IEEE CEC 2024

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IEEE WCCI 2024 Welcome Message

Let's celebrate the 30th anniversary of IEEE WCCI!

On behalf of the WCCI 2024 Organizing Committee, we are delighted to invite you to Yokohama, Japan, for the 13th biennial “IEEE World Congress on Computational Intelligence - WCCI 2024” of the Computational Intelligence Society (CIS) of IEEE, the world's largest technical professional organization.

The conference will take place from June 30th to July 5th, 2024, at PACIFICO Yokohama, one of the largest convention centers in Japan.

It is the IEEE CIS flagship conference of more than 2,500 esteemed scientists and professionals in the fields of neural networks, fuzzy systems and evolutionary computation worldwide. It enthusiastically contributes to exchanging views, sharing experiences and mixing young and young-at-heart scientists, by opening new perspectives for research and development in academy and industry.

IEEE WCCI started in 1994 in Orlando, Florida, USA, to enhance the interdisciplinary discussion and cooperation by calling together the people in neural networks, fuzzy systems, evolutionary computation and related computational intelligence areas. At the beginning, it was a quadrennial event, with annually held individual conferences, namely, International Joint Conference on Neural Networks (IJCNN), IEEE International Conference on Fuzzy Systems (FUZZ-IEEE) and IEEE Congress on Evolutionary Computation (IEEE CEC). After 2008, it has been held every two years constantly.

In these years, artificial intelligence (AI) changes the world rapidly and dramatically. This is a great success of our continuous endeavor pioneering the essence, fundamentals, technology and applications in AI as computational intelligence (CI). It is also the consequence of our contributions to strengthen the relationship between engineering and human beings. But, at the same time, AI sometimes gives rise to ethical issues and even conflicts among people. In this sense, human beings are challenged by our own technology.

Now let's sail out to unlimited horizons further, imagine the next 30 years from now, and enjoy our next journey by starting at the WCCI this year!

Yokohama is a port city, known as one of the ports first opened to the world after the closed Edo era in 1859, one of the most exciting melting-pot of eastern and western culture in the world, and for a number of universities, institutes and companies of advanced information technology, electronics, robotics, mobility, medicine and foods. A WCCI held in this area will strongly inspire the attendees to imagine next-generation science and technology.

"Best experience for all the participants" is the motto of the Organizing Committee. We look forward to welcoming you all for a memorable WCCI 2024. Let's put heads and hands together to

explore CI with a long-range scope to develop a society full of comfort, peace and humanity based on our intelligence technology!

Akira Hirose
The University of Tokyo
Japan

Hisao Ishibuchi
Southern University of Science and Technology
China

IJCNN 2024 Welcome Message

On behalf of the IJCNN Organizing Committee, it is my pleasure to extend a warm welcome to all of you attending this year's International Joint Conference on Neural Networks (IJCNN) in Yokohama, Japan. IJCNN 2024 reflects the mission of INNS, a society established in 1987 as the first international, interdisciplinary and inclusive professional organisation focusing on theoretical and computational aspects of brain-inspired learning machines.

This year's IJCNN received over 3272 submissions from 80 countries, out of which 1701 have been accepted. The conference program includes over 40 Special Sessions including Deep Learning for Graphs, Trustworthy and Explainable Federated Learning: Towards Security and Privacy Future, Domain Adaptation for Complex Situations: Theories, Algorithms and Applications, Learning from Small Data: Techniques and Applications, Machine Learning and Signal Processing for Brain or Behavioral Analysis, Neural Network-Based Methods for Human-Centric Perception and Understanding, Neuromorphic/Brainmorphic AI Models, Hardware and Applications and many more sessions on pertinent topics.

I would like to thank everyone who has given their time, energy and ideas to assist in organizing this event, including all the members of the organizing committee, the Technical Chairs (Zeng-Guang Hou, Barbara Hammer, Teresa Ludermir and Seiichi Ozawa, all the reviewers, and our keynote speakers: Johan Suykens, Masashi Sugiyama, Plamen Angelov, Yukie Nagai and Divyashree-Shivakumar Sreepathihalli.

I wish you all a wonderful and memorable experience at the International Joint Conference on Neural Networks in Yokohama, Japan. Your participation here demonstrates the dedication and enthusiasm for neural networks research that will shape and develop the future of this field.

Chrisina Jayne

IJCNN Conference Chair and INNS VP for Conferences

IEEE CEC 2024 Welcome Message

On behalf of the Organizing Committee, it is my greatest pleasure to welcome you to the 2024 IEEE Congress on Evolutionary Computation (IEEE CEC 2024), as part of the 2024 IEEE World Congress on Computational Intelligence (IEEE WCCI 2024), to be held on 30 June to 5 July 2024 at Yokohama, Japan.

IEEE CEC 2024 is a major international conference in the field of evolutionary computation, which covers all topics in evolutionary computation from theory to applications. The aims of this conference are to provide a forum for researchers and practitioners to exchange the latest advances and demonstrate state-of-the-art theory, algorithm design, and real-world applications, and to explore new directions and potentials in the field of evolutionary computation.

This year, CEC highlights 24 tutorials given by experts in the most relevant and emerging topics of evolutionary computation. It also features 49 advanced special sessions organized by domain specialists covering focused topics in evolutionary computation and computational intelligence, 5 workshops in the most exciting and lively research areas and several competitions in the field.

IEEE CEC 2024 received 665 submissions from authors of 64 countries and regions, where the top contributors by country are China, Japan, Mexico, USA, Brazil, UK, and India. Under the guidance of the WCCI 2024 general co-chairs, technical co-chairs of IEEE CEC 2024, and the help of special session organizers, 350 papers (acceptance rate is 52.63%) were accepted for publication in the proceedings after a rigorous review process, where almost all papers have at least three reviews. IEEE CEC 2024 also includes 13 Late breaking papers as well as 16 Journal-to-Conference presentations. The accepted papers cover a heathy mix of research topics ranging from the latest advances in the evolutionary computation area to the next steps in our commitment on mimicking nature to solve real-world problems.

All this would not have been possible without all the people in the organizing committee. I would like to thank the guidance and support of the General Co-Chairs: Akira Hirose and Hisao Ishibuchi. Special thanks also go to the IEEE CEC 2024 Technical Co-Chairs Carlos Coello Coello, Xiaodong Li, Juergen Branke, Nelishia Pillay, and Mengjie Zhang. I am also very grateful to Handing Wang as the Special Session Chair, Chuan-Kang Ting as the Tutorial Chair, Sanaz Mostaghim as the Conflict-of-Interest Chair, Oscar Cordon as the Plenary Session chair, Yaochu Jin as the Panel Session Chair, Jialin Liu as the Competition Chair, Ying Bi as the Workshop Chair, Yi Mei as J2C Papers Chair, Andries Engelbrecht, Kalyanmoy Deb, Pietro Oliveto and Rong Qu as the Best Paper Committee members, as well as other chairs of the WCCI 2024 conference. Last but not least, I would like to thank the plenary/keynote speakers, Akira Oyama, Yew Soon Ong, Handing Wang, Jialin Liu, Mengjie Zhang, and Tobias Rodemann.

Finally, I would like to thank all the authors who submitted their work, to the reviewers, to all the participants of IEEE CEC 2024, and the IEEE WCCI 2024 sponsors for their great support.

Sincerely,

Bing Xue,

IEEE CEC 2024 Conference Chair

FUZZ-IEEE 2024 Welcome Message

On behalf of the Organizing Committee, I would like to welcome all the delegates and their guests to The IEEE International Conference of Fuzzy Systems 2024 (FUZZ-IEEE 2024) as part of the 2024 IEEE World Congress on Computational Intelligence (IEEE WCCI 2024) which is organized from June 30 – July 5, 2024 in Yokohama, Japan.

FUZZ-IEEE 2024 is a premier event in the areas of Fuzzy Systems. This conference covers all topics in Fuzzy Systems including Mathematical and theoretical foundations; Fuzzy Set theory, fuzzy measures, fuzzy integrals; Fuzzy control; Robotics and autonomous systems; Fuzzy hardware, software, sensors, actuators, architectures; Fuzzy data analysis; Fuzzy information processing; Type 2 fuzzy sets, computing with words, granular computing, rough set; Computational and artificial intelligence; Optimization and operations research; Decision analysis, multi-criteria decision making, and decision support; Fuzzy modeling, identification, and fault detection; Knowledge discovery; Fuzzy image, speech and signal processing, vision and multimedia data; Linguistic summarization, natural language processing; Fuzzy human interfaces (HCI for and with fuzzy approaches); Deep fuzzy systems; Fuzzy applications; Responsible and trustworthy AI; Role of fuzzy approaches in explainable AI; Multi- and inter-disciplinary advances in, for, or with fuzzy approaches; Fuzzy approaches in the social sciences; and Fuzzy pattern recognition. This year, we also have a session for “Late Breaking” papers to share newly developed ideas with preliminary results and a session called “J2C” for papers that summarize concepts from the authors’ journal publications within 2-year of the conference date. There were 118 accepted regular papers out of 222 submitted papers, while there were 16 accepted late breaking papers out of 32 submitted papers. For the J2C session, the number of accepted papers is 2 out of 13. There were 51 countries of submission authors with the following top-10 countries:- Japan(13.4%), Italy(10.0%), China(8.6%), Spain(8.5%), UK(7%), India(5.4%), USA(5.2%), Taiwan(4.8%), Poland(4.5%), and Canada(3.6%), respectively.

We would like to express our deepest thanks to authors, plenary speakers, and keynote speakers for supporting FUZZ-IEEE by presenting their most recent works and sharing their ideas. We would like to thank reviewers for valuable comments. Finally, we would like to thank our supporting staffs for all helps in making this a great conference.

We wish you a fantastic conference experience and wonderful staying in Yokohama, Japan.

Welcome to Japan.

Sansanee Auephanwiriyakul, FUZZ-IEEE 2024 Conference Chair

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Scan the QR code to access the web app. View the full schedule, plan your agenda, learn more about the presentations/speakers, and more.

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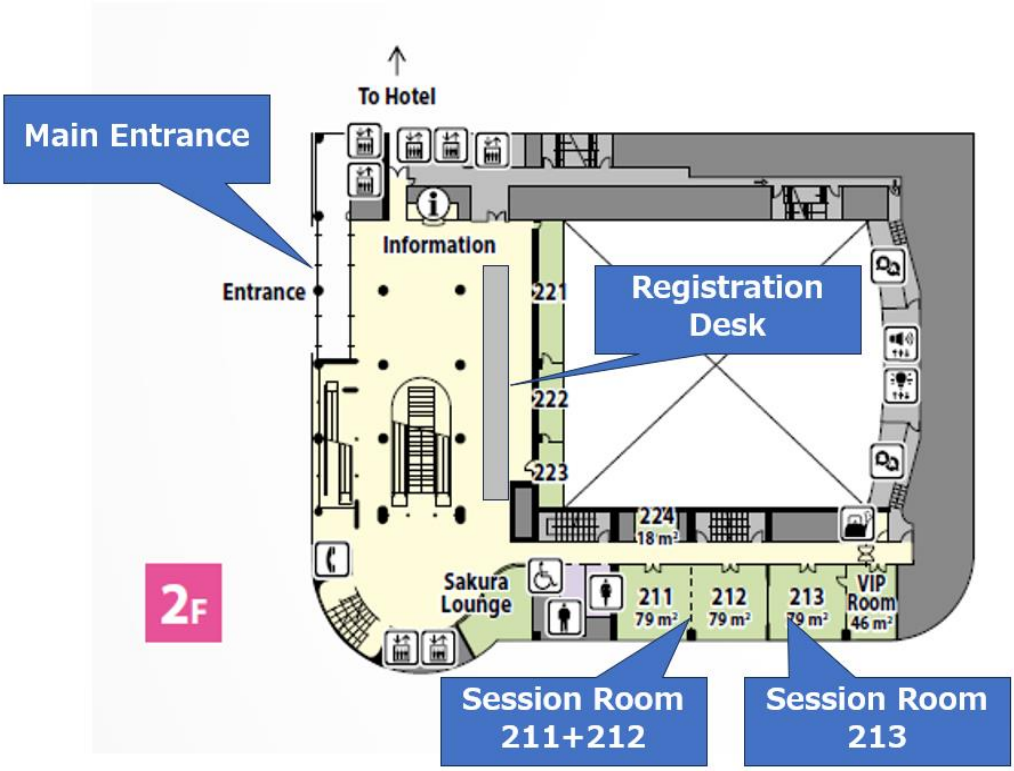
Venue Map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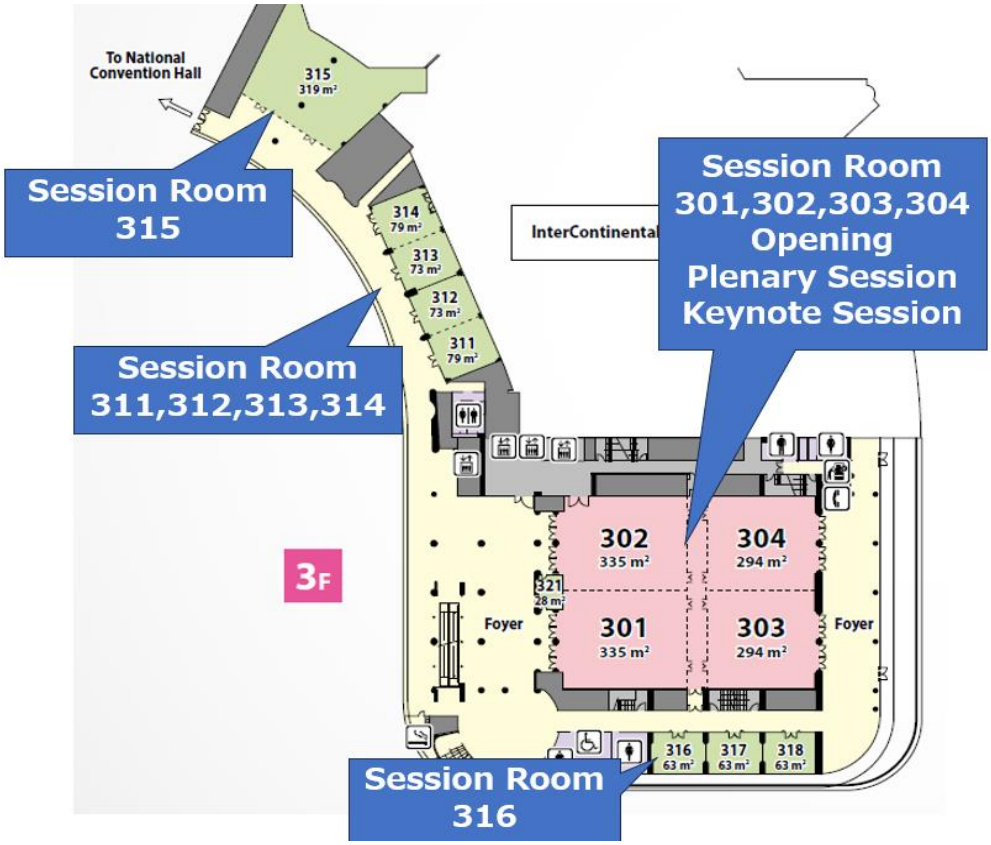
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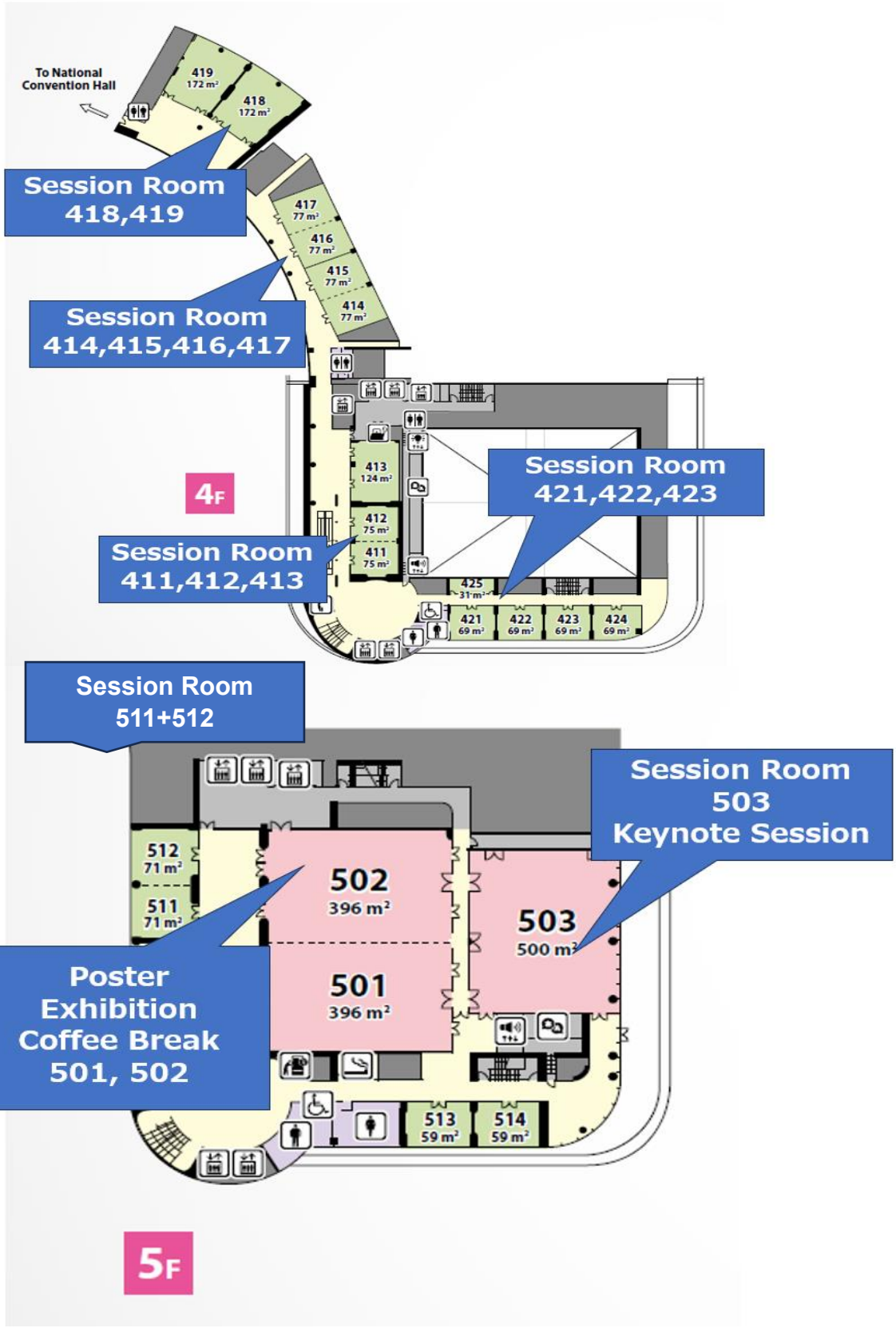
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Poster Floor Map

