2023 IEEE CIS Summer School on Computational Intelligence

22 -25 July 2023, Zhengzhou, China

Media:

http://www5.zzu.edu.cn/cilab/info/1005/1738.htm

http://www5.zzu.edu.cn/eie/info/1045/4077.htm

Organizing Committee:

Chair: Prof. Jing Liang

Committee members: Ying Bi, Ke Chen, Weifeng Guo, Junjun Li, Yuefeng Liao, Quan Sui, Yu Yan, Duo Yang, Kunjie Yu, Mingyuan Yu, Caitong Yue, Zhong Zhang

Overview:

2023 IEEE CIS summer school on computational intelligence was a four-day short-term lecture/talk organized by the Computational Intelligence Lab at the School of Electronic and Information Engineering in Zhengzhou University, China from 22 July to 25 July. The summer school has been organized in a completely physical mode.

In this summer school, nine well-known researchers in the field of computational intelligence were invited to deliver lectures/talks to attendees. They are Prof. Yaochu Jin, Prof. Mengjie Zhang, Prof. Qingfu Zhang, Prof. Hisao Ishibuchi, Prof. Bing Xue, Prof. Ke Tang, Prof. Carlos A. Coello Coello, Prof. Ponnuthurai Nagaratnam Suganthan. Except for Prof. Carlos A. Coello Coello, who was not able to present in person, the remaining eight speakers came to Zhengzhou and delivered the lectures/talks in person. All of the nine speakers provide two-hour lectures/talks, which are very informative and insightful. In addition, there are eight half-hour seminars to introduce recent research related to the lab of the host.

In total, there are more than 300 attendees from over 90 different universities and research institutes for this summer school. They came from different areas of China, such as Shenzhen, Dalian, Beijing, Lanzhou, Wuhan, Xian, Shanxi, Nanjing, etc. They are mostly master and PhD students, while a few are professors/associated professors, lecturers, and young researchers. Overall, it was a very successful event.

The IEEE CIS summer school on CI provided an exciting opportunity for young and junior researchers and graduates/postgraduates to deepen their knowledge and skills in computational intelligence and related areas. By participating in this immersive learning experience, it is expected for them to gain the skills, knowledge, and confidence needed to become good researchers and leader in this field.

Objectives:

Artificial intelligence (AI) is one of the hottest research areas nowadays and have made significant changes to our life. Under the big umbrella of AI, computational intelligence is an important topic that is increasingly becoming popular. computational intelligence includes a large number of advanced algorithms and techniques that have a great potential to solve many real-world complex problems. In recent years, computational intelligence is a key driver of innovation and progress in many fields.

The overall goal of organizing the IEEE computational intelligence society (CIS) Summer School is to popularize the computational intelligence topic in China, attract more younger researchers to join this big family, and finally contribute to its development. There are three main objectives of organizing this summer school as follows.

- Providing a good platform for world-class international researchers to deliver public lectures, courses/talks about their key research frontiers, challenges and future directions of computational intelligence;
- Providing a good chance for young/junior researchers and graduates/postgraduates to learn advanced computational intelligence techniques, research frontiers and skills;
- Providing a good opportunity for networking among senior and junior researchers, which is expected to encourage more communications and future collaborations in computational intelligence.

Therefore, the IEEE CIS summer school on computational intelligence aims to attract young researchers and graduates/postgraduates who are interested in computational intelligence and its related areas over the world to attend. Particularly, it aims to attract more attendees from China to join the summer school, where we have a large number of researchers and graduates in the computational intelligence community. Through this summer school, participants will have the opportunity to learn from well-known researchers in the field of computational intelligence stay up-to-date with the latest developments and trends, and gain practical skills and methods that they can apply to their research. Furthermore, the summer school will foster a collaborative environment that encourages participants to share their ideas and learn from their peers. Through this, participants can develop a deeper understanding of CI and develop the skills they need to become innovators in the field.

