. He is the founding director of Big Data Institute of Shenzhen University, Director of State Information Center Shenzhen Big Data Institute and Deputy Director of National Engineering Laboratory for Big Data System Computing Technology. Prof. Huang is known for his contributions to the development of a series of k-means type clustering algorithms in data mining, such as k-modes, fuzzy k-modes, k-prototypes and w-k-means that are widely cited and used, and some of which have been included in commercial software. He has extensive industry expertise in business intelligence, data mining and big data analysis. He has been involved in numerous consulting projects in Australia, Hong Kong, Taiwan and mainland China. Dr Huang received his PhD degree from the Royal Institute of Technology in Sweden. He has published over 200 research papers in conferences and journals. In 2006, he received the first PAKDD Most Influential Paper Award. He was the program chair of PAKDD 2011, the local organization chair of ICDM 2014 and the conference co-chair of PAKDD 2016.
Cyborg Intelligent Systems

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ABSTRACT: Advances in multidisciplinary fields such as brain-machine interfaces, artificial intelligence, and computational neuroscience, signal a growing convergence between machines and biological beings. Especially, brain-machine interfaces enable a direct communication pathway between the brain and machines. It promotes the brain-in-loop computational paradigm. A biological-machine intelligent system consisting of both organic and computing components is emerging, which we called cyborg intelligent systems. This talk will introduce the concept, architectures, and applications of cyborg intelligent systems. It will also discuss issues and challenges.

BIO-SKETCH: Gang Pan is a professor of the College of Computer Science and Technology at Zhejiang University. His interests include pervasive computing, computer vision, artificial intelligence, and brain-machine interfaces. He earned his B.S. and Ph.D. degrees both from Zhejiang University in 1998 and 2004 respectively. From 2007 to 2008, he was with the University of California, Los Angeles as a visiting scholar. He has co-authored more than 100 refereed papers, and has 25 patents granted. Dr. Pan is a recipient of CCF-IEEE CS Young Computer Scientist Award, Microsoft Fellowship Award. He has received many technical awards, including TOP-10 Achievements in Science and Technology in Chinese Universities (2016), National Science and Technology Progress Award (2015), Best Paper Award of ACM UbiComp’16, 2016 BCI Research Award Nomination. He serves as an associate editor of IEEE Systems Journal, ACM Proceedings of Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT), and Chinese Journal of Electronics.
Learning and Memory in Mind Model CAM

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ABSTRACT: Intelligent science is the contemporary forefront interdisciplinary subject of brain science, cognitive science, artificial intelligence and other disciplines, which studies intelligence theory and technology. The one of its core issues is to build the mind model. Mind is the human spirit of all activities, is a series of cognitive abilities, which enable individuals to have consciousness, sense the outside world, think, make judgment, and remember things. Mind model CAM (Consciousness And Memory) is mainly composed of five parts, namely, memory, consciousness, high-level cognitive functions, perception input, behavior response. CAM is general intelligent system architecture. This lecture will mainly introduce the learning and memory mechanism of the mind model CAM, focusing on the physiological basis of memory, complementary learning system, learning and memory evolution and other issues. Human brain learning and memory is a comprehensive product of two complementary learning systems. One is the brain neocortex learning system, through the experience, slowly learning about knowledge and skills. The other is the hippocampus learning system, which memorizes specific experiences and allows these experiences to be replayed and thus effectively integrated with the new cortical learning system. Explore the complementary learning and memory of short-term memory and long-term memory in CAM. The essence of learning and memory evolution is through learning, not only to increase knowledge, but also to change the structure of memory.

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BIO-SKETCH: Zhongzhi Shi is a professor at the Institute of Computing Technology, Chinese Academy of Sciences, leading the Intelligence Science Laboratory. His research interests include intelligence science, machine learning, data mining, image processing, cognitive computing and etc. Professor Shi has published 14 monographs, 15 books and more than 450 research papers in journals and conferences. He has won a 2nd-Grade National Award at Science and Technology Progress of China in 2002, two 2nd-Grade Awards at Science and Technology Progress of the Chinese Academy of Sciences in 1998 and 2001, respectively. He is a fellow of CCF and CAAI, senior member of IEEE, member of AAAI and ACM, Chair for the WG 12.2 of IFIP. He serves as Editor-in-Chief of Series on Intelligence Science, Editor-in-Chief of International Journal of Intelligence Science. Website: http://www.intsci.ac.cn/en/shizz/
Factor Space and Artificial Intelligence