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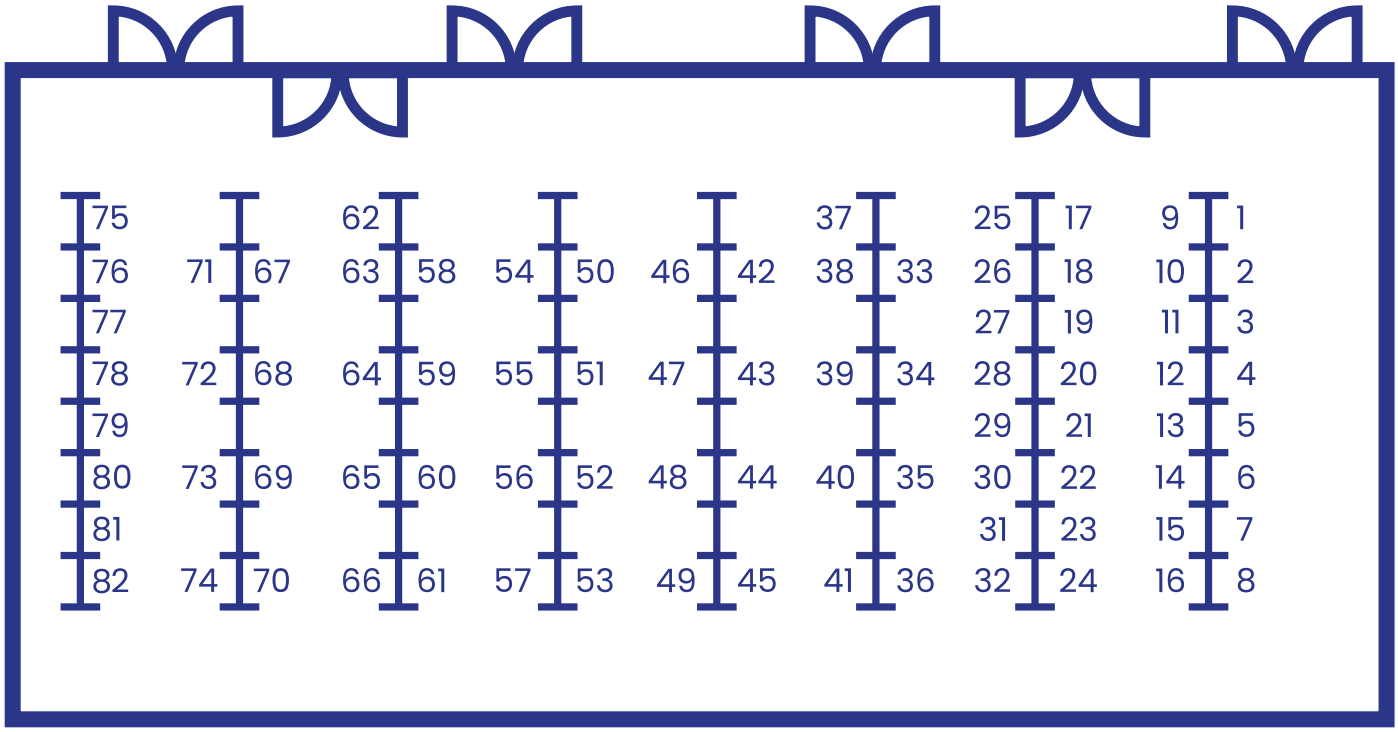

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WCCI Plenary Speakers

Marios M. Polycarpou
"Connecting Computational Intelligence to the Cyber-Physical World"

University of Cyprus

Abstract: The development of cyber-physical systems with multiple sensor/actuator components and feedback loops has given rise to advanced automation applications, including energy and power, intelligent transportation, water systems, manufacturing, etc. Traditionally, feedback control has focused on enhancing the tracking and robustness performance of the closed-loop system; however, as cyber-physical systems become more complex and interconnected and more interdependent, there is a need to refocus our attention not only on performance but also on the resilience of cyber-physical systems. In situations of unexpected events and faults, computational intelligence can play a key role in improving the fault tolerance of cyber-physical systems and preventing serious degradation or a catastrophic system failure. The goal of this presentation is to provide insight into the design and analysis of intelligent monitoring methods for cyber-physical systems, which will ultimately lead to more resilient societies.

Bernadette Bouchon-Meunier
"Can intelligent systems be conscious?"

CNRS-Sorbonne Université

Abstract: The concept of consciousness is complex and takes various forms. The fact that an intelligent system can be conscious has long been discussed and the questions are getting louder as we see systems springing up everywhere that seem capable of dialoguing with humans in a very natural way.
We propose to look at several facets of consciousness, from phenomenological consciousness linked to perceptions to access consciousness, which gives us information about one's actions. In 1982 already, Marvin Minsky 1 was considering that self-conscious systems could be done by providing machines with ways to examine their own mechanisms while they are working. Then Jacques Pitrat 2 in 2009 claimed that, for a conscious artificial being, the possibility of monitoring its own thought enables it to explain its decisions so that they can be accepted by others, which goes in the direction of eXplainable AI. A recent study 3 provides a list of indicator properties derived from scientific theories to assess consciousness for an intelligent system. We offer an overview of some interesting aspects of consciousness from the angle of intelligent systems, which can be different from human consciousness, and we wonder to what extent a present or a future system can have such a form of consciousness and what the advantages and drawbacks are.

Simon See

"Accelerating Science Discovery - High Performance Simulation, Math and AI"

Nvidia

Abstract: Modern scientific discovery relies on advances in data science, mathematics, and artificial intelligence (AI). The combination of these disciplines has led to significant breakthroughs in various fields, including materials science, drug discovery, and chip design. This talk discusses the role of AI-enriched simulation in accelerating science discovery and the use of high-performance computing, math, and AI to drive innovation.

Key aspects of AI-enriched simulation include:

Accelerating the discovery process: AI-enriched simulation uses AI to identify the most promising simulations to run on a massive dataset, reducing the computational expense and saving precious time and resources.

Automating complex simulations: AI-enriched simulation makes complex, predictive simulations automatable and user-friendly for researchers without deep computational expertise, removing a critical research bottleneck

Reducing the number of simulations needed: By using AI to analyze data and determine the most promising simulations, AI-enriched simulation can speed up screening by factors of 10-100 times.

Leveraging AI and machine learning: AI-assisted simulations use neural networks and machine learning algorithms to predict complex properties of materials and other systems, bypassing expensive physics-based routines and accelerating the discovery process.

Collaborative research: AI expertise, such as that found at Berkeley Lab, can be combined with traditional research methods to apply AI to various scientific problems, leading to innovative solutions and new discoveries.

In summary, the future of scientific discovery lies in the integration of high-performance simulation, math, and AI. By harnessing the power of these technologies, researchers can accelerate the discovery process, automate complex simulations, and unlock new possibilities in various fields.

Saori Tanaka

“Utilization of large-scale brain image database for digitalization of psychiatric and neurological disorders”

NAIST, ATR

Abstract: In recent years, neuroimaging databases for psychiatric and neurological disorders have enabled users to find common and disease-specific features and redefine disease spectra using data-driven approaches. In the Brain/MINDs beyond (2018-2023), the neuroimaging database projects have established the multiple sites, multiple disorders MRI database.

A remarkable feature of this database is the traveling-subjects dataset; each participant was scanned at each multisite. This led to the development of a harmonization method to reduce site differences and the development of a generalizable diagnostic marker with brain networks of major depressive disorder (Yamashita, et al., 2020). This database has expanded to 14 disorders and over 16 sites, and over 5,000 MRI data will be collected by the end of the project. This will be the largest MRI database of multiple neurological and psychiatric disorders from multiple sites. In addition, this database includes longitudinal patient data, allowing for the evaluation of treatment effects. This database is expected to lead to the stratification and the development of new treatment methods. Here, as a potential use of the database, I will suggest an integration with approaches based on the computational theory of the brain in addition to data-driven approaches. Computational neuroscience studies understanding the brain mathematically focused on the neural mechanisms of information processing. In recent years, these approaches have been applied to understanding psychiatric disorders. I will show some previous studies using large-scale behavioral data and computational models of psychiatric disorders and demonstrate possibilities of fusion with computational models and neuro-behavioral databases.

Akira Oyama

“Multiobjective evolutionary optimization in space engineering and spin-off to industry”

Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency

Abstract: Multiobjective evolutionary computation (MOEC) is getting popular in Japan because it has various advantages such as capability of finding wide variety of Pareto-optimal designs. In Japan Aerospace Exploration Agency (JAXA), I have been engaged in multiobjective design optimizations in space engineering such as rocket engine turbopump design, spacecraft trajectory design, reusable space transportation system design, spacecraft

landing system design, selection of Moon landing site. In this talk, I will introduce some examples of these applications of MOEC in JAXA.

Then, I will introduce spinoff of the multiobjective design optimization technology to industry. Here, I will present the collaboration work with Mazda, Kobe University, and Hiroshima University for aerodynamic car shape design and the collaboration work with Central Japan Railway Company for aerodynamic and aeroacoustics design of superconducting maglev. Finally, I will discuss current issues in using MOEC for real-world design problems and our recent approaches to overcome these issues.

Keynote Speakers

IJCNN Keynotes Speakers

Johan Suykens
“Least Squares Support Vector Machines and Deep Learning”

Katholieke Universiteit Leuven

Abstract: While powerful architectures have been proposed in deep learning, with support vector machines and kernel-based methods solid foundations have been obtained from the perspective of statistical learning theory and optimization. Simple core models were obtained within the least squares support vector machines framework, related to classification, regression, kernel principal component analysis, kernel canonical correlation analysis, kernel spectral clustering, recurrent models, approximate solutions to partial differential equations and optimal control problems, etc. The representations of the models are understood in terms of primal and dual representations, respectively related to feature maps and kernels. The insights have been exploited for tailoring representations to given data characteristics, both for high dimensional input data and large scale data sets. One can either work with explicit feature maps (such as e.g. convolutional feature maps) or implicit feature maps through the kernel functions.

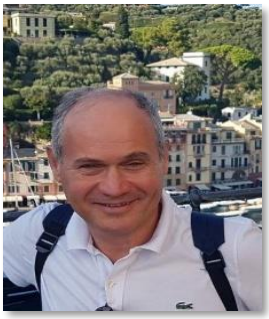
Within this talk we will mainly focus on new insights connecting deep learning and least squares support vector machines. Related to Restricted Boltzmann machines and Deep Boltzmann machines we show how least squares support vector machine models can be transformed into so-called Restricted Kernel Machine representations. It enables to conceive new deep kernel machines, generative models, multi-view and tensor based models with latent space exploration, and obtain improved robustness and explainability. On most recent work, we will explain how the attention mechanism in transformers can be seen within the least squares support vector machine framework. More precisely it can be represented as an extension to asymmetric kernel singular value decomposition with primal and dual model representations, related to two feature maps (queries and keys) and an asymmetric kernel. In the resulting method of "Primal-Attention" a regularized loss is employed to achieve low-rank representations for efficient training in the primal.
Finally, these newly obtained synergies are very promising in order to obtain the bigger and unifying picture. Several future challenges will be outlined from this perspective.

Masashi Sugiyama

“Towards More Robust and Reliable Machine Learning”

Riken, The University of Tokyo

Abstract: In statistical machine learning, training data is often full of uncertainties due to insufficient information, label noise, and bias. In this talk, I will give an overview of our research on reliable machine learning, including weakly supervised learning, noise-robust learning, and transfer learning. Then, I will discuss our recent challenges to integrate these approaches and develop a generic machine learning methodology with fewer modeling assumptions.



Plamen Angelov

“Learning from Data in post-Foundation Models Era: bringing learning and reasoning together”

Lancaster University

Abstract: Deep Learning continues to attract the attention and interest not only of the wider scientific community and industry, but also society and policy makers. Fuelled by the remarkable generalisation and separability capabilities offered by the transformers (e.g. ViT), Foundation Models (FM) offer unparalleled feature extraction opportunities. However, the mainstream approach of end-to-end iterative training of a hyper-parametric, cumbersome, and opaque model architecture led some authors to brand them “black box”. This degrades their generalisation, requires many labelled data, compute power and related energy, etc. costs. Cases were reported when such models can give wrong predictions with high confidence - something that jeopardises the safety and trust. Deep Learning is focused on accuracy and overlooks explainability and the semantic meaning of the internal model representations, reasoning and its link with the problem domain. In fact, it shortcuts from the large amount of (labelled) data to the predictions bypassing and substituting the causality with correlation and error minimisation. It relies on assumptions about the data distributions that are often not satisfied and suffers from catastrophic forgetting when faced with continual and open set learning. Once trained, such models are inflexible to new knowledge. They are good only for what they were originally trained for. Indeed, the ability to detect unseen and unexpected and start learning this new class/es in real time with no or very little supervision (zero- or few- shot learning) is critically important but is still an open problem. The challenge is to fill the gap between the high levels of accuracy and the semantically meaningful solutions. This talk will focus on “getting the best from both worlds”: the powerful latent feature spaces formed by pre-trained deep architectures such as transformers combined with the interpretable-by-design (in linguistic, visual, semantic, and similarity-based form) models. One can see this as a

fully interpretable frontend and a powerful backend working in harmony. Examples will be demonstrated from the latest projects from the area of autonomous driving, Earth Observation, health and a set of well-known benchmarks.

Yukie Nagai

“Predictive Processing: Illuminating and Modeling Cognitive Development”

The University of Tokyo

Abstract: Cognitive development is an intricate and multifaceted process that has captivated researchers for decades. Human abilities related to perception and action continually evolve during development, exhibiting remarkable diversity among individuals.

This presentation explores the concept of predictive processing as a promising unified theory for illuminating and modeling cognitive development. Rooted in neuroscience, predictive processing offers a unique perspective for understanding how the brain constructs its perception of the world. The core idea posits that the brain continually generates internal models to predict the world and refines them in response to sensory input to minimize prediction errors. This dynamic process underlies the acquisition of cognitive abilities, from self-recognition to goal-directed actions, and even fosters the emergence of social behaviors like imitation and altruism, facilitated through multimodal predictions.

Moreover, this presentation sheds light on how disruptions in predictive processing lead to individual diversities, including developmental disorders. By emphasizing the concept of predictive processing and showcasing its practical application in robotic experiments, we aim to demonstrate its potential as a unifying framework for cognitive development. This presentation opens doors to exciting opportunities for creating more adaptive and intelligent systems.

Divyashree-Shivakumar Sreepathihalli
“Keras, A shortcut to master AI”

Google

Abstract: Discover the transformative capabilities of the Keras 3 API. Delve into deep learning best practices, where you'll gain insights into crafting uncomplicated models and executing them with your preferred backend—be it PyTorch, TensorFlow, or JAX. Explore the dynamic potentials of KerasNLP and KerasCV modules, unveiling the art of constructing powerful AI applications. Witness the seamless creation of generative image and language models, empowering you to achieve remarkable feats with just a few lines of code.

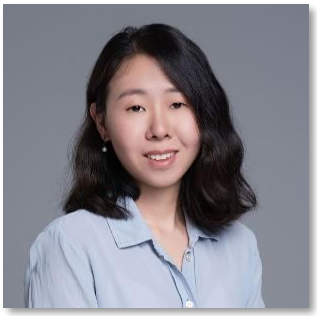
CEC Keynotes Speakers

Yew Soon Ong

"Multifactorial Evolutionary Computation with Applications in Machine Learning and Scientific Discovery"

Nanyang Technological University

Abstract: The human mind demonstrates an exceptional capacity to manage multiple tasks seemingly simultaneously while also exhibiting the ability to leverage knowledge acquired from solving one task and apply it to different yet related challenges. Given the exploding volume and variety of information streams, the opportunity, tendency, and (even) the need to address different tasks in quick succession is unprecedented. Yet, the design of population-based algorithms of evolutionary computation (EC) has traditionally focused on addressing a singular task (or problem) at a time. It is only recently that the idea of multifactorial evolution has come to the fore, leading to the growing popularity of transfer and multitask EC. The nomenclature signifies a search involving multiple optimization tasks, with each task contributing a unique factor influencing the evolution of a population of candidate solutions. The multifactorial evolutionary algorithm (MFEA) is distinguished by implicit genetic transfers between tasks, promising free lunches in optimization by reusing knowledge from related problems. The method makes possible the rapid discovery of diverse, high quality outcomes, and potentially out-of-the-box solutions through inter-task genetic crossovers. In this talk, some of the latest algorithmic advances of MFEAs shall be presented, encompassing both single-objective and multiobjective variants. The impact potential of algorithms designed to leverage multiple related tasks shall be showcased in the field of machine learning (through the creation of diverse sets of small but specialized models extracted from large pre-trained architectures) and in AI for scientific discovery (by facilitating fast simulations of multiple instantiations of the fundamental laws of nature). Multiobjective multitasking as a means to arrive at sets of Pareto optimal solution sets in other application domains shall also be highlighted.