Important Dates:

- Registration Opens on 15 June
- Registration Deadline 15 July
- Summer School Date 22 July -25 July

Registration Statistics:

- Total Number of Registration. Over 300
- Number of Registration from Other Institutes 282

- Number of Student Participants (postgraduates) 206
- Number of Faculty Participants 73
- Number of Industrial/Research Institute Participants 4
- Number of Different Institutions of Participants 95

Program Schedule:

Venue: School of Electrical and Information Engineering, Zhengzhou University, China.
Host University: Zhengzhou University
Dates: 22-25 July 2023
Duration: 4 days

21 July: Registration（Jinqiao Hotel）		
22 July		
9:00–9:30	Opening ceremony	Zhengzhou University
9:30–11:30	Lecture/talk: Evolutionary Machine Learning: Research, Applications, Challenges and Main Lessons Speaker: Prof. Mengjie Zhang	
14:00–16:00	Lecture/talk: Secure and Federated Data-Driven Optimization Speaker: Prof. Yaochu Jin	
16:30–18:30	Seminar: Introduction to the Computation Intelligence Lab Seminar: Introduction to Multimodel Multiobjective Optimization Seminar: Introuction to Constrained Multiobjective Optimisation Seminar: Evolutionary Computation for Medical Applications	
23 July		
9:30–11:30	Lecture/talk: Evolutionary Computation for Feature Selection and Feature Construction Speaker: Prof. Bing Xue	Zhengzhou University
14:00–16:00	Lecture/talk: Learning to Optimize Speaker: Prof. Ke Tang	

16:30–18:30	Seminar: Genetic Programming and its Applications to Image Classification Seminar: Knowledge-Guided Evolutionary Computation for Feature Selection Seminar: Surrogate-Assisted Evolutionary Computation for Expensive Optimization Problems Seminar 4: Demonstration of Benchmarking Test Suites	
24 July		
9:30–11:30	Lecture/talk: New Algorithm Frameworks of Multi-Objective Evolutionary Algorithms Speaker: Prof. Hisao Ishibuch	Zhengzhou University
14:00–16:00	Lecture/talk: Some Challenges in Evolutionary Multi-Objective Optimization Speaker: Prof. Carlos A. Coello Coello	
16:30–18:30	Lecture/talk: Learning to Solve Complex Optimization Problems via Genetic Programming Speaker: A/Prof. Yi Mei	
25 July		
9:30–11:30	Lecture/talk: Modeling and Solution Set Constraints in MOEA/D Speaker: Prof. Qingfu Zhang	Zhengzhou University
14:00–16:00	Lecture/talk: Randomization-Based Deep and Shallow Learning Methods for Classification and Forecasting Speaker: Prof. Ponnuthurai Nagaratnam Suganthan	
Closing		

Lectures, Courses and/or Plenary Talks

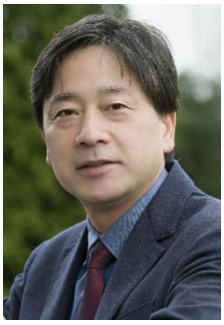
Speaker 1：Prof. Mengjie Zhangs

Affiliation: School of Engineering and Computer Science, Victoria University of Wellington, Wellington, New Zealand.

Topic: Evolutionary Machine Learning: Research, Applications, Challenges and Main Lessons

Abstract: Since the 1990s, evolutionary computation techniques have been widely used to solve machine learning tasks. In this talk, I will firstly provide a brief overview of machine learning and evolutionary computation, then provide a narrow view and a broad view of evolutionary machine learning. After discussing the state-of-the-art research and applications of the main paradigms of evolutionary machine learning and their success in classification, feature selection, regression, clustering, computer vision and image analysis, scheduling and combinatorial optimization, and evolutionary deep learning, the main challenges and lessons will be discussed. If time allows, I will provide an overview of our recent developments and discuss potential opportunities.

Speaker 2: Prof. Yaochu Jin



Affiliation: Faculty of Technology, Bielefeld University, Bielefeld, Germany.

Topic: Secure and Privacy-Preserving Federated Data-Driven Evolutionary Optimization

Abstract: Privacy preservation is a key concern in distributed machine learning and collective decision-making. This talk begins with a quick introduction to Bayesian optimization and Bayesian evolutionary optimization. Then, we briefly discuss existing ideas for privacy-preserving Gaussian process modelling and Bayesian optimization, followed by a presentation of a federated evolutionary Bayesian optimization algorithms for single- and multi-objective optimization. To further improve the privacy protection of the newly generated data, further differential privacy techniques are introduced. Finally, we present a privacy-preserving multi-task federated optimization framework. The talk is concluded by an outline of remaining challenges in privacy-preserving data-driven optimiation.