Peizhuang Wang

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ABSTRACT: Different from human intelligence, the subject of AI is not brain, but machine. How do machine emulate intelligence of brain? Is it possible to construct a brain-like machine? No matter how advanced science becomes, it is not possible to make a machine as a clone of brain. It is mystery that the insuperable barrier does not take away all belief from AI researchers. Even though the ebb of fifth generation computer in 1990s hints that computer must emulate from the structure of human brain, people still have confidence on AI facing the difficulty of structure-emulation. Indeed, we would cognize that brain is the cognition’s subject, but not the very cognition. Is there a cognition theory keeping a little independence from brain? It concerns with the relationship between cognition information and ontological information. Even though brain has influence to ontology information, ontology information is independent from the subject of cognition essentially, and there exists inner cognition theory to guide artificial intelligence. There were theories arising in artificial intelligences, unfortunately, they are not deep and united but shallow and split. There have been no deep and united artificial intelligence theory yet. No a strong theory, no substantial practice! Therefore, we are going to build a strong theory of artificial intelligence. Factor space aims to build a mathematical theory of AI. Factor is a generalization of gene since mene was been called Mendelian factor. Gene is the root of a bunch of bio-attributes, factor is the root of a bunch of attributes for anything. Factor space is the generalization of Cartesian coordinate space with axes named by factors. Factor space provides united platform to do concept generation and implication, which is the mathematics of cognition. Which provides united theory for artificial intelligence, especially, for special information processing faced big data.

BIO-SKETCH: Prof. Wang received the BS degree in Mathematics from Beijing Normal University, China in 1957. He is currently with Liaoning Technical University. His research interests include optimization and factorial analysis applied in AI and data science. Research on fuzzy set theory and random falling shadow. The model and method of fuzzy falling shadow space theory are put forward and widely used. In 1988, Prof. Wang also successfully developed a fuzzy inference engine, discrete component prototype, its reasoning speed is 15 million times / sec, so that China's breakthrough in fuzzy information processing through an important step. Presided over and completed the National Natural Science Foundation of China organized a major national projects: fuzzy information processing and fuzzy computing system. State Key Laboratory of fuzzy information processing and fuzzy computation system. 1985-89 was a part-time vice president of Guangzhou University. In 1988, the Ministry of personnel of the People's Republic of China awarded the title of "young and middle-aged experts with outstanding contributions", which was entitled to the special allowance issued by the state. He served as member of the seventh and eighth Beijing Municipal Committee of CPPCC and member of the Eighth National Committee of the cppcc. Candidates have been invited to the United States, Europe, Japan, Singapore and Hong Kong, Taiwan and other places to give lectures.
## Overview of Technical Program

<table>
<thead>
<tr>
<th>Time</th>
<th>October 25 Wednesday</th>
<th>October 26 Thursday</th>
<th>October 27 Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00-9:00</td>
<td>Registration (7:30-8:00 for early birds)</td>
<td>Registration</td>
<td>Registration</td>
</tr>
<tr>
<td>9:00-10:30</td>
<td>Plenary Session 0-a</td>
<td>ICIS2017 Opening Ceremony And Plenary Session 1</td>
<td>Plenary Session 3</td>
</tr>
<tr>
<td>10:30-11:00</td>
<td>Coffee Break</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11:00-12:30</td>
<td>Plenary Session 0-b</td>
<td>Plenary Session 2</td>
<td>Plenary Session 4 And ICIS2017 Close</td>
</tr>
<tr>
<td>12:30-14:00</td>
<td>Lunch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14:00-15:30</td>
<td>Session A0 Intelligent logistics</td>
<td>Session B0 Intelligent Transportation</td>
<td>Session C0 Retrospect &amp; Prospect of Intelligent Science</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15:30-16:00</td>
<td>Coffee Break</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16:00-17:30</td>
<td>Session A0 Intelligent logistics</td>
<td>Session B0 Intelligent Transportation</td>
<td>Session C0 Retrospect &amp; Prospect of Intelligent Science</td>
</tr>
<tr>
<td>18:00-20:00</td>
<td>Reception</td>
<td>Banquet</td>
<td></td>
</tr>
</tbody>
</table>
Technical Program

Wednesday October 25, 2017

8:00 – 17:00: Registration

9:00 – 10:30: Plenary Session 0-a
Place: Plenary hall
Chair: Zhongzhi Shi

Michael I. Jordan: Progress, Prospectives and Challenges in Machine Learning

10:30-11:00 Coffee Break

11:00-12:30: Plenary Session 0-b
Place: Plenary hall
Chair: Zhongzhi Shi

Jianwei Zhang: Experience-based Cross-modal Learning of Intelligent Robot Systems