Handing Wang
"Challenges in Data-Driven Evolutionary Optimization"

Xidian University

Abstract: Many real-world problems that are optimized based on data collected from historical records, numerical simulations, or physical experiments are called data-driven optimization problems. The interdisciplinary research area of data-driven evolutionary optimization involves techniques in data science, machine learning, and evolutionary algorithms. In an evolutionary data-driven optimization framework, data will be collected at first. Then, surrogate models, which are machine learning models, are built from the data to approximate the real objective functions and / or constraint functions. Given the approximated objective or constraint functions, evolutionary algorithms can then be applied to perform optimization. This talk will highlight the current challenges of data-driven evolutionary optimization based on the view of real-world applications. Also, the techniques to address those challenges will be introduced.

Jialin Liu
"Designing and playing games with computational intelligence"

Southern University of Science and Technology (SUSTech)

Abstract: Games provide an ideal playground for AI researchers to study, explore, evaluate, and experiment with different ideas in a controllable and safe environment. As an important application and product, games also involve complex decision-making and creative design tasks. Games have played important roles in the development of computational intelligence, while different computational intelligence methods have been widely applied to playing and designing games. In this talk, I will show how different computational intelligence methods (e.g., generative models, reinforcement learning and evolutionary computation) could be harnessed to procedurally generate new game contents, from game levels to accompanying music that correlates with game difficulties. In addition, I will also show how novel computational intelligence techniques, especially evolutionary reinforcement learning, could be used to play a range of different games. I will conclude the talk by discussing current challenges and potential research directions.

Mengjie Zhang
"Evolutionary Machine Learning: 50 Years of Progress"

Victoria University of Wellington

Abstract: Evolutionary machine learning have been very popular over the recent years. In this talk, I will firstly provide a brief overview of the history of evolutionary machine learning with the major developments over the past 50 years, then focus on the main paradigms of evolutionary machine learning and their successes in classification, feature selection, regression, clustering, computer vision and image analysis, scheduling and combinatorial optimisation, deep learning, transfer learning and explainable/interpretable machine learning. The main applications, challenges and lessons as well as potential opportunities will be also discussed.

Tobias Rodemann
"Trust in Optimization Algorithms – The End User Perspective"

Honda Research Institute Europe

Abstract: Evolutionary Algorithms have a potentially wide-spread usage. They can deal with various types of design parameters, constraints and objectives; non-linear, discontinuous, noisy fitness landscapes and many, even conflicting objectives can be handled. There are numerous open-source software packages for quickly applying EA methods on various problems. In practice, however, EAs are not used as frequently as we would hope. In this talk I would like to provide some insights from industrial projects and focus especially on the perspective of the end user. I will argue that hot topics in ML like trust, transparency and explainability, also need to be considered in Computational Intelligence.

FUZZ-IEEE Keynotes Speakers

Qiang Shen

"When There Is Little Data Can AI Still Work? – Approximate Reasoning with Knowledge Interpolation and its Applications"

Aberystwyth University

Abstract: AI is on the brink of revolutionising industries globally, having made significant advancements in recent years. These achievements are primarily attributed to the use of deep learning techniques that process vast amounts of data. Yet, a pivotal question emerges when faced with limited data for a new problem, especially if this data is ambiguously characterised. Can AI maintain its efficacy under these constraints? This presentation delves into contributions addressing this query, highlighting how fuzzy rule interpolation (FRI) enables approximate reasoning in situations marked by sparse or incomplete knowledge.

This is particularly relevant when traditional rule-based inference mechanisms falter because observations do not align with existing rules. Research into FRI techniques has been extensive within the realm of computational intelligence, yielding multiple methodologies. This presentation will centre on a prominent subset, Transformation-based FRI (T-FRI), which operates by mathematically modifying rules that bear resemblance to unmatched observations. Every technique within this category applies linear transformations of the nearest rules, automatically chosen relative to an unmatched observation. The talk will kick off with an exploration of the foundational T-FRI approach and segue into a concise overview of its expanded repertoire: adaptive T-FRI, backward T-FRI, higher-order T-FRI, dynamic T-FRI, and weighted T-FRI. Each addresses certain shortcomings inherent to the original method. Subsequently, real-world applications of these methodologies will be showcased, exemplifying their potency in tackling formidable challenges in domains like network security and medical diagnosis. These cases will underscore AI's capability to function effectively even with incomplete knowledge and ambiguous data. The presentation will wrap up with a glimpse into prospective advancements in this crucial research domain.

Francisco Herrera

"Fuzzy Systems to Support Safe and Trustworthy Artificial Intelligence"

University of Granada

Abstract: Artificial Intelligence (AI) has matured as a technology, AI has quietly entered our lives, and it has taken a giant leap in the last year. Image generative AI models or the latest evolutions of large language models have meant that AI has gone, in just a few months, practically from science fiction to being an essential part of the daily lives of hundreds of millions of people around the world.

This emergence goes hand in hand with a growing global debate on the ethical dimension of AI which raises the need for responsible, fair, inclusive, trustworthy, safe, transparent and accountable frameworks. Two essential concepts emerge in this scenario. 1) Trustworthy AI, supported on the legal, ethical, and technical robustness pillars, including seven technical requirements. 2) AI safety, which encompass machine ethics and AI alignment, aiming to make AI systems moral and beneficial, and robustness technical problems (including monitoring systems for risks, robustness against adversaries, detecting malicious use, attacks and backdoors, …) Safe and trustworthy AI is a critical area to meet upcoming regulations, the necessary auditability metrics for their analysis and compliance, address ethical issues, manage risk analysis in human-AI system interaction, and ensure the technical soundness of responsible AI systems (auditability and accountability during its design, development and use). This talk addresses the role that fuzzy systems can play in supporting the technical requirements of safe and trustworthy AI. The use of fuzzy sets and systems can support auditability and accountability metrics, to address different technical requirements for trustworthy (explainability, privacy and federated learning, fairness, ...), and to design fuzzy monitoring systems for robustness, ... Finally, we should delve into another essential aspect, discuss and think about the development of fuzzy technologies that fit into the design requirements for auditability and design frameworks for accountable AI systems. This is a great opportunity to explore in today's emerging safe and trustworthy AI scenario.

Jim Tørresen
"AI Ethics – Challenges and Opportunities"

University of Oslo

Abstract: Artificial intelligence (AI) has entered an increasing number of different domains. A growing number of people – in the general public as well as in research – have started to consider a number of potential ethical challenges and legal issues related to the development and use of AI technologies. This keynote will give an overview of the most commonly expressed ethical challenges and ways being undertaken to reduce their negative impact.

Among the most important challenges are those related to privacy, fairness, transparency, safety and security. Countermeasures can be taken first at design time, second, when a user should decide where and when to apply a system and third, when a system is in use in its environment. In the latter case, there will be a need for the system by itself to perform some ethical reasoning if operating in an autonomous mode. This keynote will introduce some examples from our own and others´ work and how the challenges can be addressed both from a technical and human side with special attention to problems relevant when working with AI research and development. AI ethical issues should not be seen only as challenges but also as new research opportunities contributing to more sustainable, socially beneficial services and systems.

Gabriella Pasi
"Large Language models: contextual knowledge matters."

University of Milano Bicocca

Abstract: The last few years have witnessed an increasing development of generative AI and its applications, which culminated in the large-scale sharing of ChatGPT on the Web, with its related potentials, risks and limitations. Large Language Models are one of the possible technologies at the basis of generative AI; they are nowadays successfully applied to a variety of NLP tasks, among which are machine translation, conversational agents, and several others. Despite this, LLMs are affected by some limitations, among which a lack in accounting for contextual knowledge related to the task at hand. A research trend is to inject such knowledge (in-context) into LLMs via prompting techniques. A more recent and promising research direction is to make use of neuro-symbolic approaches, to better model and control the process. In this talk, after a short introduction to LLMs, I will present some possible approaches finalized to this latter aim. I will also present the research issue of defining personal language models, i.e. LLMs tailored on the language of specific users or groups of users.

Jie Lu

“Fuzzy Machine learning”

University of Technology Sydney

Abstract: The talk will present the concepts, methodologies, and algorithms of fuzzy machine learning, including fuzzy transfer learning, fuzzy concept drift detection and adaptation, and fuzzy recommender systems. It will also present how the fuzzy machine learning techniques can effectively support data-driven prediction and decision-making in uncertain, complex, and dynamic situations.

Online Invited Speakers

Hussein Abbass
"Explaining Explainable Artificial Intelligence"

School of Systems and Computing, University of New South Wales

Abstract: Explainable Artificial Intelligence (XAI) is one of the hottest topics in AI today. Ironically, one would think that a motivation for the importance of XAI is for people to better understand AI and the AI models in use. However, diversity of opinions and perspectives on XAI has created more ambiguities and confusions than helping in any meaningful way. To even explain what an explanation is, some papers in the literature have confused the term, making it close to impossible to newcomers to the field to find coherence or aspire for consistency. The diversity is reaching unhealthy state with orthogonal definitions and taking antonyms and incommensurable concepts making them synonyms. The aim of this presentation is to disambiguate XAI, taking the audience into a trip that will start from the basics, travel through contemporary literature, land on current challenges of XAI and providing food for thoughts along the way. My aim is not to unify XAI or create a universal agreement. My aim is to maximise people understanding of XAI and to have the basis for those who disagree with me to communicate their disagreement in concise statements.

Erik Cambria
"Seven Pillars for the Future of AI"

NTU Singapore

Abstract: In recent years, AI research has showcased tremendous potential to impact positively humanity and society. Although AI frequently outperforms humans in tasks related to classification and pattern recognition, it continues to face challenges when dealing with complex tasks such as intuitive decision-making, sense disambiguation, sarcasm detection, and narrative understanding, as these require advanced kinds of reasoning, e.g., commonsense reasoning and causal reasoning, which have not been emulated satisfactorily yet. To address these shortcomings, we propose seven pillars (https://sentic.net/seven-pillars-for-the-future-of-artificial-intelligence.pdf) that we believe represent the key hallmark features for the future of AI, namely: Multidisciplinarity, Task Decomposition, Parallel Analogy, Symbol Grounding, Similarity Measure, Intention Awareness, and Trustworthiness.

Workshops

IJCNN Workshops

Workshop: Towards Realizing Whole-Brain Computational Models Guided by Cognitive Models
Organizer(s): Akira Taniguchi, Yoshimasa Tawatsuji, Junya Morita
Date: June 30, 2024
Time: 8:30 – 16:10
Room: 314
Abstract: In recent years, there has been a focused effort to develop Whole Brain Computational Models (WBCMs), aiming to represent the entire brain's functions and contribute to creating artificial intelligence with human-level capabilities. WBCMs involve not only neuroscientific but also cognitive models, especially in constructing a cognitive architecture for consistency. Cognitive models enhance interpretability in implementing WBCMs into AI agents, providing insight into thought processes. This approach, resembling human cognition, offers potential psychological reassurance to users. The discussion about the relationship between cognitive models and WBCMs is linked to AI alignment debates, crucial as powerful AI systems develop. The workshop aims to discuss methodologies to realize WBCMs, emphasizing the role of cognitive models.

Workshop: IEEE Humanitarian Activities Workshop with AI Technologies
Organizer(s): Kojiro Nishimiya; Kohei Ohno; Mayumi Suzuki; Toshihiko Sugie; Yasuhiro Takishima
Date: June 30, 2024
Time: 8:30 – 12:40
Room: 418
Abstract: A workshop to discuss Humanitarian Activity from a broad perspective, including global warming, renewable energy, and the SDGs, with participants. The workshop is divided into two sessions. In the first half, each participant will give a presentation on an issue broadly related to Humanitarian Activity, using his or her own technology to find a solution. In the second half, participants will be divided into small groups for discussion, which may include in-depth discussions of the presentations by the presenters in the first half, or discussions of solutions to the other Humanitarian Activity issues using the participants' own technologies. This workshop is intended for those who are interested in Humanitarian Activity but have not yet started full-scale research, and for those who are motivated by the opinions of others and wish to apply them to their future research. Therefore, student presentations are also welcome. We also welcome those who are already conducting full-scale research on Humanitarian Activity. As for technology, the workshop is open to all those who are broadly involved in computing technology, such as neural networks, fuzzy and Evolutional computing, etc. This workshop is organized by the IEEE Tokyo Section SIGHT (Special Interest Group on Humanitarian Technology).

Workshop: International Workshop on Forging Trust in Artificial Intelligence
Organizer(s): Nistor Grozavu; Nicoleta Rogovschi; Corina Besliu; Seiichi Ozawa; Aikaterini Tzompanaki; Dimitris Kotzinos
Date: July 2, 2024
Time: 8:20-18:40
Room: 211+212
Abstract: Establishing and upholding trust in AI systems is an imperative pursuit as Machine Learning becomes intricately interwoven into our daily lives. The workshop, "Forging Trust in Artificial Intelligence" brings together a group of experts and researchers from diverse subfields, converging on the exploration of how transparency, fairness, privacy, and security collectively contribute to making machine learning trustworthy. By uniting experts across these pivotal disciplines, this workshop illuminates the best practices that not only enhance the trustworthiness of AI but also reinforce its ethical foundations.

Ensuring trust in machine learning is necessary for unlocking its potential while minimizing risks. This is especially true in the current environment, where the constant expansion of data sources aligns with a growing interest in using them to develop comprehensive and universally applicable AI systems. This interest highlights the need to address issues related to transparency, fairness, privacy and security, particularly in the area of multimodal learning, where various data types and learners are combined to create sophisticated, but often opaque AI systems.

Within this context, establishing best practices for data integration is essential to ensure transparency and interpretability of AI systems based on diverse learners. Fairness considerations, on the other hand, may involve identifying and addressing potential biases from different modalities. This includes exploring approaches to mitigate their impact and leveraging fair representation learning when integrating information from sources with varying bias levels. By addressing such issues alongside data privacy and security concerns, this workshop aims to contribute to the development of ethical, transparent, and secure AI that has a positive impact on our global society's well-being.

Workshop: Advances in Optimizing and Transfer Learning Models
Organizer(s): Issam Falih; Chafik Samir
Date: June 30, 2024
Time: 16:20 –18:20
Room: 213
Abstract: Proposal This workshop will cover original and pioneering contributions, theory as well as applications on optimizing, combining, and transferring learning models, and aim at an inspiring discussion on the recent progress and the future developments. Learning models, especially those based on different paradigms, can be combined and optimized for improving their accuracy. Thus, each learning method imposes specific modeling from observations which translates to a set of constrains. However, such assumptions may lead to weak and non adapted learners if they are not satisfied. In many cases, the ill-posed of the learning process and the data partiality of observations make the optimization methods converge to different solutions and subsequently fail under various circumstances. The workshop will be a good opportunity, to discuss recent advances in optimizing and learning models. Furthermore, the effectiveness of these methods will be discussed considering the concepts of diversity and selection of these approaches. The workshop will strive to bring together the practitioners of these approaches in an attempt to study a unified framework under which these interactions can be studied, understood, and formalized. Authors of the most insightful papers already accepted for publication, will be invited to submit an extended version of their work to a Special Issue of the Computational Intelligence journal (IF: 2.8). The following is a partial list of relevant topics (not limited to) for the workshop: Transfer learning and domain adaptation Optimization of cost functions for learning Bagging and boosting techniques Collaborative clustering and learning Hybrid systems Mixtures of distributions or experts Modular approaches Multi-task learning Multi-view learning Task decomposition … Format and activities We propose a Workshop composed of one or two invited speakers, a set of contributed papers and presentations, and a panel discussion around the presented works. Depending on the number of contributions, the workshop's duration would be from half a day to one day. Program Committee members Shantanu Joshi, University of California Los Angeles, USA Razvan Andonie, Central Washington University, USA Rosanna Verde, Università della Campania "Luigi Vanvitelli", Italy Rushed Kanawati, Sorbonne Paris Nord University Seichi Ozawa, Kobe University Engelbert Mephu Nguifo, Clermont Auvergne University Mourad El Hamri, Université Paris cité Nistor Grozavu, CY Cergy Paris University Nicoleta Rogovschi, Paris Descartes University Preliminary list of invited speakers: Shantanu Joshi, University of California Los Angeles, USA Stephane Chretien, University of Lyon, France Razvan Andonie, Central Washington University, USA

Workshop: IEEE Brain Workshop on AI for Neurotechnology
Organizer(s): Damien Coyle, Cuntai Guan, Nik Kasabov
Date: June 30, 2024
Time: 8:30 – 16:10
Room: 301
Abstract: Neural Networks and Computational Intelligence researchers have a lot to offer in terms of dealing with the challenges to create robust and trustworthy AI for Neurotechnology. The IEEE Brain AI for Neurotechnology workshop aims to bring together researchers specifically focused on neurotechnology with experts in AI to present and learn about the most recent advances in AI for neurotechnology data gathering and data sharing initiatives federated learning for privacy preserving model training building towards foundational models approaches

The workshop, associated with the Institute for the Augmented Human at the University of Bath will provide opportunities for AI and neural networks researchers to contribute to and benefit from improving neurotechnology with the latest advances in AI.

