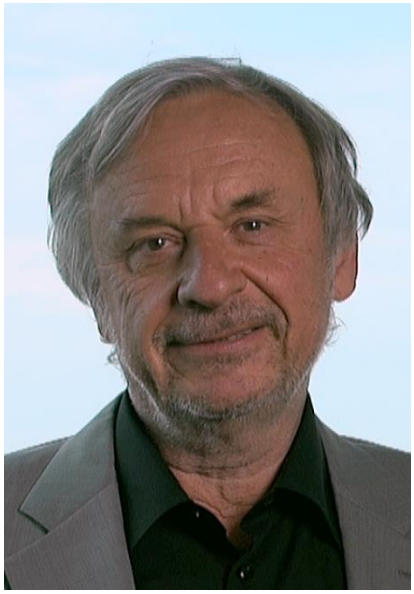
Keynote and Invited Speakers



Keynote Speaker 1: Emeritus Professor Zbigniew Michalewicz, Chief Scientist of Complexica, Australia

Increasing Revenue, Margin, and Customer Engagement through Automated Analytics

Abstract: The talk is on business applications for transforming data into decisions, based on work done for 3 companies (NuTech Solutions, SolveIT Software, and Complexica) over the last 16 years. A few general concepts would be discussed, illustrated by a few examples - from NuTech, from SolveIT, and from Complexica. The final set of examples would illustrate Complexica's approach for increasing revenue, margin, and customer engagement through automated analytics.

Bio: Zbigniew Michalewicz is the Chief Scientist of Complexica, an Artificial Intelligence software company that helps large organisations sell more products and services, at a higher margin, through the use of automated analytics. He is also Emeritus Professor at the School of Computer Science, University of Adelaide, and holds Professor positions at the Institute of Computer Science, Polish Academy of Sciences, and the Polish-Japanese Academy of Information Technology, as well as an honorary Professor position at the State Key Laboratory of Software Engineering of Wuhan University, China. He is associated with the Structural Complexity Laboratory at Seoul National University, South Korea, too. In December 2013, he was awarded by the President of Poland, Mr. Bronislaw Komorowski, the Order of the Rebirth of Polish Polonia Restituta - the second highest Polish state decoration for a civilian (after the Order of the White Eagle) - for outstanding achievements in the fields of education, science, sports, culture, arts, economy, national defence, social activities, the civil service and development of good relations with other countries.

For many years, his research interests were in the field of evolutionary computation. He published several books, including a monograph *Genetic Algorithms + Data Structures = Evolution Programs* (3 editions; a few translations; over 18,300 citations, source: Google Scholar), and over 250 technical papers in journals and conference proceedings that have been cited widely (over 40,000 citations, source: Google Scholar). He was one of the Editors-in-Chief of the *Handbook of Evolutionary Computation* and the General Chair of the first IEEE International Conference on Evolutionary Computation held in Orlando, June 1994.

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Zbigniew Michalewicz has over 35 years of academic and industry experiences, and possesses expert knowledge of numerous Artificial Intelligence technologies. He was the co-Founder and Chief Scientist of NuTech Solutions, which was acquired by Netezza and subsequently by IBM, and the co-Founder and Chief Scientist of SolveIT Software, which was acquired by Schneider Electric after becoming the 3rd fastest growing company in Australia. Both companies grew to approximately 200 employees before they were being acquired.

During his time in the corporate world, Professor Michalewicz led numerous large-scale predictive analytics and optimisation projects for major corporations, including Ford Motor, BHP Billiton, U.S. Department of Defence, and Bank of America. Professor Michalewicz also served as the Chair of the Technical Committee on Evolutionary Computation, and later as the Executive Vice President of IEEE Neural Network Council.

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Keynote Speaker 2: Professor Yew Soon Ong, Chair of Computer Science and Engineering, Nanyang Technological University, Singapore

Can we have a *Smarter Search*, maybe one that learns?

Abstract: Optimization problems are widespread in science and engineering. A significantly under-explored area of optimization search in the literature is the study of methodologies that can evolve or learn along with the problems solved. Particularly, present evolutionary optimization approaches generally start their search from scratch or the ground-zero state of knowledge, independent of how similar the given new problem of interest is to those solved/optimized previously. There has thus been the apparent lack of automated knowledge transfer and reuse across problems. Taking this cue, this talk begins with some insights to memetic computation for smarter search, one that is modelled after how humans solve problems and embark on a study towards intelligent evolutionary optimization of problems through the transfer of structured knowledge in the form of memes as building blocks learned from previous problem solving experiences, to enhance future evolutionary searches.