12:00pm-14:00: Lunch Break

14:00pm–17:30pm: Parallel Sessions

Session A0: Intelligent logistics
Room: Plenary hall
Chair: Yongsheng Yang

Guibao Xu: National Strategic Plan on Logistics (Tentative)
Yongsheng Yang: Forward Trends in Smart Ports
Daofang Chang: Automated warehousing of third party logistics
Haiqing Yao: Internet of Things for Smart Ports: Technologies and Challenges

Session B0: Intelligent Transportation
Room: Chamber A
Chair: Zhaoying zhu

Hailin Chen: Driverless vehicles and future urban transit

Question and discussion

Session C0: Retrospect and Prospect of Intelligent Science
Room: Chamber B
Chair: Jiali Feng

Question and discussion

18:00 – 20:00: Reception
Room: Lobby (first floor)
Thursday October 26, 2017

8:00 – 17:00: Registration

9:00-9:30: ICIS2017 Opening Ceremony
Place: Plenary hall
Chair: Yongqing Hong

Addresses from honored guests
Group photo

9:30-10: 30 Plenary Session 1
Room: Plenary hall
Chair: Guoyin Wang

Mu-ming Poo: Pattern Recognition by the Brain: Neural Circuit
Andrzej Skowron: Interactive Granular Computing: Toward Computing Model for Turing Test

10:30-11:00 Coffee Break

11:00-12: 30 Plenary Session 2
Room: Plenary hall
Chair: Jiali Feng

Zhongzhi Shi: Learning and Memory in Mind Model CAM
Xin Yao: Multi-objective Ensemble Learning and Its Applications
Lai Xu: The Crazy Artificial Intelligence

12:30-14:00: Lunch Break

14:00– 17:30: Parallel Sessions

Session A1: Cognitive Computing
Room: Plenary hall
Chair: Rigui Zhou

1. A Case-based Approach for Modelling the Risk of Driver Fatigue
   Qiaoting Zhong and Guangnan Zhang
2. Gazes induce similar sequential effects as arrows in a target discrimination task
   Qian Qian, Xiaoting Wang, Miao Song, and Feng Wang
3. Discrete Cuckoo Search with Local Search for Max-cut Problem
   Yingying Xu,
4. A New Cuckoo Search
   Zhigang Lian, Lihua Lu, and Yangquan Chen
5. Resting state fMRI data classification method based on K-means algorithm optimized by Rough Set
   Xianzhe Li, Weiming Zeng, Yahu Shi, and Shaojun Huang
6. Improved CNN based on Super-pixel Segmentation
Yadong Yang and Xiaofeng Wang
7. Speaker Verification Channel Compensation based on DAE-RBM-PLDA
   Shuangyan Shan and Zhijing Xu

Session B1: Intelligent Information Processing
Room: Chamber A
Chair: Lizhuang MA

1. Channels’ Matching Algorithm for Mixture Models
   Chenguang Lu
2. Understanding: How to Resolve Ambiguity
   Shunpeng ZOU and Xiaohui ZOU
3. Exploration on Causal Law of Understanding and Fusion Linking of Natural Language
   Peihong Huang
4. Depression Tendency Recognition Model Based on College Student’s microblog Text
   Qiu Jie and GAO Junbo
5. A Two-Step Pedestrian Detection Algorithm based on RGB-D Data
   Qiming LI, Liging HU, Yaping GAO, Yimin CHEN, and Lizhuang MA
6. The Research of Attribute Granular Computing Model in Cognitive and Decision-making
   Ruqi Zhou and Yuepeng Zhou
7. HCI based on Gesture Recognition in an Augmented Reality System for Diagnosis Planning and Training
   Qiming LI, Chen HUANG, Zeyu LI, Yimin CHEN, and Lizhuang MA

Session C1: Intelligent Logistics
Room: Chamber B
Chair: Mingyu Lu

1. A Functional Model of AIS Data Fusion
   WANG Yongming and WU Lin
2. Using Convolutional Neural Network with Asymmetrical Kernels to Predict Speed of Elevated Highway
   Di Zang, Jiawei Ling, Jiujun Cheng, Keshuang Tang, and Xin Li
3. Ship Identification based on Ship Blade Noise
   Haitao Qi and Zhijing Xu
4. Online Shopping Recommendation with Bayesian Probabilistic Matrix Factorization
   Jinming Wu, Zhong Liu, Guangquan Cheng, Qi Wang, and Jincai Huang
5. Inferring and Analysis Drivers Violation Behavior through Trajectory
   Zouqing Cai, Wei Pei, Yongying Zhu, Mingyu Lu, and Lei Wu
6. Research of the Evaluation Index System of Green Port Based on Analysis Approach of Attribute Coordinate
   Xueyan DUAN, Xiaolin XU, and Jiali FENG
7. Two Stages Empty Containers Repositioning of Asia-Europe Shipping Routes under Revenue Maximization
   Hengzhen Zhang, Lihua Lu, and Xiaofeng Wang