The workshop will include a keynote talk, invited speakers, a panel session and a poster session for papers submitted by delegates. Invited speakers will include this working at the cutting edge of applying Deep Neural Network Technologies to process brain data for neurotechnology applications.

There are prizes for best papers/poster.

According to IEEE Brain from whom we have sought sponsorship for this workshop (http://www.ieeebrain.org/), neurotechnologies represent the next technology frontier – the workshop is supported by the IEEE Brain Technical Community and IEEE CIS.

Workshop: AI Innovations for Education: Transforming Teaching and Learning through Cutting-Edge Technologies
Organizer(s): Irwin King, Danilo Mandic, Eyad Elyan and Zenglin Xu
Date: June 30, 2024
Time: 8:30 – 12:40
Room: 423
Abstract: In this workshop, we will explore the latest advancements in AI technology, with a particular focus on its applications in education. Our aim is to provide an in-depth understanding of how these innovations can revolutionize content creation, teaching methods, and assessments. Topics may include Augmented Reality (AR), Virtual Reality (VR), Gamification, Generative AI for content creation, language learning, administrative task automation, accessibility, automated grading and assessment systems, and Intelligent Tutoring Systems.

We will also discuss the practical challenges and ethical considerations related to integrating AI in education. This includes the potential impact of AI on job roles within the education sector, how AI can complement rather than replace teachers, and the importance of developing AI literacy among educators. The need for ongoing research and development in this field will also be emphasized.

The workshop will feature a keynote, a panel discussion, and invited talks. The keynote will underscore the workshop's theme, while the panel will probe into the future of AI in education, exploring potential advancements and their advantages for both educators and students. Invited talks will envision a future where AI holds a substantial role in education and discuss how we can prepare for this change.

Remember, the future of education lies at the crossroads of pedagogy and technology. Join us as we venture into this exciting future.

The workshop, associated with the Institute for the Augmented Human at the University of Bath will provide opportunities for AI and neural networks researchers to contribute to and benefit from improving neurotechnology with the latest advances in AI.

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FUZZ-IEEE Workshops

Workshop: Computational Intelligence in Human Informatics

Organizer(s): Javier Andreu-Perez; Satoru Hiwa; Tomoyuki Hiroyasu

Date: June 30, 2024 / July 3, 2024

Time: 8:30-12:40 / 14:20 – 18:00

Room: 316 / 213

Abstract: This workshop is a multi-conference event focused on Human Informatics. It is designed for researchers engaged in exploring and modelling human data through computational intelligence. This includes data gathered from real-world observations or experimental situations, with the aim of enhancing human-machine interfaces and deepening our understanding of human behaviours or biological processes. It further included computational theories aimed at improving the harmonious integration of AI and intelligent machines with humans. The goal is to enable these technologies to be effectively utilized by humans, to work collaboratively and in tandem with them, and to promote a deeper comprehension and collaboration between artificial intelligence and their human operators. The event will feature presentations by global experts and panel discussions. These sessions will delve into the newest advancements in computational intelligence within this research area. Additionally, there will be a focus on discussing the current challenges and trends in the field. Existing research can also be brought in for discussion with the community. This platform aims to foster a comprehensive exchange of ideas and insights among senior and early-career scientists in this intense field of research.

CEC Workshops

Workshop: Workshop on Computational Intelligence Applications
Organizer(s): Hiroyuki Sato, Akira Oyama, Ohta Yoshihiro, Takehisa Kohira, Takakuni Minewaki, and Masaya Nakata.
Date: July 2, 2024
Time: 8:20 - 18:40
Room: 213
Abstract: In this workshop, we discuss research related to computational intelligence, mainly evolutionary computation. Computational intelligence is attracting attention as a way to tackle complex and large-scale real-world problems and reduce human intervention. The objectives of this workshop are to share real-world applications using computational intelligence and their methodologies and intensively discuss things that can be, cannot be, and should be done by computational intelligence. Although the main topic is evolutionary computation, other computational intelligence methodologies can be discussed in this workshop to advance the research in this domain further. Each speaker in this workshop can make a presentation with/without paper submission. Organizers will make a proceeding including the submitted papers and share only among the participants of this workshop.

Workshop: Workshop on Search and Selection in Continuous Domains
Organizer(s): Stephen Chen and Marjan Mernik
Date: June 30, 2024
Time: 14:10 – 18:20
Room: 423
Abstract: A recurring theme in metaheuristics research is to consider the balance between Exploration and Exploitation. An often forgotten area of research is the effect of Selection on Search/Exploration. It is noted that Selection has the ability to turn any search process into a hill climber by rejecting all exploratory search solutions (and keeping only exploitative solutions). The first goal of this workshop will be to reanalyze current metaheuristics from the perspective of selection (as opposed to exploration and/or an underlying metaphor). Subsequent results/goals include a selection-based taxonomy for the explosion of metaphor-based metaheuristics, tools to accurately measure exploration and the effects of selection on exploratory search solutions, the identification and categorization of selection errors, and suggestions for future methods of selection and metaheuristic design.

Workshop: Workshop on Multimodal Optimization for Machine Learning
Organizer(s): Jing Liang, Caitong Yue, Kunjie Yu, Ying Bi
Date: July 4, 2024
Time: 14:20-18:40
Room: 211+212
Abstract: The theme of this workshop is the use of multimodal optimization for machine learning, covering ALL different evolutionary computation-based techniques paradigms for machine learning. The aim of this workshop is to investigate both the new theories and applications in different multimodal optimization paradigms for machine learning. This workshop will bring together researchers and practitioners from around the world to discuss the latest advances in the field and will act as a major forum for the presentation of recent research.

Workshop: Privacy-Preserving and Fairness-Aware Optimization
Organizer(s): Xilu Wang, Shiqing Liu, Xiangyu Wang, Yaochu Jin, Ulrich Rückert
Date: July 4, 2024
Time: 8:30 – 16:40
Room: 213
Abstract: Optimization problems widely exist in many economic, scientific and engineering applications. Evolutionary optimization algorithms have been extensively studied and achieved remarkable results in the fields of mathematics, operations research and computer science. A common implicit assumption in most existing optimization methods is that all resources for an optimization task are available and stored on a single device. Unfortunately, the assumption is violated in many applications with the growing storage of personal data and computational power of edge devices. Furthermore, jointly addressing optimization tasks among multiple edge devices with distributed data raises concerns about data security, privacy protection and fairness. As a result, it is crucial to develop new optimization paradigms to leverage the power of distributed computing and storage.

Over the past years, federated learning has become a popular machine learning paradigm that can leverage distributed data without leaking sensitive information. This is achieved by constructing a global model by aggregating local models separately trained on different devices/clients using local data. In contrast to federated learning, privacy preserving optimization has received much less attention. For data-driven optimization, it could be affected by data or algorithmic bias and thus generate unfair results: when the objective function values are correlated with real-world rewards (e.g., money), parties may be hesitant to collaborate if they risk incurring smaller real-world rewards than others. Hence, addressing the potential unfairness problems in optimization is also vital for building a positive and sustainable ecosystem, highlighting the need for new optimization techniques.

Workshop: The Evolutionary Computation in Health (TECH)
Organizer(s): Neil Vaughan
Date: July 1, 2024
Time: 14:20 – 16:20
Room: 213
Abstract: This Evolutionary Computation for Healthcare workshop (TECH-2024) is multidisciplinary, bringing together AI and Healthcare researchers working in the fields of personalised medicine, medical devices; clinical diagnostics, and patient monitoring by applying advanced genetic and evolutionary computation techniques to address critical problems in digital healthcare and medical applications.

The Evolutionary computation for health (TECH) and novel AI solutions, offer the next generation of healthcare solutions, when the demand on health systems and hospitals worldwide is increasingly becoming unsustainable. As the mode of treatment turns from the hospital to the home, there has been a particular focus on AI and EC for personalized medicine in the hope of improving patient care and reducing costs.

Topics of interest include (not exhaustive):

• Medical imaging

• Medical signal processing

• Medical text analysis

• Clinical diagnosis and therapy

• Data mining medical data records

• Clinical expert systems

• Modelling and simulation of medical processes

• Drug description analysis

• Genomic-based clinical studies

• Patient-centric care

• Patient/hospital management optimization

Competitions

CEC Competition Session 1

Date: July 1, 2024
Time: 8:20 – 9:40
Room: 213

Competition: Competition on Multiobjective Neural Architecture Search Challenge for Real-Time Semantic Segmentation
Website: https://www.emigroup.tech/index.php/news/ieee-cec-2024-competition-on-multiobjective-neural-architecture-search/

Competition: Competition on Super Large-scale Multiobjective Optimization for Status Assessment of Measuring Equipment
Website: https://github.com/ChengHust/IEEE-CEC-2024-Competition

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CEC Competition Session 2

Date: July 3, 2024
Time: 16:40 – 18:00
Room: 419

Competition: Competition on Constrained Multiobjective Optimization
Website: http://www5.zzu.edu.cn/ecilab/info/1036/1354.htm

Competition: Competition on Numerical Optimization (Single/Multi-Objectives, with and without constraints)
Website: https://github.com/P-N-Suganthan/2024-CEC

Competition: Competition on Fuzzy AI agent for Python game Kessler
Date: June 30, 2024
Time: 14:10 – 16:10
Room: 213
Website: https://xfuzzycomp.github.io/XFC/

Competition: 2024 IEEE CIS Student Grand Competition on Computational Intelligence in Biomedicine and Healthcare
Date: June 30, 2024
Time: 13:00 – 17:00
Room: 418

Competition: A Sandbox for Teaching and Learning in QCI for Pre-University and Undergraduate Students
Date: June 30, 2024
Time: 8:30 – 18:20
Room: 419
Website: https://sites.google.com/asap.nutn.edu.tw/ieee-wcci-2024/

Competition: Competition on Multi-Objective Black-Box Optimization Benchmarks in Human-Powered Aircraft Design
Date: July 1, 2024
Time: 16:40 – 18:40
Room: 213
Website: https://ec-comp.jpnsec.org/competitions/wcci2024

Panels

Panel: Explainable Artificial Intelligence - Recent Developments and Future Aspirations
Chair(s): Jonathan Garibaldi
Panelist(s): Keeley Crockett, Hussein Abbass, Alexander Gegov, Uzay Kaymak, Joao Sousa
Date: July 3, 2024
Time: 14:20 – 16:20
Room: 503
Explanation: The purpose of this panel session is to provide an open forum for discussing a wide range of important aspects of Explainable Artificial Intelligence (XAI) such as informativeness, trustworthiness, fairness, transparency, causality, transferability, reliability, accessibility, privacy, safety, verifiability and accountability.

Building citizen trust in Artificial Intelligence (AI) products and services requires clear responsibility and accountability pipelines. Human centred explainability is a key aspect of accountability and clear communication of how and why automated decisions are made requires user facing approaches. The panel will discuss explanations from a user perspective and why a mutual language of understanding about AI is important.

The topics discussed at the panel will cover technical aspects of XAI that may include local and global scope, specific and agnostic models, as well as aspects of constructive, what-if, counterfactual and example-based explanations.

Potential topics within the scope of the panel will include aspects related to real world bias of AI, how this bias is reflected in data bias, the encoding of data bias in algorithmic bias, its uncovering by XAI, and how the latter can then be used for closing the loop by mitigating real world bias.

The panel will also explore current challenges and future perspectives in XAI that may include formalisation and evaluation of explanations, their adoption in industry, their potential for improving human machine collaboration as well as their ability to facilitate collective intelligence, responsibility, security and causality in AI.

The actual selection of topics covered will be guided by the questions from the audience.

Panel: IEEE Standards Developments: Recent Advancements and Hot Topics
Chair(s): Bruno DiStefano and Robert Kozma
Panelist(s): Edward Au, Plamen Angelov, Autilia Vitiello
Date: July 1, 2024
Time: 16:20 – 18:40
Room: 301+302
Explanation: The Panel addresses the importance of standards in modern technologies overall, and describes the goals of IEEE Standards Association (SA), in particular. Target audience goes beyond volunteers who are actively involved in standards development at present. We reach out to a wide range of researchers and scientists, academic and industry experts, and describe that involvement in standards can be very beneficial for their professional development, their IEEE membership grades, including Fellows. We also involve young researchers, who are interested in learning about this important technical activity and potentially would get involved in it in the future.

The covered topics include: (i) Main features and advantages of standards development by IEEE SA, considering today's diverse field of Standards Development Organizations (SDOs). (ii) The key role of standards in Strategic Planning of IEEE and other organizations aiming at maintaining cutting edge expertise in technologies. (iii) Common threads and specifics in various industrial segments and geographic regions. (iv) Successful Standards Working Groups (SWGs) in CIS SC, such as Fuzzy Markup Language (FML) SWG, eXtensible Event Streams (XES) SWG, Explainable AI (XAI) SWG, and Video Games Vocabulary (VGV) SWG. (v) Present challenges in standards developments and hot topics, including public perception and ethical issues surrounding AGI, ChatGPT, and computational intelligence, in general.

Panel: Inside the Editorial Room: Conversations with CIS Editors-in-Chief
Chair(s): Kay Chen Tan
Panelist(s): Hussein Abbass, Yiu-ming Cheung, Carlos A. Coello Coello, Jonathan Garibaldi, Yongduan Song, Huajin Tang, Chuan-Kang Ting, Dongrui Wu, Georgios N. Yannakakis
Date: July 2, 2024
Time: 8:20 – 10:00
Room: 301+302+303+304
Explanation: The purpose of the Editors-in-Chief Panel Session is to create a forum where Editors-in-Chief from CIS Transactions/Magazine can share their insights, experiences, and best practices in academic publishing with the conference attendees. As the academic publishing landscape evolves rapidly, this panel discussion will shed light on the latest trends, challenges, and opportunities in the field.

During this panel session, attendees can engage with the Editors-in-Chief as they delve into a range of pertinent topics. The discussion will cover evolving trends in academic publishing and their implications for research dissemination, ethical considerations and best practices for authors, reviewers, and editors; strategies for successful manuscript submission, review, and publication; addressing issues related to peer review, plagiarism, and scientific misconduct, and the importance of collaboration between researchers and journals.

Panel: Can AI Craft AI Inspired by the Brain?: Insights from the Fathers
Chair(s): Hiroshi Yamakawa
Panelist(s): Kunihiko Fukushima, Shunichi Amari, Shiro Takagi
Date: July 3, 2024
Time: 14:20 – 16:20
Room: 301+302
Explanation: In recent years, neural network research has seen remarkable development of Transformer-based models, including large-scale language models, basic models, and generative AI. However, current technological advances may be approaching their limits, and it remains to be seen whether the realization of advanced AI, such as Artificial General Intelligence (AGI), is possible using only existing methods. This may be partly due to the inability to rapidly expand the readily available data.

This panel invites two pioneers in neural network-based AI to explore whether insights from neuroscience can be incorporated into future AI research. The session will begin with a talk by Kunihiko Fukushima. He will discuss lessons learned from AI and its contributions to the technology behind deep learning. Shiro Takagi will then talk about the current state of the art in this field and present the current state and potential of AI research conducted by AI itself. In addition, Shunichi Amari, author of "The New Era of AI," will address a wide range of topics related to evolving AI research in light of the rapid progress of AI.

The panel discussion will delve into AI's impact on AI researchers' work and the evolution of AI research methods. Through this discussion, we aim to explore AI's future of AI research and humans' evolving role in this research domain. Ultimately, this panel discussion will provide valuable insights to the participants and catalyze specific action plans and new research directions for the future of AI research.

Panel: How to Improve and Promote EC Research and EC Conferences
Chair(s): Yaochu Jin and Mengjie Zhang
Panelist(s): Carlos Coello Coello, Kalyanmoy Deb, Hisao Ishibuchi, Yew Soon Ong, Kay Chen Tan, Bing Xue
Date: July 2, 2024
Time: 14:20 – 16:20
Room: 418
Explanation: In recent years, neural network research has seen remarkable development of Transformer-based models, including large-scale language models, basic models, and generative AI. However, current technological advances may be approaching their limits, and it remains to be seen whether the realization of advanced AI, such as Artificial General Intelligence (AGI), is possible using only existing methods. This may be partly due to the inability to rapidly expand the readily available data.

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Panel: What will bring AI towards AGI?
Chair(s): Hava Siegelmann and Robert Kozma
Panelist(s): Hiroshi Yamakawa, Jose Principe, Roy Siegelmann, Alvaro Velasquez, Don Wunch
Date: July 1, 2024
Time: 14:20 – 16:20
Room: 301+302
Explanation: Artificial General Intelligence (AGI) is the not-yet-achieved goal of highly capable systems which can do far more than static classification, playing computer games or operating robot in sterile environments. The strong definition of AGI is a system that is more intelligent than all humanity together, since it will learn all expertise that any person can have, and as such will be able to solve all problems of the world. The weak definition of AGI includes systems capable of performing a wide array of human-like abilities – such as perhaps walking, speaking, and

creating new ideas, rendering them practical to safely perform a variety of tasks including in complex, real-world environments. We will boldly consider the feasibility of both AGI definitions and what steps the community can take to advancing AI to be more general that it is now. Among questions we will ask:

- Is the strong AGI possible, or is it a religious fantasy for people who push the belief in God and want to find a substitute through technology?
- Does the development of Large Language Models change our way in believing or accepting the future of AGI?
- Is the Turing computing enables the existence of AGI? Or does it necessitate the Super-Turing computation?
- What inherent changes do we need to do in our research directions within AI to enable it to develop into AGI? What are the serious hurdles?
- If AI is that strong, how will our world change? Are these changes desirable? What developments are required to improve the chance of good-to-humanity usage?