Further, we take a peek into the new paradigm of multitask optimization, firstly introduced in the IEEE Transactions on Evolutionary Computation journal. It was noted that traditional methods for optimization, including the population-based search algorithms of Evolutionary Computation, have generally been focused on efficiently solving only a single optimization task at a time. It is only very recently that Multifactorial Optimization (MFO) has been developed to explore the potential for evolutionary multitasking. MFO is found to leverage the scope for implicit genetic transfer across problems in a simple and elegant manner, thereby opening doors to a plethora of new research opportunities in multitask optimization, dealing in particular with the exploitation of underlying synergies between seemingly distinct tasks. Last but not least, some real world applications of evolutionary multitasking are showcased.

Bio: Yew-Soon Ong is Chair of the School of Computer Science and Engineering at Nanyang Technological University (NTU), Singapore. He served as Director of the Computational Intelligence Research Centre from 2008 to 2015. He is currently a Director of the A*Star SIMTECH-NTU Joint Lab on Complex Systems. He is also a Principal Investigator of the Data Analytics & Complex Systems Programme in the NTU-Rolls Royce Corporate Laboratory. He received his Bachelor and Master's

degrees from NTU, and obtained his PhD degree on Artificial Intelligence in Complex Design from the Computational Engineering and Design Centre at the University of Southampton, United Kingdom.

His research focuses on computational intelligence (CI), particularly on evolutionary, memetic computation and machine learning. He is known for his research and development of new concepts and novel solutions and applications in memetic computation, which mimics biological evolution and cultural evolution (or learning). He founded the Task Force on Memetic Computing under the IEEE Computational Intelligence Society's Emergent Technology Technical Committee, and served as its Chair from 2007 to 2010. In 2009, he also co-founded the Memetic Computing journal and has been serving as its Technical Editor-in-Chief since. His work on memetic computation has been well received and he has delivered many keynote, plenary or invited talks at international conferences, workshops and research institutions worldwide. He was featured for his research work in memetic computation by the Thomson Scientific's Essential Science Indicators as one of the most cited new areas of research in August 2007. He also received the 2015 IEEE Computational Intelligence Magazine Outstanding Paper Award and the 2012 IEEE Transactions on Evolutionary Computation Outstanding Paper Award for his work pertaining to Memetic Computing. He is also Founding Chief Editor of the Springer book series on Studies in Adaptation, Learning, and Optimization, and Associate Editor of many journals including the IEEE Transactions on Evolutionary Computation, IEEE Transactions on Neural Networks & Learning Systems, IEEE Computational Intelligence Magazine, IEEE Transactions on Cybernetics, IEEE Transactions on Big Data, and others. He has filed several patents and innovative achievements in the area of computational intelligence. His research results have generated considerable commercialisation impact and led to new start-ups. Dark-Dots, a CI enabled iOS game that tops the charts in 48 countries including the USA, China and Singapore, was downloaded by well over 448,000 players worldwide when it was launched, with 27% of its players from China and 17% from the USA.

At the IEEE Computational Intelligence Society, he chaired the Intelligent Systems Applications Technical Committee from 2013-2014 and the Emergent Technology Technical Committee from 2011-2012. He also participates actively in the organization of international conferences. He has served as General co-Chair of the 18th Asia Pacific Symposium of Intelligent and Evolutionary Systems (2014), Program co-Chair of the 9th International Conference on Simulated Evolution and Learning (2012), General co-Chair of the International Conference on Systems-Biology and Bioinformatics (2010 & 2011), and as a local advisor of the Asian Conference on Machine Learning (2012). He has also served as Track Chair of the ACM Genetic and Evolutionary Computation Conference from 2011- 2014. Presently, he is Conference Chair of the 2016 IEEE Congress on Evolutionary Computation to be held in Vancouver, Canada, this July, and serves as Secretary of the IEEE Transactions on Computational Intelligence and AI in Games steering committee.