Speaker 5: Prof. Bing Xue

Affiliation: School of Engineering and Computer Science, Victoria University of Wellington, Wellington, New Zealand.

Topic: Evolutionary Computation for Feature Selection and Feature Construction

Abstract: Man real-world problems such as biomedical and biological data, a large number of features or attributes are collected. However, not all the features are essential since many of them are redundant, irrelevant or even noisy. Using all features for machine learning or data mining typically does not produce good results due to the big dimensionality and the large search space. This problem can be solved by selecting a small subset of original (relevant) features or feature construction to create a smaller set of high-level features using the original low-level features. Furthermore, finding the most influential features/factors in a model is of great importance for achieving Explainable AI (XAI) or interpretable machine learning. In this talk, I will discuss the challenges and development of feature selection and feature construction. State-of-the-art methods using evolutionary computation in this area will be reviewed, with a focus on classification tasks but also covering other machine learning tasks. Major applications of feature selection and construction in real-world problems will also be discussed. Finally, the talk will also cover current challenging issues and open research questions in this area.

Speaker 4: Prof. Qingfu Zhang

Affiliation: Department of Computer Science, City University of Hong Kong, Hong Kong SAR, China.

Topic: Modeling and Solution Set Constraints in MOEA/D

Abstract: MOEA/D is a popular algorithm for solving multi-objective optimization problems. However, in some cases, it is necessary to include constraints in the optimization problem to ensure the feasibility of solutions. Modelling and incorporating constraints in MOEA/D requires careful consideration, as it can affect the algorithm's performance and solution quality. This lecture discusses different approaches for modelling constraints in MOEA/D and their impact on the algorithm's performance. Additionally, it discusses the use of solution set constraints to restrict the number of solutions returned by MOEA/D. This lecture provides an overview of the challenges and opportunities associated with modelling and incorporating constraints in MOEA/D, with a focus on practical applications.

Speaker 3: Prof. Ke Tang

Affiliation: Research Institute of Trustworthy Autonomous Systems, Southern University of Science and Technology, Shenzhen, China

Topic: Algorithm Evolution

Abstract: Algorithm evolution has become increasingly important in recent years as the complexity of problems and the amount of available data continues to grow. This lecture provides an overview of the different techniques used in algorithm evolution, including their strengths and limitations. Additionally, it discusses the challenges associated with algorithm evolution. Finally, the lecture examines the potential future directions of algorithm evolution, such as the integration of machine learning and artificial intelligence techniques.

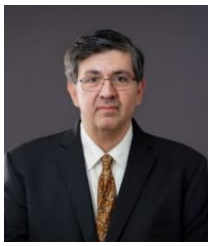
Speaker 6: Prof. Hisao Ishibuchi

Affiliation: Southern University of Science and Technology, China.

Topic: New Algorithm Frameworks of Multi-Objective Evolutionary Algorithms

Abstract: In the field of evolutionary multi-objective optimization (EMO), various EMO algorithms have been proposed in the last three decades under the following widely-accepted implicit assumption: The final population is presented to the decision maker. Thus, the goal of EMO algorithm design is to find a good final population, and the performance of EMO algorithms is evaluated using the final population. Recently, two different algorithm frameworks have been actively studied. One is the use of an unbounded external archive, and the other is the Pareto front (or Pareto set) modelling. In the first algorithm framework, all the examined solutions are stored in the archive. Then, an arbitrary number of solutions can be selected from the archive for the decision maker. In the second algorithm framework, the Pareto front (or Pareto set) is modelled by a machine learning technique using examined solutions. Then, an arbitrary number of final solutions can be obtained from the model for the decision maker. These two algorithm frameworks are much more flexible than the traditional EMO algorithm framework since an arbitrary number of solutions can be presented to the decision maker, which may increase the practical usefulness of EMO-based decision making. In this talk, first I will explain the traditional EMO framework and the two new frameworks (the use of unbounded external archive, and the modelling of the Pareto front/set). Then, I will discuss some interesting research challenges related to the two new algorithm frameworks.