Panel: Envisioning the Future: Continuing the Legacy of Professor Michio Sugeno
Chair(s): Isao Hayashi
Panelist(s): Kaoru Hirota, Katsushige Fujimoto, Kazuo Tanaka, Ichiro Kobayashi, Hiroshi Nakajima
Date: June 30, 2024
Time: 16:20 – 18:20
Room: 211+212
Explanation: Professor Michio Sugeno (Emeritus, Tokyo Institute of Technology), 83, passed away on August 9th, 2023. He has long been a world authority in the field of fuzzy theory and applications, with countless outstanding achievements ranging from fuzzy measure/Sugeno integral to fuzzy control and everyday language computing. For his achievements, he received the IEEE CIS Fuzzy Systems Pioneer Award in 2000, the IEEE Frank Rosenblatt Award in 2010, and the IEEE Systems, Man, and Cybernetics (SMC) Society's Lotfi A. Zadeh Pioneer Award in 2017 to name a few. His legacy is not only his research achievements but also his attitude and philosophy toward research. This panel welcomes professors closely related to Prof. Sugeno as panelists to discuss the future of the three significant achievements in fuzzy theory that he had developed. Furthermore, this panel also shares his memories and the future that he would have envisioned with the audience.

IEEE CIS Student and Early Career Mentoring Program

Event: Paper Development Workshop (PDW)
Date: July 1, 2024
Time: 14:20 – 16:20
Room: 211+212
Abstract: The purpose of the PDW is to provide the mentoring program's participants the opportunity to hear from and engage with the editorial team(s) from the IEEE CIS flagship journals. The focus of the PDW is for potential authors to learn about paper development for publication in top journals and get hands-on feedback on their own papers. At WCCI 2024, the PDW will be run by members (Editors-in-Chief and Associate Editors) of the IEEE Transactions on Evolutionary Computation (TEC) and IEEE Transactions on Fuzzy Systems (TFS), editorial teams, offering both an overview of the journal and its priorities, as well as small-group, hands-on sessions for participants.

IEEE CIS Young Professionals

Event: Young Professionals Session
Date: July 4, 2024
Time: 8:30 – 10:10
Room: 211+212
Website: https://aingames.cn/wcci2024-yp/

Tutorials

IJCNN Tutorials

Tutorial: Dynamic Programming (DP) for AI with DP Perceptions of Back-Propagation
Organizer(s): Eiji Mizutani
Date: June 30, 2024
Time: 10:40 – 12:40
Room: 311+312
Abstract: In this tutorial, we begin with a quick review of various DP principles for AI including A* search (using cost-so-far and cost-to-go values), dynamic time warping (DTW) for pattern recognition, and temporal-difference reinforcement learning (TDRL) including Q-learning. Then, for neural-network learning, we show an efficient derivation of standard back-propagation (BP) using a nominal state-action Q-value-to-go function in the spirit of DP. We also show how BPTT (back-propagation through time) for recurrent networks will be derived in the same manner as well as for fully-connected cascaded networks.

As an application, we describe a constrained Markov decision process (MDP) problem, in which we first show a standard state-augmenting DP approach and then highlight how a recurrent network function approximation can be employed for model-free TDRL with no state augmentation.

Tutorial: Methods for Learning with Few Data
Organizer(s): Marcus Liwicki; Prakash Chandra Chhipa; Richa Upadhyay
Date: June 30, 2024
Time: 14:10 – 16:10
Room: 302
Abstract: Deep Neural Networks are data hungry, they require millions of labelled data in order to work! — Really? — The last decade has shown useful approaches to work with less labelled data, either by having a lot of data from a similar domain or by letting the network learn meaningful representations without explicit supervision. This tutorial first brings self-supervised learning to a general perspective of learning with few data, covering typical transfer learning and auto-encoder approaches or perceptual loss. Furthermore, the tutorial will investigate some typical (mis-) conceptions of these methods and suggest some practical tips on how to learn with few data. By participating in this tutorial, you will get deep insights in representation learning and learning with few data, as well as practical tools to start working on data in your own domain.

Tutorial: Efficient and Secure Foundation Models
Organizer(s): Minjing Dong; Daochang Liu; Chang Xu
Date: June 30, 2024
Time: 14:10-16:10
Room: 303
Abstract: With the development of machine learning algorithms, more and more challenging tasks can be well-addressed by foundation models, such as Vision Transformers in computer vision tasks, BERT in natural language processing tasks, diffusion models in generative tasks, etc. These models, while achieving remarkable performance, face challenges related to efficiency and security. This tutorial aims to provide a comprehensive exploration of these foundation models, emphasizing their role in addressing real-world applications, and discussing their potential issues as well as current solutions regarding efficiency and security.

Tutorial: From Natural Language Processing to Technical Language Processing
Organizer(s): Marcus Liwicki; Karl Löwenmark; Fredrik Sandin
Date: June 30, 2024
Time: 10:40 – 12:40
Room: 303
Abstract: Narrow AI systems have achieved super-human performance in Natural Language Processing (NLP) - this is at least, what some big companies state and publish. But in most applications, specifically in industrial context, we cannot observe a major adoption of NLP methods. Domain-specific data, technical terms, and expectations for perfect performance are hindering the wide-spread use of NLP.

This tutorial will give a short overview of the recent developments in NLP and introduces into the area of technical language processing. Methods for dealing with technical terms, adapting to specific domains, and integrating log data and sensor values will be presented. Furthermore, this tutorial presents langchain and it's usage in practice to create context-aware, reasoning large language model applications in industrial contexts and beyond.

Tutorial: Instance Space Analysis for Rigorous and Insightful Algorithm Testing
Organizer(s): Kate Smith-Miles; Mario Andrés Muñoz
Date: June 30, 2024
Time: 14:10 – 16:10
Room: 316
Abstract: This hands-on tutorial introduces Instance Space Analysis (ISA), a methodology for experimental evaluation of algorithms, by making use of the on-line tools available at the Melbourne Algorithm Test Instance Library with Data Analytics (MATILDA - https://matilda.unimelb.edu.au). ISA offers a more nuanced opportunity to gain insights into algorithm strengths and weaknesses for various types of test instances, and to objectively assess the relative power of algorithms, free from any bias introduced by the choice of test instances. An instance space is constructed whereby test instances can be visualised as points in a 2d plane, with algorithm footprints identified as the regions of predicted good performance of an algorithm, based on statistical evidence from empirical testing. From this view of a broad instance space, including the theoretical boundary where additional test instances could exist, we can assess the diversity of a chosen test set, and gain much needed insights into how structural properties of various instances influence the strengths and weaknesses of algorithms. Moreover, through ISA we can identify where additional test instances would be valuable to support greater insights. By setting target points in the instance space, new test instances with controllable properties can be generated to fill the instance space, enabling algorithms to be comprehensively "stress-tested" under all possible conditions.

Tutorial: Learning from Imbalanced Data Streams
Organizer(s): Alberto Cano
Date: June 30, 2024
Time: 10:40 – 12:40
Room: 302
Abstract: This tutorial covers the many challenges in learning from data streams with imbalance, including data-level difficulties, concept drift, and the data and algorithm level approaches to address these issues. The tutorial will provide an overview of the state of the art, discuss benchmarks and performance metrics, and will give the participants the code of a framework for evaluating and comparing algorithms for imbalanced data streams. The tutorial can have a duration between 2 and 4 hours.

Tutorial: A Comprehensive Tutorial on Active Learning: Strategies and Applications
Organizer(s): Alaa Othman
Date: June 30, 2024
Time: 8:30 – 10:30
Room: 303
Abstract: This tutorial provides a comprehensive exploration of active learning strategies in machine learning and covers key aspects such as active labeling, active class selection, active feature detection and their integration with deep learning. Participants will gain practical insights into optimizing model performance through strategic data annotation, dealing with uncertainty, and effective use of active learning techniques. The tutorial aims to demystify the basics of active learning and make it accessible to both beginners and practitioners. Join us as we dive into the basics and advanced applications of active learning to unlock its potential for improving machine learning models.

Tutorial: TinyML: An Introduction to Machine Learning on Tiny Devices
Organizer(s): Massimo Pavan; Manuel Roveri
Date: June 30, 2024
Time: 10:40 – 12:40
Room: 304
Abstract: Long considered an impossible task, the execution of Machine and Deep Learning algorithms on tiny devices is becoming more and more feasible every day. Following the computing-everywhere paradigm, the pervasive diffusion of smart, tiny devices (such as Internet-of-things or edge computing devices), is expected to become pervasive in the next few years. Achieving this goal requires a complete redesign of the standard machine and deep learning solutions that until now have been primarily targeting high level hardware.

The tutorial will introduce TinyML models and algorithms, deepening their architectures and the optimizations that enable their execution on tiny devices. A specific focus will be given to the execution of neural networks and deep learning algorithms on tiny devices and approximate computing solutions, such as quantization, pruning and knowledge distillation, will be introduced. This algorithmic deepening will be complemented by a hands-on session, in which the attendees will be introduced to the implementation and porting of TinyML models on tiny devices with a specific focus on the wake-word detection application scenario, a widely used solution in TinyML applications.

Tutorial: Hypercomplex Neural Networks for Multidimensional Data
Organizer(s): Danilo Comminiello; Clive Cheong Took; Danilo Mandic
Date: June 30, 2024
Time: 14:10 – 16:10
Room: 313
Abstract: Hypercomplex algebras have recently become popular in the field of deep neural networks due to their properties that lead to superior results when dealing with multidimensional data in real-world 3D and 4D paradigms.

This tutorial provides a foundational framework that serves as a roadmap for understanding why hypercomplex neural networks are so successful and how their potential can be exploited. Such a theoretical framework is described in terms of inductive bias, i.e., a collection of assumptions, properties, and constraints that are built into training algorithms to guide their learning process toward more efficient and accurate solutions. In the hypercomplex domains, which deal with numbers and data structures beyond the complex numbers, specific inductive biases can be derived to handle the unique properties of such domains as well as the structures of multidimensional data. This novel perspective for hypercomplex deep networks promises to both demystify this class of methods and clarify their powerfulness, under a unifying framework. We show how to develop neural networks in the hypercomplex domain to deal with a wide variety of classic and emerging applications. This may boost the prominence of hypercomplex models as viable alternatives to classical neural networks for multidimensional data.

The tutorial is divided in 5 main parts involving both theoretical and practical aspects of hypercomplex deep learning. Danilo P. Mandic will introduce the topic, problems and motivation, and will explain why hypercomplex models are so advantageous for complex problems. Clive Cheong Took will then talk about the fundamental tools required for the hypercomplex domain in terms of calculus, functions, and statistics, and their exploitation in neural networks. The most popular and important models in the hypercomplex domain will be introduced. Danilo Comminiello will provide an in-depth explanation of inductive biases and why hypercomplex neural networks can provide outstanding results for multidimensional data. Then, an extension of these models is presented to generalize the hypercomplex properties regardless of the dimensionality of the signals. All the speakers will then cover some of the possible applications on which we can successfully apply hypercomplex neural networks. Danilo Mandic will close the tutorial providing a view on future possibilities in this field.

Tutorial: Causal Reinforcement Learning: Empowering Agents with Causality
Organizer(s): Zhihong Deng; Jing Jiang; Chengqi Zhang
Date: June 30, 2024
Time: 14:10 – 16:10
Room: 311+312
Abstract: Reinforcement learning has made significant progress in solving sequential decision problems under uncertainty. However, reinforcement learning agents generally lack a fundamental understanding of the world and must therefore learn from scratch through numerous trial-and-error interactions. They may also face challenges in providing explanations for their decisions and generalizing the acquired knowledge. Causality presents a promising approach to address these issues by formalizing knowledge in a systematic manner and leveraging invariance for effective knowledge transfer. This tutorial aims to comprehensively review the emerging field of causal reinforcement learning. We will introduce the basic concepts of causality and reinforcement learning and demonstrate how causality can enhance traditional reinforcement learning algorithms. The tutorial will categorize and systematically review existing causal reinforcement learning approaches based on their target problems and methodologies. We will also outline open issues and future research directions to foster the continuous development and application of causal reinforcement learning in real-world scenarios. We believe that this tutorial will contribute significantly to the machine learning community, offering a unique perspective on integrating causality into reinforcement learning and providing participants with valuable knowledge to explore this emerging field.

Tutorial: Explainable AI (XAI) for Computer Vision – A Review of Existing Methods and a New Method to Extract a Symbolic Model from a CNN Model
Organizer(s): Asim Roy
Date: June 30, 2024
Time: 14:10 – 16:10
Room: 304
Abstract: Along with the advent of deep learning and its quick adoption, there is concern about using models that we don't really understand. And because of this concern, many critical applications of deep learning are hindered. The concern about transparency and trustworthiness of these models is so high that it is now a major research focus of Artificial Intelligence (AI) programs at funding agencies like DARPA and NSF in the US. If we can make deep learning explainable and transparent, the economic impact of such a technology would be in the trillions of dollars.

One of the specific forms of Explainable AI (XAI) envisioned by DARPA includes the recognition of objects based on identification of their parts. For example, the form requires that to predict an object to be a cat, the system must also recognize some of the specific features of a cat, such as the fur, whiskers, and claws. Object prediction contingent on recognition of parts provides additional verification for the object and makes the prediction robust and trustworthy.

The first part of this tutorial will review some of the existing methods of XAI in general and then those that are specific to computer vision.

The second part of this tutorial will cover a new method that decodes a convolutional neural network (CNN) to recognize parts of objects. The method teaches a second model the composition of objects from parts and the connectivity between the parts. This second model is a symbolic and transparent model. Experimental results will be discussed including those related to object detection in satellite images. Contrary to conventional wisdom, experimental results show that part-based models can substantially improve the accuracy of many CNN models. Experimental results also show part-based models can provide protection from adversarial attacks. Thus, a school bus will not become an ostrich with the tweak of a few pixels.

Tutorial: Deep Learning for Graphs
Organizer(s): Davide Bacciu
Date: June 30, 2024
Time: 16:20-18:20
Room: 311+312
Abstract: The tutorial will introduce the audience to the area of deep learning on graph data and some of its most compelling research challenges. Current models dealing with graph data almost inevitably leverage a neural message-passing like approach. We will first introduce the foundations of such an approach and discuss its reference literature models. Then we will identify and discuss the limitations of these approaches and the research opportunities that are stemming from this. In this second part, we will cover research topics under development in the community, touching upon generative models, neural graph ODEs, dynamic graphs and algorithmic reasoning.

Tutorial: Collaborative Learning and Optimization
Organizer(s): A. Kai Qin
Date: June 30, 2024
Time: 8:30 – 10:30
Room: 304
Abstract: Machine learning (ML) and optimization are two essential missions that Computational Intelligence (CI) aims to address. Accordingly, many CI-based ML and optimization techniques have been proposed, where deep neural networks (used for ML) and evolutionary algorithms (used for optimization) are the most well-known representatives. Intrinsically, CI-based ML and optimization are closely related. On the one hand, CI-based ML consists of various model-centric or data-centric optimization tasks. On the other hand, CI-based optimization is often formulated into ML-assisted search problems. In recent years, there emerges a new research frontline in CI, as the proposed title (COLO), which studies how to synergise CI-based ML and optimization techniques while unleashing the unprecedented computing power (e.g., via supercomputers) to generate more powerful ML and optimization techniques for solving challenging problems. This tutorial aims at introducing this newly emerging research direction. Specifically, we will first introduce CI, CI-based ML and optimization techniques, and their relationships, and then describe COLO from three aspects, i.e., how to make use of ML techniques to assist optimization (Learn4Opt), how to leverage optimization techniques to facilitate ML (Opt4Learn), and how to synergise ML and optimization techniques to deal with real-world problems which involve ML and optimization as two indispensable and interwoven tasks (LearnOpt), where the most representative research hotspot in each of these three aspects, i.e., automated construction of deep neural networks, data-driven evolution optimization, and predictive optimization will be discussed in detail.

