

SSCI 2018 Special Session Proposal

Special Session on “Data-Driven Evolutionary Optimization of Computationally Expensive Problems”

Organizers:

Chaoli Sun

Department of Computer Science and Technology, Taiyuan University of Science and Technology
Taiyuan, Shanxi 030024 China

chaoli.sun.cn@gmail.com, chaoli.sun@tyust.edu.cn

http://www.dscil.cn/people/sun_en.html

Jonathan Fieldsend

Department of Computer Science, University of Exeter
Exeter, Devon EX4, UK

J.E.Fieldsend@exeter.ac.uk

<http://emps.exeter.ac.uk/computer-science/staff/jefields>

Yew-Soon Ong

School of Computer Engineering,
Nanyang Technological University
Block N4, 2a-28, Nanyang Avenue, Singapore 639798

ASYSOng@ntu.edu.sg

<http://www.ntu.edu.sg/home/asysong/>

Handing Wang

Department of Computer Science, University of Surrey
Guildford, GU27XH, UK

handing.wang@surrey.ac.uk

<https://sites.google.com/site/handingwanghomepage/>

Aim and Scope

Meta-heuristic algorithms, including evolutionary algorithms and swarm optimization, face challenges when solving time-consuming problems, as typically these approaches require thousands of function evaluations to arrive at solutions that are of reasonable quality. Surrogate models, which are computationally cheap, have in recent years gained in popularity in assisting meta-heuristic optimization, by replacing the compute-expense/time-expensive problem during phases of the heuristic search. However, due to the curse of dimensionality, it is very difficult, if not impossible to train accurate surrogate models. Thus, appropriate model management techniques, memetic strategies and other schemes are often indispensable. In addition, modern data analytics involving advance sampling techniques and learning techniques such as semi-supervised learning, transfer learning and active learning are highly beneficial for speeding up evolutionary search while bringing new insights into the problems of interest. This special session

aims at bringing together researchers from both academia and industry to explore future directions in this field.

The topics of this special session include but are not limited to the following topics:

- Surrogate-assisted evolutionary optimization for computationally expensive problems
- Adaptive sampling using machine learning and statistical techniques
- Surrogate model management in evolutionary optimization
- Data-driven optimization using big data and data analytics
- Knowledge acquisition from data and reuse for evolutionary optimization
- Computationally efficient evolutionary algorithms for large scale and/or many-objective optimization problems
- Real world applications including multidisciplinary optimization

Potential Contributors:

- Chaoli Sun, Taiyuan University of Science and Technology, China, chaoli.sun.cn@gmail.com
- KarthikSindhya, University of Jyvaskyla, Finland, karthik.sindhya@jyu.fi
- Rommel G. Regis, Saint Joseph's University, Philadelphia PA, rregis@sju.edu
- Bo Liu, Glyndwr University, UK, b.liu@glyndwr.ac.uk
- Tapabrata Ray, The University of New South Wales, Australia, t.ray@adfa.edu.au
- Xuhua Shi, Ningbo University, China, shixuhua@nbu.edu.cn
- Handing Wang, University of Surrey, UK, h.wang@surrey.ac.uk
- Xingyi Zhang, Anhui University, China, xyzhanghust@gmail.com
- Jie Tian, Taiyuan University of Science and Technology, China, tianjie918@163.com
- Tinkle Chugh, University of Jyvaskyla, Finland, tinkle.t.chugh@jyu.fi
- Jakob Bossek, University of Munster, Germany, bossek@wi.uni-muenster.de
- Ivo Couckuyt, Ghent University, Belgium, ivo.couckuyt@ugent.be
- Rodolphe Le Riche, CNRS and Ecole des Mines de Saint Etienne, France, leriche@emse.fr
- Ilya Loshchilov, University of Freiburg, Germany, ilya.loshchilov@gmail.com
- Nobuo Namura, Tohoku University, Japan, namura@edge.ifs.tohoku.ac.jp
- Victor Picheny, INRA, France, Victor.Picheny@toulouse.inra.fr
- Alma Rahat, University of Exeter, UK, aamr202@exeter.ac.uk
- Bas van Stein, LIACS, Netherlands, bas9112@gmail.com
- Simon Wessing, TU Dortmund, Germany, simon.wessing@tu-dortmund.de
- Saul Zapotecas-martinez, SHINSHU University, Japan, saul.zapotecas@gmail.com
- Kheng Cheng Wai, University Tunku Abdul Rahman, khengcw@utar.edu.my
- Hemant Singh, The University of New South Wales, h.singh@adfa.edu.au
- Michael T.M. Emmerich, Leiden University, m.t.m.emmerich@liacs.leidenuniv.nl
- Yaochu Jin, University of Surrey, yaochu.jin@surrey.ac.uk

Short Biography of the Organizers

Chaoli Sun

Department of Computer Science and Technology, Taiyuan University of Science and Technology
Taiyuan, Shanxi 030024 China

chaoli.sun.cn@gmail.com, chaoli.sun@tyust.edu.cn

http://www.dscil.cn/people/sun_en.html

Dr. Chaoli Sun received her B.C. and M.S. degrees in Computer Application Technology from Hohai University, Nanjing, Jiangsu, China, and Ph.D. in Mechanical Design and Theory from Taiyuan University of Science and Technology, Taiyuan, Shanxi, China, in 2011. From September 2014 to September 2016, she was a Postdoctoral Research Fellow in Department of Computer science, University of Surrey. Now she is a Professor in the Department of Computer Science and Technology, Taiyuan University of Science and Technology. Her areas of expertise include evolutionary computation, swarm intelligence, self-organized robotic systems, fitness estimation and surrogate assisted evolutionary optimization with application to mechanical structural optimization.