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Invited Speaker 1: Dr Haris Aziz, Data61/NICTA, Australia

Strategy-Proof Peer Selection

Abstract: We study an important crowdsourcing setting where agents evaluate one another and, based on these evaluations, a subset of agents are selected. This setting is ubiquitous when peer review is used for distributing awards in a team, allocating funding to scientists, and selecting publications for conferences. The fundamental challenge when applying crowdsourcing in these settings is that agents may misreport their reviews of others to increase their chances of being selected. We propose a new strategy-proof (impartial) mechanism that satisfies desirable axiomatic properties. We then show, using a detailed experiment with parameter values derived from target real world domains, that our mechanism performs better on average, and in the worst case, than other strategy-proof mechanisms in the literature. Our mechanism employs a randomized rounding technique that is of independent interest, as it solves the apportionment problem that arises in various settings where discrete resources such as parliamentary representation slots need to be divided proportionally.

Bio: Haris Aziz is a senior researcher at Data61 (combining NICTA and CSIRO's Digital Productivity business unit) and a conjoint senior lecturer at the University of New South Wales, Sydney. He is also an invited Fellow of the Centre for Policy and Market Design, University of Technology Sydney, and was an invited professor at University Paris Dauphine. He completed his PhD from the University of Warwick, MSc from the University of Oxford, and BSc (Honours) from Lahore University of Management Sciences. He undertook his postdoctoral research at Ludwig Maximilian University of Munich and Technical University of Munich in Germany.

Haris' research interests lie at the intersection of artificial intelligence (AI) and economics – especially computational social choice and algorithmic game theory. In 2015, he was selected by the Institute of Electrical and Electronics Engineers (IEEE) as one of AI's 10 to Watch. Haris has published at computer science venues (such as AAAI, AAMAS, AIJ, IJCAI, JAIR, STOC), economics venues (Games and Economic Behavior, Economics Letters, Economic Theory Bulletin, Journal of Mathematical Economics, and Social Choice & Welfare), as well as the primary venues being the intersection of the two fields (such as ACM EC, SAGT, and WINE). He has served as Program Committee/Senior Program Committee members of conferences including ACM EC, AAAI, AAMAS, IJCAI and COMSOC, and was the co-chair of workshops CoopMAS 2013 and Explore 2015-2016.

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Invited Speaker 2: Professor Hisao Ishibuchi, Osaka Prefecture University, Japan

Evolutionary Many-Objective Optimization: Difficulties and Future Research Directions

Abstract: Recently, evolutionary many-objective optimization has been one of the most active research areas in the field of evolutionary computation. It has been repeatedly pointed out that the main stream research framework in the evolutionary multi-objective optimization (EMO) community does not work well on many-objective problems. When an EMO algorithm is applied to a many-objective problem, almost all individuals in a population (i.e., candidate solutions) become non-dominated in a very early stage of the evolutionary process (e.g., within 10 generations). In this situation, Pareto dominance-based fitness evaluation cannot generate strong selection pressure to efficiently drive the population toward the Pareto front. The use of a hypervolume (HV) indicator for performance comparison is also difficult due to its huge computation load for the large solution set of a many-objective problem (e.g., a set of 500 solutions with 15 objectives). A number of approaches to many-objective optimizations have been proposed in the literature. The current trend is the use of uniformly-distributed normalized weight vectors to generate reference lines (i.e., search directions) for many-objective optimization together with the inverted generational distance (IGD) indicator for performance comparison. We will discuss difficulties in performance comparison of evolutionary many-objective algorithms from the following viewpoints: (1) Population size specification for fair comparison and solution selection, (2) Pareto incompliant comparison results by the IGD indicator, (3) Special characteristics of frequently-used well-known many-objective test problems, (4) Dependency of high performance of the weight vector-based EMO algorithms on the special characteristics of the many-objective test problems. Our discussions will suggest some future research directions, especially, the necessity of a wide variety of many-objective test problems and an adaptation mechanism of weight vectors with high flexibility.

Bio: Hisao Ishibuchi received the BS and MS degrees from Kyoto University in 1985 and 1987, respectively. In 1992, he received the PhD degree from Osaka Prefecture University, where he has been a full professor since 1999. He received Best Paper Awards from GECCO 2004, HIS-NCEI 2006, FUZZ-IEEE 2009, WAC 2010, SCIS & ISIS 2010, FUZZ-IEEE 2011 and ACIIDS 2015. He also received a 2007 JSPS prize. He was the IEEE CIS Vice-President for Technical Activities (2010-2013), the General Chair of ICMLA 2011, the Program Chair of IEEE CEC 2010 and IES 2014, and a Program/Technical Co-