Tutorial: Prospects and Limits of Generative Artificial Intelligence for Medical Systems: Intelligent Healthcare
Organizer(s): Eros G Pasero
Date: June 30, 2024
Time: 16:20 – 18:20
Room: 314
Abstract: The elderly population's increasing numbers, dwindling healthcare resources, and the perilous doctor-patient contact due to pathologies like COVID-19 signal a need for a shift in the current medical model. Yet, the question remains: what new model to adopt? Artificial Intelligence (AI), the foundation of contemporary life changes, pledges a transformative impact on patient care and the healthcare system. However, the genuine challenge lies in devising a practical model to curb the escalating demand for elderly operations amidst a larger populace with fewer health issues. The potential frontier emerges in Generative Artificial Intelligence, offering fresh data and models for future healthcare systems. These systems facilitate the interpretation of outcomes and the generation of personalized medicine. Leveraging digital twins, models can discern the treatment effects on patients through their digital counterparts. Additionally, AI wearable technology in virtual hospitals enables the remote monitoring of multiple patients within their homes. An overarching query persists: can these systems earn trust in medicine? Questions revolve around the accuracy, precision, sensitivity, ROC curve, and F-score of data produced by generative AI. Addressing these concerns, the latter part of this tutorial will contribute insights, utilizing metrics common in the world of Metrology

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Tutorial: Conscious Learning vs. Deep Learning
Organizer(s): Juyang Weng
Date: June 30, 2024
Time: 8:30 – 10:30
Room: 302
Abstract: Autonomous development needs a general-purpose theory. Experimental studies require such a theory. Consciousness seems not a wishful add-on to AI, but instead a necessary condition toward strong AI. Unfortunately, consciousness has been largely overlooked or deliberately avoided in AI research. This situation resulted in a major weakness in many well-known neural networks, such as deep learning and ChatGPT. This tutorial will teach basic knowledge about biologically inspired neural networks that enables on-the-fly learning for the three bottleneck problems in AI, Vision, Audition, Natural Languages, plus subjects that have been extremely challenging for neutral networks but are necessary, such as planning and machine thinking. All these subjects are essential for conscious learning. This tutorial will also compare with deep learning, ChatGPT, and evolutional computation that suffer from Post-Selection misconduct. More updated detail of Conscious Learning is available at https://doi.org/10.21203/rs.3.rs-1700782/v2

Tutorial: Neural Network Design and Optimization for 3D Point Cloud Computing
Organizer(s): Wei Gao; Ge Li
Date: June 30, 2024
Time: 10:40 – 12:40
Room: 313
Abstract: 3D point cloud computing has become very popular in both academia and industry communities, due to its powerful modeling capability for 3D real world with high-precision geometry and attributes. Deep learning-based 3D point clouds can bring better visual experience and machine vision performance, where neural network design and optimization play a critical role for efficient compression, enhancement and analysis of this new type of data.

Tutorial: Ethical Risks and Challenges of Computational Intelligence
Organizer(s): Jim Tørresen; Xin Yao
Date: June 30, 2024
Time: 8:30 – 10:30
Room: 313
Abstract: Artificial intelligence (AI) has entered an increasing number of different domains. A growing number of people – in the general public as well as in research – have started to consider a number of potential ethical challenges and legal issues related to the development and use of AI technologies. There have been related initiatives across the globe, such as the High-Level Expert Group on Artificial Intelligence (AI HLEG) appointed by the European Commission that has a general goal of supporting the implementation of the European Strategy on Artificial Intelligence. This has been followed up with the proposal of the European Artificial Intelligence Act (AIA) and the New Machinery Directive (MD), focusing on developing a framework for trustworthy Artificial Intelligence within Europe, laying down harmonised rules for both AI systems with and without a physical layer (e.g., chatbots vs. robots etc.). This tutorial will give an overview of the most commonly expressed ethical challenges and ways being undertaken to reduce their negative impact using the findings in an earlier undertaken review (https://www.frontiersin.org/articles/10.3389/frobt.2017.00075/full) and an overview paper of Artificial Intelligence Ethics
(https://www.computer.org/csdl/journal/ai/5555/01/09844014/1Fnr097UNd6), supplemented with recent work and initiatives.

Among the most important challenges are those related to privacy, fairness, transparency, safety and security. Countermeasures can be taken first at design time, second when a user should decide where and when to apply a system and third when a system is in use in its environment. In the latter case, there will be a need for the system by itself to perform some ethical reasoning if operating in an autonomous mode. This tutorial will introduce some examples from our own and others´ work and how the challenges can be addressed both from a technical and human perspective with special attention to problems relevant when working with AI research and development. AI ethical issues should not be seen only as challenges but also as new research opportunities contributing to more sustainable, socially beneficial services and systems. The tutorial is an updated version of the one given in IJCNN 2023: https://2023.ijcnn.org/tutorials

Tutorial: A Guided Tour of Neural Architecture Search
Organizer(s): Szymon Lukasik; Bing Xue
Date: June 30, 2024
Time: 8:30 – 10:30
Room: 311+312
Abstract: In the ever-evolving landscape of Artificial Intelligence, Deep Learning has emerged as a dominant force, revolutionizing industries and scientific research. However, the success of neural networks-based methods crucially depends on finding the right network architecture—a task that has proven vital and challenging.

The tutorial will aim to provide a comprehensive guide on Neural Architecture Search a category of methods designed to adapt the structures of the network to the problem at hand. We will explore various approaches for NAS, including reinforcement learning-based methods, evolutionary algorithms, and gradient-based optimization techniques. Participants will gain an understanding of the theoretical foundations and practical implications of each approach. Through case studies and practical demonstrations, attendees will also learn about state-of-the-art NAS methods. To facilitate hands-on learning, the tutorial will provide code snippets and practical examples that attendees can readily incorporate into their research and projects. These resources will empower participants to apply NAS techniques to their datasets and problems.

As a follow-up to the highly successful WCCCI 2022 keynote, this tutorial will be primarily intended for early-career researchers and graduate students who are beginning their journey in Deep Learning. Its role will be to serve as a foundational resource, equipping them with the expertise needed to explore NAS.

Tutorial: In-Material Physical Computing
Organizer(s): Takuya Matsumoto; Tsuyoshi Hasegawa; Hirofumi Tanaka; Ryosho Nakane; Seiya Kasai; Akira Hirose
Date: June 30, 2024
Time: 16:20 – 18:20
Room: 316
Abstract: This tutorial will provide an introduction to "computing based on material", which utilizes the inherent structure and properties in materials to perform in-situ environmental recognition such as speech and text. The talks will be given by leading researchers in a wide range of fields, from theoretical background to applications to devices and robotics using inorganic, organic, and nanomaterials. This tutorial contains six talks: 1. Overview – theory and applications, 2. Physical computing based on dynamics in analog electronic devices and circuits, 3. Reservoir computing with spin waves: how to leverage waves in materials, 4. Electrolyte-based physical reservoir computing, 5. Molecular physical computing, 6. Material physical reservoir computing with chemical dynamics.

Tutorial: Quantum Tensor Networks in Machine Learning and Artificial Intelligence
Organizer(s): Jun Qi, Ying-Jer Kao, Samiel Yen-Chi Chen, Mohammadreza Noormandipour
Date: June 30, 2024
Time: 16:20 – 18:20
Room: 313
Abstract: Quantum tensor networks, along with their applications in classification, time-series modeling, and natural language processing, signify a burgeoning and interdisciplinary field within the realms of quantum computing and machine learning. This tutorial strives to empower researchers in the fields of machine learning and artificial intelligence by offering insights and tools to explore this cutting-edge domain, presenting accessible entry points and illustrative code samples.

CEC Tutorials

Tutorial: What You Always Wanted to Know About Evolution Strategies, But Never Dared to Ask
Organizer(s): Hans-Georg Beyer
Date: June 30, 2024
Time: 8:30 – 10:30
Room: 411+412
Abstract: While Evolution Strategies (ES) are widely known as one of the streams of evolutionary computation and are meanwhile regarded as a competitive alternative to standard learning techniques in Reinforcement Learning, most people associate ES with the covariance matrix evolution strategy.

However, there is more than just this particular evolutionary algorithm designed for unconstrained real-valued search spaces.

This introductory tutorial provides a broader perspective and view stressing the design philosophy of Evolution Strategies being not restricted to a specific search space, such as unconstrained real-valued optimization, but also includes discrete and combinatorial search spaces. This philosophy can be best understood from the ES history that started from the evolution of material objects - nowadays often referred to as hardware-in-the-loop evolutionary optimization. That is, evolution is done on the "phenotype."

Accepting the constraints involved in such optimizations, one naturally can derive design principles for mutation and recombination operators and the control of those operators by self-adaptation - one of the great inventions of ES. Special emphasis is put on a vivid understanding of how the ES explores the search spaces. Recent findings will be presented and supported by live experiments to explain the ES's ability to locate global optima in landscapes with a huge number of local optima. The tutorial will also investigate the reasons why ESs are now regarded as a scalable alternative to Reinforcement Learning.

The tutorial will include a live computer experiment demonstrating the relevance of the design and working principles discussed. This tutorial will be on an introductory level requiring only a minimum of maths.

Tutorial: Towards Better Explainable AI Through Genetic Programming
Organizer(s): Yi Mei; Qi Chen; Andrew B J Lensen; Bing Xue; Mengjie Zhang
Date: June 30, 2024
Time: 8:30 – 10:30
Room: 413
Abstract: Although machine learning has achieved great success in many real-world applications, it is criticised as usually behaving like a black box, and it is often difficult, if not impossible, to understand how the machine learning system makes the decision/prediction. This could lead to serious consequences, such as the accidents of the Tesla automatic driving cars, and biases of the automatic bank loan approval systems.

To address this issue, Explainable AI (XAI) is becoming a very hot research topic in the AI field due to its urgent needs in various domains such as finance, security, medical, gaming, legislation, etc. There have been an increasing number of studies on XAI in recent years, which improves the current machine learning systems from different aspects.

In evolutionary computation, Genetic Programming (GP) has been successfully used in various machine learning tasks including classification, symbolic regression, clustering, feature construction, and automatic heuristic design. As a symbolic-based evolutionary learning approach, GP has an inherent great potential to contribute to XAI, as a GP model tends to be interpretable. However, the interpretability in GP is not as straightforward as one expect it to be, and the models evolved by GP can still be huge and complex, thus less interpretable.

This tutorial will give a brief introduction on how one may achieve better model interpretability in XAI using GP. To this end, we will first briefly introduce XAI and GP. Then we will introduce the GP techniques/strategies that could lead to better model interpretability. We follow the common taxonomy of XAI, and divide the techniques into intrinsic and post-hoc methods. In addition, we will also review some visualisation methods by/for GP to improve interpretability. The tutorial is concluded with some discussions on the current trend, challenges, and potential future research directions.

This tutorial will be interested to all researchers who are interested in XAI, GP, and more general evolutionary machine learning and optimisation, as well as practitioners who want to solve their real-world problems with more interpretable solutions.

Tutorial: Decomposition Multi-Objective Optimization: Current Developments and Future Opportunities
Organizer(s): Ke Li; Qingfu Zhang
Date: June 30, 2024
Time: 10:40 – 12:40
Room: 416+417
Abstract: Evolutionary multi-objective optimization (EMO) has been a major research topic in the field of evolutionary computation for three decades. It has been generally accepted that combination of evolutionary algorithms and traditional optimization methods should be a next generation multi-objective optimization solver. As the name suggests, the basic idea of the decomposition-based technique is to transform the original complex problem into simplified subproblem(s) so as to facilitate the optimization. Decomposition methods have been well used and studied in traditional multi-objective optimization. Multi-objective evolutionary algorithm based on decomposition (MOEA/D) decomposes a multi-objective problem into a number of subtasks, and then solves them in a collaborative manner. MOEA/D provides a very natural bridge between multi-objective evolutionary algorithms and traditional decomposition methods. It has been a commonly used evolutionary algorithmic framework in recent years.

Tutorial: Evolutionary Algorithms and Hyper-Heuristics
Organizer(s): Nelishia Pillay
Date: June 30, 2024
Time: 14:10 – 16:10
Room: 411+412
Abstract: Hyper-heuristics is a rapidly developing domain which has proven to be effective at providing generalized solutions to problems and across problem domains. Evolutionary algorithms have played a pivotal role in the advancement of hyper-heuristics and is continuing to do so. The aim of the tutorial is to firstly provide an introduction to evolutionary algorithm hyper-heuristics for researchers interested in working in this domain. An overview of hyper-heuristics will be provided including the assessment of hyper-heuristic performance. The tutorial will examine each of the four categories of hyper-heuristics, namely, selection constructive, selection perturbative, generation constructive and generation perturbative, showing how evolutionary algorithms can be used for each type of hyper-heuristic. A case study will be presented for each type of hyper-heuristic to provide researchers with a foundation to start their own research in this area. The EvoHyp library will be used to demonstrate the implementation evolutionary algorithm hyper-heuristic. A theoretical understanding of evolutionary algorithm hyper-heuristics will be provided. A new measure to assess the performance of hyper-heuristic performance will also be presented. Challenges in the implementation of evolutionary algorithm hyper-heuristics will be highlighted. The tutorial will also examine recent trends in evolutionary algorithm hyper-heuristics such as transfer learning, hyper-heuristics for continuous optimization and machine learning and hyper-heuristics. The tutorial will end with a discussion session on future directions in the field.

Tutorial: Evolutionary Feature Reduction for Machine Learning
Organizer(s): Bach Hoai Nguyen; Bing Xue; Mengjie Zhang
Date: June 30, 2024
Time: 16:20 – 18:20
Room: 414+415
Abstract: We are now in the era of big data, where vast amounts of high-dimensional data become ubiquitous in a variety of domains, such as social media, healthcare, and cybersecurity. When machine learning algorithms are applied to such high-dimensional data, they suffer from the curse of dimensionality, where the data becomes very sparse. Furthermore, the high-dimensional data might contain redundant and/or irrelevant features that blur useful information from relevant features. Feature reduction can address the above issues by building a smaller but more informative feature set.

Feature selection and feature construction are two main approaches of feature reduction. Feature selection aims to select a small subset of original (relevant) features. Feature construction aims to create a small set of new high-level (informative) features based on the original feature set. Although both approaches are essential data pre-processing steps, they are challenging due to their large search spaces and complex interactions between features. While exhaustive searches are impractical due to their intensive computation cost, traditional heuristic searches require less computational resources but can be trapped at local optima. Recently, evolutionary computation (EC) has been widely applied to achieve feature reduction because of its potential global search ability. Existing EC-based feature reduction approaches successfully reduce the data dimensionality while still improve the classification performance as well as the interpretability of the built models.

This tutorial firstly describes a general framework of feature reduction followed by the applications of feature reduction in real-world scenarios. Then, we will show how EC techniques, particularly genetic algorithms, particle swarm optimisation, differential evolution, genetic programming, ant colony optimisation and evolutionary multi-objective optimisation (EMO) can be applied to address challenges in feature reduction. The effectiveness of EC-based feature reduction is illustrated through several applications including bioinformatics, image analysis and pattern classification, symbolic regression, and cybersecurity. The tutorial concludes with existing challenges for future research.

Tutorial: Evolutionary Bilevel Optimization: Methods and Applications
Organizer(s): Ankur Sinha; Hemant K Singh; Kalyanmoy Deb
Date: June 30, 2024
Time: 16:20 – 18:20
Room: 413
Abstract: Many practical optimization problems should better be posed as bilevel optimization problems in which there are two levels of optimization tasks. A solution at the upper level is feasible if the corresponding lower level variable vector is optimal for the lower level optimization problem. Consider, for example, an inverted pendulum problem for which the motion of the platform relates to the upper level optimization problem of performing the balancing task in a time-optimal manner. For a given motion of the platform, whether the pendulum can be balanced at all becomes a lower level optimization problem of maximizing stability margin. Such nested optimization problems are commonly found in transportation, engineering design, game playing and business models. They are also known as Stackelberg games in the operations research community. These problems are too complex to be solved using classical optimization methods simply due to the "nestedness" of one optimization task into another.

Evolutionary Algorithms (EAs) provide some amenable ways to solve such problems due to their flexibility and ability to handle constrained search spaces efficiently. Clearly, EAs have an edge in solving such difficult yet practically important problems. In the recent past, there has been a surge in research activities towards solving bilevel optimization problems. In this tutorial, we will introduce principles of bilevel optimization for single and multiple objectives, and discuss the difficulties in solving such problems in general. With a brief survey of the existing literature, we will present a few viable evolutionary algorithms for both single and multi-objective EAs for bilevel optimization. Recent studies on bilevel test problems and some application studies will be discussed. Finally, a number of immediate and future research ideas on bilevel optimization will also be highlighted.

Tutorial: Fair Performance Comparison of Evolutionary Multi-Objective Algorithms
Organizer(s): Lie Meng Pang; Ke Shang; Hisao Ishibuchi
Date: June 30, 2024
Time: 14:10 - 16:10
Room: 421
Abstract: Evolutionary multi-objective optimization (EMO) has been a very active research area in recent years. Almost every year, new EMO algorithms are proposed. When a new EMO algorithm is proposed, computational experiments are usually conducted in order to compare its performance with existing algorithms. Then, experimental results are summarized and reported as a number of tables together with statistical significance test results. Those results usually show higher performance of the new algorithm than existing algorithms. However, fair comparison of different EMO algorithms is not easy since the evaluated performance of each algorithm usually depends on experimental settings. This is also because solution sets instead of solutions are evaluated.

In this tutorial, we will first explain some commonly-used software platforms and experimental settings for the comparison of EMO algorithms. Then, we will discuss how to specify the common setting of computational experiments, which is used by all the compared EMO algorithms. More specifically, the focus of this tutorial is the setting related to the following four issues: (i) termination condition, (ii) population size, (iii) performance indicators, (iv) test problem. For each issue, we will provide a clear demonstration of its strong effects on comparison results of EMO algorithms. Following that, we will discuss how to handle each of these issues for fair comparison. These discussions aim to encourage the future development of the EMO research field without focusing too much on the development of overly-specialized new algorithms in a specific setting. Finally, we will also suggest some promising future research topics related to each issue.

Tutorial: New EMO Algorithm Framework with an Unbounded External Archive: Basic Ideas and Research Directions
Organizer(s): Lie Meng Pang; Ke Shang; Hisao Ishibuchi
Date: June 30, 2024
Time: 16:20 – 18:20
Room: 421
Abstract: In the field of evolutionary multi-objective optimization (EMO), early EMO algorithms in the 1990s are called non-elitist algorithms where no solutions in the current population are included in the next population. That is, the next population is the offspring population of the current population. This non-elitist algorithm framework is clearly inefficient since we cannot preserve good solutions during the execution of EMO algorithms. As a result, almost all EMO algorithms in the last two decades are based on the elitist framework where the next population is selected from the current population and its offspring population. In both frameworks, the final population is presented to the decision maker as the final output from EMO algorithms. Recently, some potential difficulties of the elitist framework have been pointed out. One is that the final population is not always the best subset of all the examined solutions. It was demonstrated in the literature that some solutions in the final population are dominated by other solutions generated and deleted in previous generations. It is also difficult to utilize solutions in previous generations to generate new solutions. Offspring are always generated from solutions in the current population. Another difficulty is that only a limited number of solutions (i.e., only solutions in the final population) are obtained. A new framework with an unbounded external archive can easily handle these difficulties since the final solution set is selected from all the examined solutions. In this framework, we can select an arbitrary number of solutions as the final output from EMO algorithms. Stored solutions in the external archive can be used to create new solutions and also to select solutions for the next population. In this tutorial, some interesting research issues in the new EMO algorithm framework are explained.