Speaker 7: Prof. Carlos A. Coello Coello

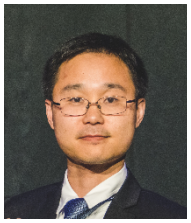


Affiliation: Department of Computer Science， CINVESTAV-IPN (Evolutionary Computation Group)， Mexico City, Mexico

Topic: Some Challenges in Evolutionary Multi-Objective Optimization

Abstract: In this talk, after providing a very short introduction to evolutionary multi-objective optimization, some of its current research challenges will be briefly described, including diversity measures, large-scale problems, expensive objectives and constraints, parallelism and algorithmic design. Also, a discussion on the importance of advancing the field with more disruptive ideas rather than just doing research by analogy will be also emphasized.

Speaker 8: A/Prof. Yi Mei



Affiliation: School of Engineering and Computer Science, Victoria University of Wellington, Wellington, New Zealand.

Topic: Learning to Solve Complex Optimization Problems via Genetic Programming

Abstract: Many real-world optimization problems such as vehicle routing, scheduling and resource allocation are very complex, with large problem sizes and dynamic/stochastic environments. Manually designing algorithms to effectively solve these problems requires strong domain expertise and is very time-consuming with many rounds of trial-and-error. This makes it extremely hard to solve the various optimization problems in the real world. With the recent rapid progress in AI and machine learning, learning to optimize becomes a hot topic in optimization, operations research, machine learning and evolutionary computation. To address the difficulty of manually designing effective optimization algorithms, this trending research area explores the use of machine learning techniques to automatically design algorithms for solving complex optimization problems. Among all the machine learning techniques, genetic programming is a powerful technique for learning to optimize due to its flexible representation, gradient-free search mechanism to handle the non-differentiable algorithm space, and the inherent advantage in the interpretability of the learned models. In this presentation, I will introduce how to use genetic programming to learn how to design effective optimization algorithms. This will cover the fundamental design issues including how to design individual representation, fitness evaluation, parent selection, and genetic operators, as well as more advanced techniques such as feature selection, the use of surrogate models and knowledge

transfer. We will use our recent work published on top venues (e.g., IEEE TEVC, TCYB, GECCO) as case studies.

Speaker 9: Prof. Ponnuthurai Nagaratnam Suganthan

Affiliation: School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore.

Topic: Randomization Based Deep and Shallow Learning Methods for Classification and Forecasting

Abstract: This talk will first introduce the main randomization-based feedforward learning paradigms with closed-form solutions. The popular instantiation of the feedforward neural network is called random vector functional link neural network (RVFL). Other feedforward methods included in the talk are random weight neural networks (RWNN), extreme learning machines (ELM), Stochastic Configuration Networks (SCN), Broad Learning Systems (BLS), etc. We will also present deep random vector functional link implementations. Hyperparameter tuning will be discussed. The talk will also present extensive benchmarking studies using classification and forecasting datasets.

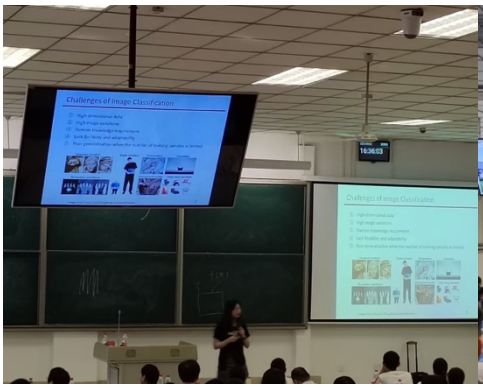
IEEE CIS Summer School on Computational Intelligence Pictures

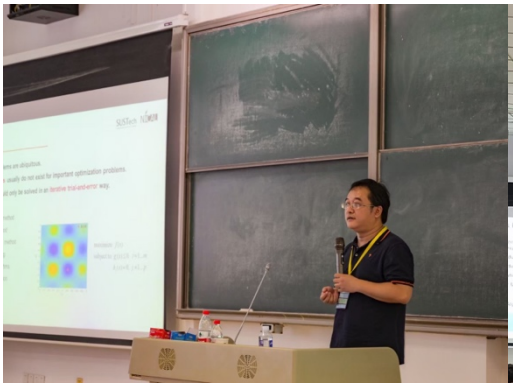
Registration desk:

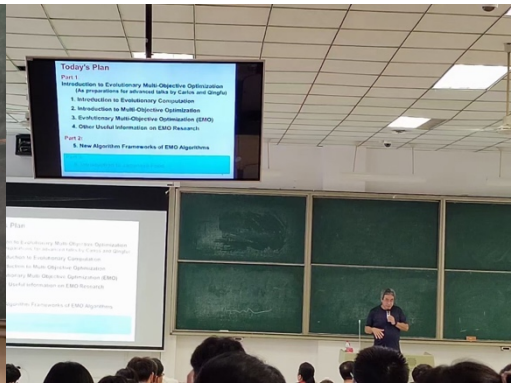
All attendees:

Opening:

Lectures/talks/attendees and other information:


Challenges of Image Classification




Today's Plan
Part I:
Introduction to Evolutionary Multi-Objective Optimization
(As preparations for advanced talks by Carlos and Qingfu)
1. Introduction to Evolutionary Computation
2. Introduction to Multi-Objective Optimization
3. Evolutionary Multi-Objective Optimization (EMO)
4. Other Useful Information on EMO Research
Part II:
5. New Algorithm Frameworks of EMO Algorithms



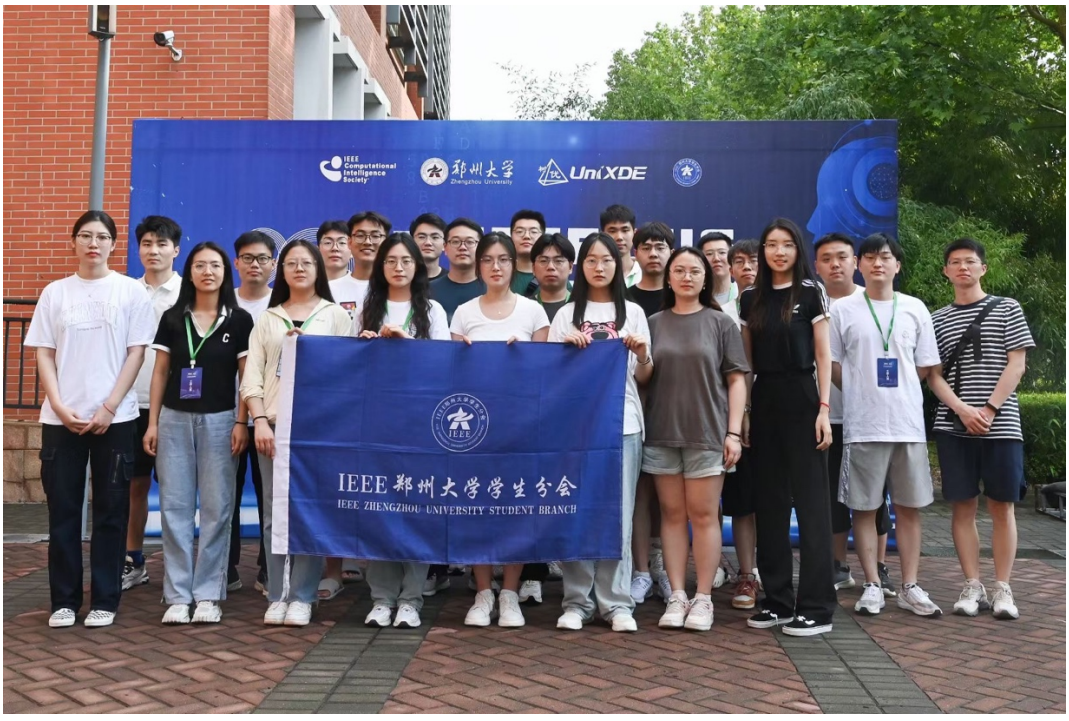






2023
IEEE CIS
计算智能暑期学校
IEEE 郑州大学学生分会


IEEE SSCI 2023 Symposium (Mexico City, Mexico)
EvoStar 2024 (Aberystwyth, UK)
IEEE CEC 2024 (Yokohama, Japan)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