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Chair of FUZZ-IEEE 2006, 2011-2013, 2015 and IEEE CEC 2013-2014, 2018. Currently, he is the Editor-in-Chief of IEEE CI Magazine (2014-2017), an IEEE CIS AdCom member (2014-2016), and an IEEE CIS Distinguished Lecturer (2015-2017). He is also an Associate Editor of IEEE TEVC (2007-2016), IEEE Access (2013-2016) and IEEE TCyb (2013-2016). He is an IEEE Fellow. His research interests include fuzzy rule-based classifier design, evolutionary multi-objective and many-objective optimization, and evolutionary games. According to Google Scholar, the total number of citations of his publications is about 18,000 and his h-index is 59 (April 2016).

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Invited Speaker 3: Associate Professor Eugene Ch'ng, The University of Nottingham (Ningbo Campus), China

Crowd Behaviour Mining with Virtual Environments

Abstract: Virtual Reality is fundamentally an 'output' technology. In whichever tasks and domains where it is used, users receive digital outputs in the form of representations of abstract, or real-world objects so that they might be informed, or be trained in domain-specific tasks. 3D virtual environments used in computer games, on the other hand, has an additional element of 'input', where users directly contribute to the building of their world, with the subsequent evolution of the information landscape over time. Rarely do we see a third strand of work in virtual environment research where crowd intelligence or latent behaviours are being harvested, and merged with the context of the environment for solving real-world problems. This talk is based on the recent MIT Press' *Presence* invited article "Crowd Behaviour Mining with Virtual Environments". The talk posits the new topic within the "reality-virtuality continuum" and its relation to the concept of presence. It covers two recent Royal Society "Behaviour Mining" case studies involving two large EU grants, and thus, grounding the new concept within real-world data-driven interdisciplinary research.

Bio: Eugene Ch'ng graduated from the Department of Electronics, Electrical and Computer Engineering, University of Birmingham, UK, in 2007. He is presently an Associate Professor in Computer Science and Deputy Director for the International Doctoral Innovation Centre (IDIC) at the University of Nottingham's China campus. He pioneered and directs the Big Data and Visual Analytics Lab at Nottingham's China campus, which works with large e-commerce companies and technology corporations.

Eugene is an associate scientist for Nvidia Technology Centre in Singapore, and has a joint lab with Nvidia in Mixed Reality: Visualisation and AI (MRVAI) at the University of Nottingham's China campus. He has previously served as Director of Innovations at the IBM Visual and Spatial Technology Centre and the £3.5m Digital Humanities Hub, both at the University of Birmingham where he led a research team in the development and application of cutting-edge interface technologies for heritage and culture. His research has an overarching theme in complex systems science related to the reconstruction and modelling of terrestrial, social, political and virtual landscapes. These topics naturally involve the collection and generation of massive multimodal and longitudinal datasets and therefore the need for Big Data research. Eugene's particular interest is in

the scalability of data-mining and machine learning approaches applied in the study of societal phenomena, such as within social media and social networks. Eugene has over 20 years of experience and expertise in data-driven virtual reality, enhanced virtual environments and multi-agent systems that model and understand past and contemporary human behaviour. He has completed many VR-related research projects in defense, architecture, education and heritage.

Eugene is also actively involved in editorial boards, technical and program committees in international journals and conferences in his field. He has been invited to the Royal Society Summer Science Exhibition twice, and has appeared in National Geographic Television, Channel Four's Time Team Special, Nature, Scientific American and other media channels. He is a council member of the Complex Systems Society, and an associate editor for MIT Press' Presence: Teleoperators and Virtual Environments. His has led many grants to completion as PI, one of which is from The Leverhulme Trust. His two recent grants as Co-PI are the ERC "Lost Frontiers" Advanced Research Grant and the AHRC "Curious Travellers" project. Eugene was awarded the prestigious Ningbo Municipal Individual 3315 Talents award in 2015.