Tutorial: Multi-Objective Machine Learning
Organizer(s): Vishnu Naresh Boddeti; Zhichao Lu; Xi Lin; Qingfu Zhang; Kalyanmoy Deb
Date: June 30, 2024
Time: 14:10 – 16:10
Room: 414+415
Abstract: Real-world applications of machine learning (ML) often have to contend with objectives beyond predictive performance, i.e., more than one equally important and competing objective or criterion. Examples include cost functions pertaining to invariance (e.g., to photometric or geometric variations), semantic independence (e.g., to age or race for face recognition systems), privacy (e.g., mitigating leakage of sensitive information), algorithmic fairness (e.g., demographic parity), generalization across multiple domains, computational complexity (FLOPs, compactness), to name a few.

In such situations, seeking a single solution that optimizes all objectives simultaneously becomes infeasible. Instead, the goal shifts towards finding a set of solutions that adequately describe the trade-off among the objectives. Various strategies have been developed to address these problems, including simple scalarization and population-based methods.

This tutorial aims to provide a comprehensive introduction to fundamentals and recent advances in multi-objective optimization (MOO), and its applications to representative machine learning tasks with hands-on coding examples. Some emerging machine learning applications of MOO include (1) multi-task learning as multi-objective optimization; (2) representation learning for privacy and fairness; and (3) neural architecture search. Potential research directions intersecting MOO and machine learning research will be summarized.

This tutorial also seeks to convene researchers who are pioneering methods and applications at the crossroads of MOO and machine learning. The goal is to foster a dynamic exchange of ideas, reveal new insights, and explore the untapped potential within this interdisciplinary domain.

Tutorial: Pareto Optimization for Subset Selection: Theories and Practical Algorithms
Organizer(s): Chao Qian
Date: June 30, 2024
Time: 8:30 – 10:30
Room: 416+417
Abstract: Pareto optimization is a general optimization framework for solving single-objective optimization problems, based on multi-objective evolutionary optimization. The main idea is to transform a single-objective optimization problem into a bi-objective one, then employ a multi-objective evolutionary algorithm to solve it, and finally return the best feasible solution w.r.t. the original single-objective optimization problem from the generated non-dominated solution set. Pareto optimization has been shown a promising method for the subset selection problem, which has applications in diverse areas, including machine learning, data mining, natural language processing, computer vision, information retrieval, etc. The theoretical understanding of Pareto optimization has recently been significantly developed, showing its irreplaceability for subset selection. This tutorial will introduce Pareto optimization from scratch. We will show that it achieves the best-so-far theoretical and practical performances in several applications of subset selection. We will also introduce advanced variants of Pareto optimization for large-scale, noisy and dynamic subset selection.

Tutorial: Particle Swarm Optimization: A Multi-Purpose Optimization Approach
Organizer(s): Andries Engelbrecht
Date: June 30, 2024
Time: 10:40 – 12:40
Room: 411+412
Abstract: The main objective of this tutorial is to show that particle swarm optimization (PSO) has emerged as a multi-purpose optimization approach. In the context of this tutorial, this means that the PSO can be applied to a wide range of optimization problem types as well as search domain types. The tutorial will start with a very compact overview of the original, basic PSO. The remainder and bulk of the tutorial will cover a classification of different problem types, and will show how PSO can be applied to solve problems of these types. This part of the tutorial will be organized in the following sections, one for each problem type: Continuous-valued versus discrete-valued domains; Unimodal versus multi-modal landscapes; Multi-modal optimization to find multiple solutions; Constrained versus unconstrained problems, also covering boundary constraints; Multi-objective and many-objective optimization; Dynamic environments to include problems where constraints change over time, dynamic multi-objective optimization, tracking multiple optima, and changing problem dimensionality; Large-scale optimization problems. For each problem type, it will be shown why the standard PSO cannot solve these types of problems efficiently without modification. Simple adaptations to the PSO that will allow it to solve each problem type will then be discussed. The focus will be on PSO adaptations that do not violate the foundational principles of PSO. For each of these problem types a small subset of the most successful algorithms will be discussed and links to benchmark problems will be provided.

Tutorial: Genetic Programming and Machine Learning for Scheduling
Organizer(s): Fangfang Zhang; Mengjie Zhang; Yi Mei; Su Nguyen
Date: June 30, 2024
Time: 10:40 – 12:40
Room: 413
Abstract: Scheduling is an important optimisation problem that reflects the practical and challenging issues in real-world scheduling applications such as order picking in warehouses, the manufacturing industry and grid/cloud computing. Job shop scheduling (JSS) is a typical scheduling problem, which covers a full range of topics and tasks including static JSS, dynamic JSS, flexible JSS, dynamic flexible JSS, from basic research to a huge number of real-world industrial applications. With recent technological advances in internet-of-things, artificial intelligence, and automation, modern production systems are digitalized and more flexible, and production environments can be monitored and diagnosed in real-time. Scheduling in such dynamic and complex environments is challenging since scheduling needs to be more efficient and reactive, and scheduling decisions have to incorporate dynamic information and uncertainty.

Instead of manually designing scheduling heuristics and algorithms for each problem, we can use machine learning and hyper-heuristics to automatically learn effective scheduling heuristics from low-level heuristics, characteristics of scheduling problems, and dynamic information from production environments. Among the techniques studied and applied within the research field of JSS, genetic programming (GP), a powerful evolutionary machine learning technique, has been successfully used to learn scheduling heuristics for JSS, especially for dynamic JSS. This automated design approach can significantly reduce the time required to develop solution methods by domain experts and increase the chance of discovering novel and effective scheduling heuristics.

Although GP has shown its advantage in learning scheduling heuristics for JSS, GP still has several limitations for handling JSS such as high computational cost and large search space. In addition, most of existing studies focus mainly on single JSS task optimisation, the multiple tasks solving ability of GP has not been explored.

This tutorial will provide a comprehensive introduction to evolutionary machine learning techniques for JSS. This tutorial will cover different types of (advanced) evolutionary machine learning approaches for JSS. From this tutorial, you are expected to get familiar with evolutionary machine learning in four aspects. First, you will learn the definition of hyper-heuristic learning with a comparison of heuristic learning. Second, the details of JSS (e.g., static, dynamic, flexible JSS) will be given. Third, how to use GP as hyper-heuristic approaches to learn heuristics for JSS will be introduced with examples. Last, this tutorial will show how to use advanced machine learning techniques such as feature selection, surrogate and multitask learning with GP to JSS. All the techniques mentioned will be introduced with promising results.

Tutorial: Evolutionary neural architecture search
Organizer(s): Yanan Sun; Bing Xue; Mengjie Zhang; Gary Yen
Date: June 30, 2024
Time: 10:40 – 12:40
Room: 414+415
Abstract: Deep Neural Networks (DNNs), as the cornerstone of deep learning, have demonstrated their great success in diverse real-world applications, such as image classification, natural language processing, speech recognition, to name a few. The architectures of DNNs play a crucial role in their performance, which is usually manually designed with rich expertise. However, such a design process is labor-intensive because of the trial-and-error process, and also not easy to realize due to the rare expertise in practice.

Neural Architecture Search (NAS) is a kind of technique that could automatically designing promising DNN architectures by formulating the design process as optimization problems. Among existing optimizers for solving NAS, the Evolutionary Computation (EC) methods have demonstrated their powerful ability and have drawn increasing attention.

This tutorial will provide a comprehensive introduction to NAS techniques based on EC, i.e., ENAS, for automatically designing the architectures of DNNs. Specifically, this tutorial will cover the ENAS algorithms over 200 papers of most recent ENAS methods in light of the core components, to systematically show their design principles as well as justifications on the design. From this tutorial, the audiences are expected to get familiar with ENAS in four aspects. First, audiences will learn the encoding space categories, different encoding strategies and architecture representations. Second, audiences will learn a variety of EC paradigms use respective metaphors to generate new individuals. Third, audiences will learn the methods to reduce the need for large amounts of time and computing resources, which is a huge obstacle to efficiency. Last, current challenges and issues will be introduced to identify future research in this emerging field.

Tutorial: A Deep Dive into Robust Optimization Over Time: Problems, Algorithms, and Beyond
Organizer(s): Danial Yazdani; Xin Yao
Date: June 30, 2024
Time: 10:40 – 12:40
Room: 421
Abstract: In the evolving landscape of optimization, Dynamic Optimization Problems (DOPs) manifest as a pivotal area of exploration. These problems, characterized by their changing search space over time, present a maze of challenges for optimization algorithms. While much of the existing literature on DOPs primarily focuses on tracking the moving optimum, many real-world DOPs present a different set of challenges and impose a distinct set of requirements. In many practical scenarios, frequent changes to deployed solutions are often undesirable. This aversion stems from various factors, including the high cost associated with switching between deployed solutions, limitations on the resources required to deploy new solutions, and the system's inability to tolerate frequent changes in the deployed solutions.

Robust Optimization Over Time (ROOT) emerges as a beacon in such dynamic scenarios, intertwining the principles of robust optimization and dynamic optimization to form a robust framework capable of navigating the turbulent waters of DOPs. ROOT acknowledges the high cost and resource limitations associated with frequent solution deployments, striving for algorithms capable of dealing with the implications of deploying or maintaining solutions over longer time horizons involving multiple environmental changes.

In this tutorial, we unravel the intricacies of ROOT, providing a gateway to understand, analyze, and address these problems adeptly. The tutorial is structured to offer a panoramic view of the ROOT realm, covering the underlying problems, innovative algorithms designed to tackle these problems, and benchmarks and performance indicators crucial for evaluating the robustness and effectiveness of these algorithms.

Tutorial: Principle and Applications of Semantic Genetic Programming
Organizer(s): Qi Chen; Bing Xue; Mengjie Zhang
Date: June 30, 2024
Time: 14:10 – 16:10
Room: 413
Abstract: Semantic genetic programming is a rapidly growing research track of Genetic Programming (GP). Semantic GP incorporates semantic awareness into GP and explicitly uses more information on the behaviour of programs in the search. When evaluating a program, semantic GP characterises it with a vector of outputs instead of a single scalar fitness value. Research has demonstrated the successfulness of additional behavioural information to facilitate the design of a more effective GP search. In addition, the geometric properties of the semantic space lead to more attractive search operators with better theoretical characteristics. With the geometric information of semantics, the GP dynamics are easier to understand and interpret. Inappropriate behaviours are easier to prevent. All these contribute to making GP a more informed and intelligent method. This tutorial will give a comprehensive overview of semantic GP methods. We will review various ways of integrating semantic awareness in the evolutionary process of GP. In particular, we will introduce geometric semantic GP and review its formal geometric semantic framework, and analyse the theoretical properties of the fitness landscape under this framework. This will be followed by a review of many novel developments of provably good semantic genetic operators. Another aspect is the efficient implementation of semantic search operators, which is still challenging. We will illustrate efficient and concise implementations of these operators. Another focus of this tutorial is to stimulate the audience by showing some promising applicative results that have been obtained so far in many applications of semantic GP including many symbolic regression and classification tasks in the areas of healthcare, civil engineering, natural language processing and so on. We will also identify and discuss current challenges and promising future directions in semantic GP with the hope of motivating new and stimulating contributions.

Tutorial: Benchmarking and analyzing iterative optimization heuristics with IOHProfiler
Organizer(s): Elena Raponi; Thomas Bäck; Jacob de Nobel; Diederick Vermetten; Anna V Kononova; Niki van Stein; Carola Doerr
Date: June 30, 2024
Time: 16:20 – 18:20
Room: 422
Abstract: Comparing and evaluating optimization algorithms is an important part of evolutionary computation and requires a robust benchmarking setup to be done well. IOHProfiler supports researchers in this task by providing an easy-to-use, interactive, and highly customizable environment for benchmarking iterative optimizers.

IOHProfiler is designed as a modular benchmarking tool. The experimenter module provides easy access to common problem sets (e.g., COCO/BBOB functions) and modular logging functionality that can be easily combined with other optimization functions. The resulting logs (and logs from other platforms, e.g., COCO and Nevergrad) are fully interoperable with the IOHanalyzer, which provides access to highly interactive performance analysis, in the form of a wide array of visualizations and statistical analyses. A GUI, hosted at https://iohanalyzer.liacs.nl/ makes these analysis tools easy to access. Data from many repositories (e.g., COCO, Nevergrad) are pre-processed, such that the effort required to compare performance to existing algorithms is greatly reduced.

This tutorial will introduce the key features of IOHProfiler by providing background information on benchmarking in Evolutionary Computation and showing how this can be done using the modules of IOHProfiler. The key components will be highlighted and demonstrated by the organizers. Guided examples will be provided to highlight the many aspects of algorithm performance, which can be explored using the interactive GUI. Participants will learn how a standardized benchmarking environment can facilitate their experimental setup and data analysis. Following the basic benchmarking setup, we will elucidate how to track adaptive parameters and customize the logging procedure for generating data. Also, we will illustrate how to add new problems to the existing problem sets. We also demonstrate how easy it is to compare your own data to previously recorded ones using IOHProfiler; our data repositories comprise data sets for the BBOB functions of the COCO environment https://github.com/numbbo/coco and from Nevergrad https://facebookresearch.github.io/nevergrad/.

Tutorial: Tracking the moving optimum in dynamic optimization problems
Organizer(s): Michalis Mavrovouniotis; Danial Yazdani
Date: June 30, 2024
Time: 8:30 – 10:30
Room: 421
Abstract: In the ever-evolving landscape of real-world problems, the dynamic nature of optimization challenges is increasingly prevalent. This tutorial delves into the exciting field of evolutionary dynamic optimization, focusing on tracking the moving optimum in both discrete and continuous search spaces. It is designed to cater to a wide audience, ranging from those with an interest in evolutionary computation to those seeking the latest advancements in dynamic optimization.

Tutorial: Evolutionary Diversity Optimization for Combinatorial Optimization
Organizer(s): Aneta Neumann; Frank Neumann
Date: June 30, 2024
Time: 10:40 – 12:40
Room: 422
Abstract: In the classical setting evolutionary algorithms (EAs) are used to compute a single solution of high quality with respect to the objective function or a set of trade-off solutions in the field multi-objective optimization where one deals with multiple, usually conflicting objectives. Here, diversity preservation is usually introduced as a means to prevent premature convergence. In many engineering applications and in the field of algorithm selection/configuration however, it is beneficial to produce a set of solutions that is (1) of high quality and (2) diverse with respect to the search space and/or some features of the given problem. Evolutionary Diversity Optimization enables the computation of a large variety of new and innovative solutions that are unlikely to be produced by traditional evolutionary computation methods for single-objective or multi-objective optimization. Related to evolutionary diversity optimization is the concept of novelty search. Here EAs are used to discover new designs/solutions without focusing on explicit objectives as a driver for the search process. The goal of novelty search is to explore solutions that are different to the ones previously obtained.

In this tutorial, we will give a detailed overview on evolutionary diversity optimization which is a new important research area within evolutionary computation that aims to provide sets of diverse solutions. Apart from that, we give a brief introduction into novelty search, highlight similarities and differences to evolutionary diversity optimization and give an outlook how both fields can benefit from each other.

Tutorial: Designing Metaheuristics with Large Language Models: Challenges and Opportunities
Organizer(s): Michal Pluhacek; Adam Viktorin; Roman Senkerik
Date: June 30, 2024
Time: 8:30 – 10:30
Room: 414+415
Abstract: This tutorial will explore the possibilities of utilizing Large Language Models (LLMs) like GPT-4 for designing metaheuristic algorithms tailored to specific optimization problems. The central theme of the talk revolves around a systematic approach to leveraging LLMs' capabilities in this innovative context.

Workflow and Analysis Process:

Proposing New Algorithms: We will start by prompting the model to propose new metaheuristic algorithms for predefined optimization problems. This will involve inputting detailed problem specifications into the LLM and analyzing the metaheuristic solutions it generates.

Logical and Correctness Evaluation: Each of the proposed algorithms will be meticulously analyzed for their logical structure and correctness. This stage is crucial in assessing whether the solutions provided by LLMs are not only innovative but also logically sound and applicable to the problem at hand.

Viability Assessment: The focus will then shift to evaluating the viability of these proposed algorithms. We will discuss and criticise the practicality of implementing the model output, considering factors such as computational efficiency, scalability, and adaptability to real-world scenarios.

Potential for Novel and Powerful Metaheuristics: A key aspect of the talk will be to determine if LLM's involvement can lead to the development of novel and more powerful metaheuristic algorithms. We will explore whether the LLM contributions can transcend conventional approaches, offering new perspectives and solutions in the field of metaheuristics.

Conclusion and Future Outlook:

The session will conclude with reflections on the broader implications of integrating LLMs like GPT-4 in metaheuristic development. We'll discuss the potential future directions this research could take and how it might shape the evolution of algorithmic problem-solving in various domains.