Prof. Sun is an Editorial Board Member of the *Soft Computing* Journal and an Editorial Board Member of *Complex and Intelligence Systems*. She is a member of the Emergent Technologies Technical Committee of IEEE CIS, a member of the Evolutionary Computation Technical Committee of IEEE CIS and a member of the Intelligent Systems Application Technical Committee of IEEE CIS. She is also the chair of TF on Data-Driven Evolutionary Optimization of Expensive Problems, and a member of TF on Emerging Technologies in Operations Research and Management Sciences. She published a monograph on Swarm Intelligence for Mechanical Design, and more than 20 first-author papers in international journals and conferences.

Jonathan Fieldsend

Department of Computer Science, University of Exeter
Exeter, Devon EX4, UK

J.E.Fieldsend@exeter.ac.uk

<http://emps.exeter.ac.uk/computer-science/staff/jefields>

Jonathan Fieldsend graduated with a BA in Economics from the University of Durham in 1998, a M.Sc. in Computational Intelligence from the University of Plymouth in 1999 and a Ph.D. in Computer Science from the University of Exeter in 2003. He is currently Associate Professor in Computational Intelligence at the University of Exeter. His research interests, spanning theory to application, include multi-objective and multi-modal optimization methods, optimization with uncertainty, surrogate-assisted optimization, evolutionary approaches to learning, data visualization, data structures for optimizers, and the use of Bayesian classification/modeling techniques. He has extensive experience collaborating with industry and engineers on expensive optimization problems, from tuning short-term conflict alert systems in air traffic control through to lightweight design optimization and CFD. His funded research includes collaborations with the Met Office, NATS, AI corp, IMC Group, QinetiQ and Ricardo. He has published over 70 papers in international journals and conferences, and was the recipient of Best Paper Awards at GECCO 2014, GECCO 2013, and IPSI 2006. His work on multi-swarm multi-modal optimization won the 2015 IEEE CEC Competition on Niching Methods for Multimodal Optimization. He is a member of the IEEE, the IEEE Computational Intelligence Society, the BCS, the ACM Special Interest Group on Genetic and Evolutionary Computation and a Fellow of the Higher Education Academy, and sits on the South-West committee of the BCS.

Yew-Soon Ong

School of Computer Science and Engineering,
Nanyang Technological University
N4-02a-20, Nanyang Avenue, Singapore 639798

ASYSOng@ntu.edu.sg

<http://www.ntu.edu.sg/home/asysong/>

Yew-Soon Ong is Professor and Chair of the School of Computer Science and Engineering, Nanyang Technological University, Singapore. He is Director of the A*Star SIMTECH-NTU Joint Lab on Complex Systems and Programme Principal Investigator of the Data Analytics & Complex System Programme in the Rolls-Royce@NTU Corporate Lab. He received his Bachelors and Masters degrees in Electrical and Electronics Engineering from Nanyang Technological University and subsequently his PhD from University of Southampton, UK.

He is founding Editor-In-Chief of the IEEE Transactions on Emerging Topics in Computational Intelligence, founding Technical Editor-In-Chief of Memetic Computing Journal (Springer), Associate Editor of IEEE Computational Intelligence Magazine, IEEE Transactions on Evolutionary Computation, IEEE Transactions on Neural Network & Learning Systems, IEEE Transactions on Cybernetics, IEEE Transactions on Big Data, International Journal of Systems Science, Soft Computing Journal, and chief editor of Book Series on Studies in Adaptation, Learning, and Optimization as well as Proceedings in Adaptation, Learning, and Optimization.

His current research interests include computational intelligence spanning memetic computing, evolutionary optimization using approximation/surrogate/meta-models, complex design optimization, intelligent agents in game, and Big Data Analytics. His research has advanced the academic standing of evolutionary computation, earning him the recognition of a Thomson Reuters Highly Cited Researcher for two consecutive years (2015 and 2016) and a position among the World's Most-Influential-Scientific Minds. He 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 Computation. He is a fellow of the IEEE.

Handing Wang

Department of Computer Science, University of Surrey
Guildford, GU27XH, UK

handing.wang@surrey.ac.uk

<https://sites.google.com/site/handingwanghomepage/>

Dr. Handing Wang received her B.Eng. and Ph.D. degrees from Xidian University, Xi'an, China, in 2010 and 2015, respectively. She is currently a research fellow with the Department of Computer Science, University of Surrey, UK. Her areas of expertise include multi-objective optimization, multiple criteria decision making, and surrogate-assisted evolutionary optimization.

Dr. Wang is an Editorial Board Member of the Springer journal "Complex & Intelligent Systems". She is the vice chair of webinar committee of IEEE CIS. She is also the chair of TF on Intelligence Systems for Health in the Intelligent Systems Application Technical Committee of IEEE CIS. She published more than 20 papers in international journals and conferences. She has applied the data-driven optimization algorithm to Scotland trauma system, where the emergence records of the one year in Scotland rather than geographic information is used for searching the optimal system on both clinical and economical outputs. The experimental results give the British government a fundamental reference to design the system. Due to the successful research output, a further research on "Modelling and optimizing complex aeromedical retrieval systems: a pilot study" is funded by NHS Endowment Research Grant.