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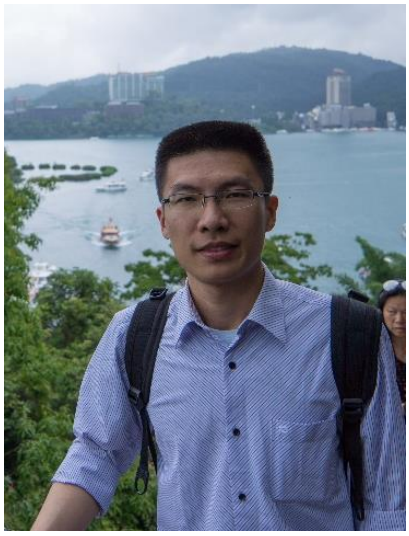

Invited Speaker 4: Professor Rui Zhang, Xiamen University of Technology, China

Energy-Efficient Production Scheduling for Job Shops

Abstract: In recent years, there has been a growing concern over the environmental impact of traditional manufacturing, especially in terms of energy consumption and related emissions of carbon dioxide. Besides the adoption of new equipment, production scheduling could play a key role in reducing the total energy consumption of a manufacturing plant. In this talk, we will introduce a way to incorporate the objective of minimizing energy consumption into a typical production scheduling model, i.e., the job shop scheduling problem, based on a machine speed scaling framework. To solve this bi-objective optimization problem, we propose a multi-objective genetic algorithm combined with two problem-specific local improvement strategies. These local improvement procedures aim to enhance solution quality by utilizing the mathematical models of two restricted subproblems derived from the original problem. We will discuss our results from comprehensive computational experiments for verifying the effectiveness of the proposed solution approach. The work presented here may shed light on future research related to energy-efficient production scheduling.

Bio: Rui Zhang received his B.S., M.S., and Ph.D. degrees from the Department of Automation, Tsinghua University, Beijing, China. He is currently a Professor with the School of Economics and Management, Xiamen University of Technology, Xiamen, China. His research interest focuses on the scheduling of complex production systems with computational intelligence-based methods. He has published in various journals in the field, such as the Journal of Cleaner Production, International Journal of Production Research, International Journal of Production Economics and European Journal of Operational Research. One of his papers received the Emerald Citations of Excellence Award in 2016. He is a member of the Editorial Review Board for Production and Operations Management since 2015. He has served as the Managing Guest Editor for a special issue entitled “Sustainable Scheduling of Manufacturing and Transportation Systems” published in the European Journal of Operational Research in 2016.

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Invited Speaker 5: ARC Future Fellow Professor Pablo Moscato, The University of Newcastle, Australia

Evolutionary Computation, Memetic Algorithms and Data Science: Opportunities, Challenges and Duties

Abstract: Data Scientists are in high demand and, as a profession, it has been declared "The Sexiest Job of the 21st Century". Before you embrace it as a new destination of your education or research endeavours a reasonable question you should ask first: "*What is Data Science?*"

This talk will give a perspective forged in almost three decades of experience with problems that involve the combined application of machine learning techniques and evolutionary computation methods (in particular those from memetic computing). We will refer to previous work in the areas of bioinformatics, business and customer analytics, and combinatorial optimisation problems arising in a variety of domains with emphasis in the most challenging applications.

We will address the central question and how this new interdisciplinary agenda brings more opportunities but also many challenges to practitioners of evolutionary computation.

Bio: Pablo Moscato is an Australian Research Council Future Fellow and Professor of Computer Science at The University of Newcastle. At the California Institute of Technology (1988-89), he developed a methodology called "memetic algorithms", which is now widely used around the world in artificial intelligence, data science, and business and consumer analytics. Pablo was Founding Director of both the Priority Research Centres for Bioinformatics, Biomarker Discovery and Information-based Medicine (2007-2015) and the Newcastle Bioinformatics Initiative (2002-2006). His expertise in data science was then essential for a large number of applied projects.

Pablo has been working in applied mathematics for 30 years, and in heuristic methods for operations research problems since 1985. Also at Caltech, he introduced the idea of deterministic update in Simulated Annealing in 1990 (Physics Letters A, 146 (4), 204-208). He is responsible for the introduction of Evolutionary Attack of Algorithms too (Applied Mathematics Letters, 16 (1), 41-47), and used it against the world's best exact algorithm for the Traveling Salesman Problem (see Lecture Notes in Computer Science, vol. 6624, pp. 1-11, 2011).

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His work and ideas have been highly influential in a large number of scientific and technological fields, and his publications have been highly cited. The journal “Memetic Computing” is largely dedicated to a methodology he championed (memetic algorithms). Nearly every 24 hours a new published paper brings a novel application of these techniques. Due to this work and his other contributions in the areas of classification and machine learning, Pablo is now well-respected around the world and he has become one of Australia’s most cited computer scientists.