15:30-16:00: Coffee Break

Session A2: Machine Perception
Room: Plenary hall
Chair: He Ouyang

1. Patch Image based LSMR Method for Moving Point Target Detection
Weina Zhou, Xinwei Lin, Zhijing Xu, and Xiangyang Xue

2. An Improved Image Transformation Network for Neural Style Transfer
   Qiu Hong-Xu and Huang Xiao-Xia

3. An Improved Algorithm for Redundant Readers Elimination in Dense RFID Networks
   Xin Zhang and Zhijing Yang

4. A Coding Efficiency Improvement Algorithm for Future Video Coding
   Xiantao Jiang, Xiaofeng Wang, Yadong Yang, Tian Song, Wen Shi, and Takafumi Katayama

5. Go Mapping Theory and Factor Space Theory Part I: An Outline
   He Ouyang

6. Transfer Learning for Music Genre Classification
   Guangxiao Song, Zhijie Wang, Fang Han, and Shenyi Ding

7. Entropy-based Support Matrix Machine
   Changming Zhu

Session B2: Intelligent Applications
Room: Chamber A
Chair: Zuqiang Meng

1. Traffic Parameters Prediction Using a Three-channel Convolutional Neural Network
   Di Zang, Dehai Wang, Jiajun Cheng, Keshuang Tang, and Xin Li

2. Speed Optimization of UAV Vehicle Tracking Algorithm
   Yanming Xu, Wei Pei, Yongying Zhu, Mingyu Lu, and Lei Wu

   Wu Zhengtao

4. Beam Bridge Health Monitoring Algorithm Based on Gray Correlation Analysis
   Jianguo Huang, Lang Sun, and Hu Meng

5. Designing an Optimal Water Quality Monitoring Network
   Xiaohui Zhu, Yong Yue, Yixin Zhang, Prudence W.H. Wong, and Jianhong Tan

6. A Composite Weight Based Access Network Selection Algorithm in Marine Internet
   Liang Zhou and Shengming Jiang

7. Power control in D2D network based on Game Theory
   Kai Zhang and Xuan Geng

Session C2: Big Data Analysis and Machine Learning
Room: Chamber B
Chair: Zhenxue Huang

1. Enlightening the Relationship between Distribution and Regression Fitting
   Hang Yu, Qian Yin, and Ping Guo

2. Application and Implementation of Batch File Transfer in Redis Storage
   Hu Meng, Yongsheng Pan, and Lang Sun

3. The Optimization Algorithm of Circle Stock Problem with Standard Usage Leftover
   Yan Chen, Qiqi Xie, Qiulin Chen, Li Zhang, Yaodong Cui, and Zuqian Meng

4. Weighting Features Before Applying Machine Learning Methods to Pulsar Search
   Dayang Wang, Qian Yin, and Hongfeng Wang

5. The effect of Expression Geometry and Facial Identity on the Expression Aftereffect
   Miao Song, Qian Qian, and Shinomori Keizo

6. Transfer Learning for Music Genre Classification
   Guangxiao Song, Zhijie Wang, Fang Han, and Shenyi Ding
Friday October 27, 2017

9:00-10:30 Plenary Session 3
Room: Plenary hall
Chair: Zhongzhi Shi

David Xianfeng Gu: Optimal Mass Transportation Theory Applied for Machine Learning
Jiali Feng: Entanglement of Inner Product, Topos Induced by Opposition and Transformation of Contradiction, and Tensor Flow
Guang-Bin Huang: Extreme Learning Machines (ELM) – Filling the Gap between Machine Learning and Biological Learning
Jianfeng Feng: Quantifying your Brain and Identifying Brain Disease Roots

10:30-11:00 Coffee Break

11:00-12:30: Plenary Session 4
Room: Plenary hall
Chair: Jiali Feng

Joshua Zhexue Huang: How can we effectively analyze big data in terabytes or even petabytes?
Elizabeth Marie Ehlers: On Intelligence: Symbiotic, Holonic, and Immunological Agents
Gan Pang: Cyborg Intelligent Systems
Peizhuang Wang: Factor Space and Artificial Intelligence

ICIS2017 Close

12:30-14:00: Lunch Break

14:00–17:30: Tour to intelligent unmanned pier of Yangshan Port