Tutorial: Embedding Knowledge into Optimization Process
Organizer(s): Amir H Gandomi
Date: June 30, 2024
Time: 14:10 – 16:10
Room: 416+417
Abstract: Real-world optimization problems are usually large-scale and involve several constraints and sometimes even finding a single feasible/acceptable solution is a challenging task. To solve these complex real-world problems, heuristics and concept-based approaches can be very helpful and narrow down the search space. Here, I am going to talk about four approaches used in order to incorporate information into the problem and the optimization process, listed below:

- Variable functioning: In this method, the relationships among one or more subsets of variables are defined with functions using information prior to optimization; thus, instead of modifying the variables in the search process, the function variables are optimized.

- Semi-Independent Variable: the concept of a semi-independent variable (SIV) problem representation is investigated that embodies a set of expected or desired relationships among the original variables, with the goal of increasing search effectiveness and efficiency.

- Boundary update: This study introduces a new approach for implicitly handling constraints. The proposed approach reduces the consideration of infeasible solutions by directly updating variable bounds with constraints, which is called the boundary update (BU) method.

- Variable grouping and co-evolution: In this approach, cooperative coevolution is presented and introduced to efficiently solve optimization problems.

These four approaches are coupled with several evolutionary optimization algorithms and the results show that they are practical and effective approaches, and lead to better solutions with fewer function evaluations in most cases. This tutorial should motivate optimization researchers and practitioners to pay more attention to embedding different sources of knowledge into the optimization process to boost it.

Tutorial: Landscape Analysis for Explainable Optimization
Organizer(s): Arnaud Liefooghe; Sébastien Verel
Date: June 30, 2024
Time: 14:10 – 16:10
Room: 422
Abstract: The aim of optimization algorithm designers is to choose the right algorithm and its proper configuration to solve the problem they face. It is, however, even more important to understand and to be able to explain why this choice is relevant. There is in fact a multitude of algorithms among which it is often difficult to determine which one to use for solving a particular optimization problem — or even a particular problem instance.

Indeed, many evolutionary and related search-based optimization algorithms have been proposed for solving a wide range of problems, ranging from single- to multi-objective or continuous to combinatorial optimization. Nevertheless, despite their efficiency and skillful design, it is not always clear in which context an algorithm works best. It is therefore essential to gain a fundamental understanding of their strength and weakness in view of the problem they are aiming to solve. In addition, the informed design and automated selection or configuration of an efficient optimization algorithm is also a challenge that attracts increasing attention from the research community. Landscape analysis is a well-established field that aims to understand the relationship between the underlying structure of a given problem search space and algorithms as well as their underlying components and parameters.

Starting by introducing state-of-the-art tools for single-objective landscapes, we identify the key differences and additional properties to address multi-objective landscapes. We expose and contrast the impact of landscape characteristics on the performance of single- and multi-objective optimization algorithms. We identify a sound and concise summary of features characterizing the landscape of a problem instance. We also review the fundamental principles for designing new relevant features, and we show the main methodologies for sampling combinatorial and continuous search spaces. By providing effective tools and practical examples from landscape analysis, further insights are provided on the importance of ruggedness, multimodality and objective correlation in predicting algorithm performance for unseens problems. We conclude with guidelines for the design of search-based optimization by means of key landscape features, and we identify a number of open challenges for the future of landscape analysis and (evolutionary) optimization algorithms.

Tutorial: Adversarial Optimisation through Competitive co-Evolutionary Algorithms
Organizer(s): Per Kristian Lehre; Mario A Hevia Fajardo
Date: June 30, 2024
Time: 8:30 – 10:30
Room: 422
Abstract: Classical evolutionary algorithms require a fitness function to compare the quality of candidate solutions. However, the quality of candidate solutions in real-world optimization is often a function of adversarial and unforeseen factors which are difficult to model explicitly. In fact, finding hard or worst-case scenarios to evaluate a given solution is itself a difficult optimization problem. Thus, solutions obtained by EAs using a fixed fitness function may perform poorly when deployed in a competitive, real-world scenario. Co-evolutionary algorithms -- which model evolutionary arms-races between populations of predators and prey -- do not rely on explicit fitness functions. They represent one of the most exciting ideas in evolutionary computation, with successful applications ranging from designing sorting networks, playing backgammon, and patching software bugs. Related approaches from the broader AI field, including self-play in reinforcement learning and generative adversarial networks (GANs), highlight the importance of co-evolution. This tutorial has been designed for those who want an introduction to competitive co-evolution, covering their design, analysis, and applications. It assumes no specific background in evolutionary computation, game theory, or analysis of randomized algorithms. We will begin by giving examples of practical adversarial optimization scenarios where co-evolutionary algorithms are applicable. Then we explain how such problems can be captured within a game-theoretic framework with appropriate solution concepts. This part allows participants to recognize problem types where co-evolution can be used. We will then proceed to give an overview of the design of co-evolutionary algorithms, including essential components such as evaluation and archiving methods. This part also covers so-called co-evolutionary pathologies and how they can be remedied. After attending this part, participants will be able to design and implement existing and new co-evolutionary algorithms. Finally, we will discuss theoretical analyses of co-evolutionary algorithms, including No Free Lunch theorems and runtime analysis. This part will give participants a deeper and theoretically founded understanding of how and why co-evolutionary algorithms work, and why they sometimes fail. Several interactive activities are planned, including visualization of algorithms using our own software. This will give the audience a practical and hands-on experience in how co-evolutionary population dynamics are influenced by characteristics of the game and the design of the algorithm. Based on our previously held tutorials in conferences such as CEC, GECCO, and PPSN, we expect an audience of approximately 50 people.

Tutorial: Evolutionary Multi-task Optimization
Organizer(s): Liang Feng; Abhishek Gupta; A. Kai Qin
Date: June 30, 2024
Time: 16:20 – 18:20
Room: 411+412
Abstract: Evolutionary algorithms (EAs) typically start the search from scratch by assuming no prior knowledge about the task being solved, and their capabilities usually do not improve upon past problem-solving experiences. In contrast, humans routinely make use of the knowledge learnt and accumulated from the past to facilitate dealing with a new task, which provides an effective way to solve problems in practice as real-world problems seldom exist in isolation. Similarly, practical artificial systems like optimizers will often handle a large number of problems in their lifetime, many of which may share certain domain-specific similarities. This motivates the design of advanced optimizers which can leverage on what has been solved before to facilitate solving new tasks. In this tutorial, we will present recent advances in the field of evolutionary computation under the theme of evolutionary transfer and multi-task optimization via automatic knowledge transfer. Particularly, we will describe a general definition of transfer optimization, encompassing the sequential transfer and multitasking paradigms. We will also introduce recent theoretical developments in transfer optimization and describe corresponding evolutionary methodologies that can be put into use in practice. Some potential applications of evolutionary transfer and multi-task optimization in real-world scenarios will also be discussed.

Tutorial: Differential Evolution with Ensembles, Adaptations and Topologies
Organizer(s): Ponnuthurai Nagaratnam Suganthan
Date: June 30, 2024
Time: 16:20 – 18:20
Room: 411+412
Abstract: Differential Evolution (DE) is one of the most powerful stochastic real-parameter optimization algorithms of current interest. DE operates through similar computational steps as employed by a standard Evolutionary Algorithm (EA). However, unlike traditional EAs, the DE-variants perturb the current-generation population members with the scaled differences of distinct population members. Therefore, no separate probability distribution has to be used for generating the offspring. Since its inception in 1995, DE has drawn the attention of many researchers all over the world resulting in a lot of variants of the basic algorithm with improved performance. This tutorial will begin with a brief overview of the basic concepts related to numerical optimization and DE, DE's algorithmic components and control parameters. It will subsequently discuss some of the significant algorithmic variants of DE for bound constrained single-objective optimization. Recent modifications of the DE family of algorithms for constrained, multi-objective and niching problems will also be included. The talk will discuss the effects of incorporating ensemble learning in DE – a relatively recent concept that can be applied to swarm & evolutionary algorithms to solve various kinds of optimization problems. The talk will also discuss neighborhood topologies based DE and adaptive DEs to improve the performance of DE. The talk will finally highlight a few problems that pose challenge to the state-of-the-art DE algorithms and demand strong research effort from the DE-community in the future.

FUZZ-IEEE Tutorials

Tutorial: A primer on challenges in Ethical AI – from practice to teaching
Organizer(s): Keeley Crockett; Tayo Obafemi-Ajayi; Christian Wagner
Date: June 30, 2024
Time: 14:10 – 16:10
Room: 211+212
Abstract: The aim of this tutorial is to briefly introduce and discuss a range of ethical issues that need to be considered by data scientists, software development teams, industry and academia professionals either when applying AI, conducting AI research, or developing teaching materials and research funding applications. We will highlight practical approaches such as consequence scanning to evaluate the ethical impact of AI research ideas/new products and services on individuals and society. There is no specific prerequisite knowledge required. It will be an interactive session where participants are expected to bring their own laptops with internet connection. Tools such as padlet and mentimeter will be used to help facilitate group discussions. Participants will be equipped with skills and tools to empower them to carry out their research and teaching within the scope of Ethical AI.

Tutorial: Interpretable Fuzzy Networks for Explainable Artificial Intelligence
Organizer(s): Alexander Gegov; Farzad Arabikhan
Date: June 30, 2024
Time: 8:30 – 10:30
Room: 211+212
Abstract: This is a 2-hour tutorial that includes two 45-minute parts. Each part will be followed by a 15-minute discussion session with questions and comments from the audience.

The tutorial focuses on the inherent interpretability of fuzzy networks which makes them a suitable tool for building explainable artificial intelligence models. These models facilitate the identification of causal relationships between inputs and outputs by intermediate variables.

The tutorial highlights some recent research results of the presenters that have been published in several specialised journals such as ‘IEEE Transactions on Fuzzy Systems', ‘Fuzzy Sets and Systems', ‘Intelligent and Fuzzy Systems', ‘Computational Intelligence Systems', ‘Uncertainty, Fuzziness and Knowledge Based Systems' as well as in the Springer Book Series ‘Studies in Fuzziness and Soft Computing'.

The tutorial is expected to be attended mainly by participants from the Fuzzy Systems strand of the congress but participants from the other two strands may also be interested to attend. In view of the current high popularity of Explainable Artificial Intelligence and the exponential growth in the number of recent publications in this area, the tutorial is expected to be well attended by a large number of congress participants.

Tutorial: Using Fuzzy Sets and Systems for Explainable Artificial Intelligence – How and Why?
Organizer(s): Jose M Alonso; Direnc Pekaslan; Christian Wagner
Date: June 30, 2024
Time: 10:40 – 12:40
Room: 211+212
Abstract: AI is pervading many aspects of our Society. This poses challenges to avoid people being put aside when their own data are processed by AI systems, which provide decisions that may result in harmful discrimination. Our focus is on knowledge representation and how to enhance human-centered information processing in the context of Explainable Artificial Intelligence (XAI in short). XAI is an endeavor to evolve AI methodologies and technology by focusing on the development of intelligent agents capable of both generating decisions that a human can understand, and explicitly explaining such decisions. This way, it is possible to scrutinize the underlying intelligent models and verify if automated decisions are made based on accepted rules and principles, so that decisions can be trusted, and their impact justified. Accordingly, intelligent systems are expected to naturally interact with humans, thus providing comprehensible explanations of decisions automatically made.

Accordingly, there are three main open research problems: (1) designing explainable algorithms; (2) implementing explainable human-machine interfaces; and (3) evaluating the goodness of explanations.

Even if this tutorial will briefly introduce the main concepts and methods in the context of XAI in general, the focus will be on how to deal (and compute) properly with words and perceptions in both generation and evaluation of explanations. More precisely, we will consider the explainable design of Fuzzy Sets and Systems for paving the way from interpretable machine learning to XAI. Such systems deal naturally with uncertainty and approximate reasoning (as humans do) through computing with words and perceptions. This way, they facilitate humans to scrutinize the underlying intelligent models.

This tutorial is of interest for researchers, practitioners, and students (PhD, MSc, BSc, or undergraduate students) working in the field of XAI; with special emphasis on fuzzy-grounded knowledge representation and reasoning.

Tutorial: A leap forward in overcoming the drawbacks of fuzzy set theory
Organizer(s): Gustavo Rivas-Gervilla
Date: June 30, 2024
Time: 8:30 – 10:30
Room: 213
Abstract: Adapting crisp systems and their crisp foundations (algorithms, concepts and theories) to the fuzzy case is both a necessity and a challenge. A necessity because "fuzziness" is at the core of human reasoning and communication abilities, and we are in the era of systems that intend to manage information provided by humans, communicate with humans using concepts and natural language, and emulate human reasoning. A challenge because, though a plethora of resources have been provided over fifty-five years of research in fuzzy set theory and their extensions, we still have to renounce to properties of crisp systems when moving to the fuzzy side. Paradigmatic examples are the unability of fuzzy set theories to keep all the Boolean properties of set operations simultaneously, and the unability of fuzzy numbers to keep the algebraic structure of crisp numbers. In this tutorial we talk about new theories for representing graduality for a swift, simple and property-lossless move to the fuzzy side.

Tutorial: Efficient Optimization of TSK Fuzzy Systems
Organizer(s): D. Wu
Date: June 30, 2024
Time: 10:40 – 12:40
Room: 213
Abstract: TSK fuzzy systems have been widely used in classification and regression. However, for big data, traditional evolutionary algorithm based and full-batch gradient descent based optimization strategies become too costly. This tutorial first introduces functional similarity/equivalence between TSK fuzzy systems and classical machine learning models such as radial basis function network, mixture of experts. Then, it extends their optimization techniques, such as mini-batch gradient descent, DropOut, Batch normalization and Adam, to the optimization of TSK fuzzy systems.

Technical Content
June 30, 2024

18:30 – 20:30
WCCI Welcome Reception
Room: 301-304

19:00 – 20:40
Virtual: Algorithms 1
Conference: CEC
Room: Zoom 24
Session Chair(s):

19:00 Using selected heuristic algorithms in solving nonlinear differential equations
Mariusz Pleszczyński (Silesian University of Technology, Poland)

19:20 Automated Synthesis of Commutative Approximate Arithmetic Operators
Zdenek Vasicek (Brno University of Technology, Czech Republic)

19:40 Prediction of Managed Forest Growth Based on Machine Learning and Cellular Automata
Pablo H. Freitas and Murillo G. Carneiro (Federal University of Uberlândia, Brazil); Thiago P. Protasio (Federal Rural University of Amazonia, Brazil); Delman A. Gonçalves (Brazilian Agricultural Research Corporation, Brazil); Rodrigo O. V. Miranda and Alvaro A. V. Soares (Federal University of Uberlandia, Brazil); Luiz Gustavo A. Martins (Federal University of Uberlândia, Brazil)

20:00 Using Island Model in Asynchronous Evolutionary Strategy to Search for Backdoors for SAT
Artem Pavlenko and Alexander Semenov (ITMO University, Russia)

20:20 Estimation of glycated hemoglobin by symbolic regression
Esther Maqueda (Hospital Universitario de Toledo, Spain); J. Ignacio Hidalgo and J. Manuel Velasco (Universidad Complutense de Madrid, Spain); Oscar Garnica (Complutense U. of Madrid, Spain)

21:00 – 22:40
Virtual: Algorithms 2
Conference: CEC
Room: Zoom 24
Session Chair(s): Sara Pérez Carabaza

21:00 Ant Colony Based Dynamic Voronoi Method for the Multi-Depot Multiple TSP
Sara Pérez Carabaza and Akemi Gálvez (University of Cantabria, Spain); Andres Iglesias (University of Cantabria, Spain & Toho University, Japan)

21:20 Dynamic Multi-Objective Optimization Time Series Ensemble Prediction Framework Based on Correlation Type Detection
Lele Xie, Xiaoming Zhang, Ran Hu and Shun Zhang (Anhui University, China)

21:40 Enhanced Multi-Scale Quantum Harmonic Oscillator Algorithm with Opposition-based Learning
Xinggui Ye (University of Electronic Science and Technology of China, China); Jian Li (UESTC Chngedu, China); Peng Wang (Southwest Minzu University, China)

22:00 Improving Inference of Biochemical Composition in Marine Biomass via Genetic Algorithm-based Feature Selection on Raman Spectroscopic Data
Kaan Demir and Bach Hoai Nguyen (Victoria University of Wellington, New Zealand); Jeremy S. Rooney (University of Otago, New Zealand); Bing Xue (Victoria University of Wellington, New Zealand); Mengjie Zhang (VUW, New Zealand); Kirill Lagutin and Andrew MacKenzie (Callaghan Innovation, New Zealand); Keith C. Gordon (University of Otago, New Zealand); Daniel P. Killeen (The New Zealand Institute for Plant and Food Research Limited, New Zealand)

22:20 Ingredient Planning for Copper Industry: A Deep Reinforcement Learning-Based ε-Constrained Multi-Objective Optimization Framework
Xuerui Zhang (Dalian University of Technology, China); Zhongyang Han (School of Control Science and Engineering, Dalian University of Technology, China); Zhiyuan Wang, J. Zhao and W. Wang (Dalian University of Technology, China)

July 1, 2024

8:20 – 9:40
CEC MO1-R10: Multi-modal Optimization
Conference: CEC
Room: 414+415
Session Chair(s): Lisa Schönenberger

8:20 Evolutionary Multi-modal Optimization Using Persistence-Based Clustering in Riemannian Manifolds
Xiang Meng and Yan Pei (University of Aizu, Japan); Hideyuki Takagi (Emeritus of Kyushu University, Japan)

8:40 Enabling Dual Subpopulations and Clustering for Multimodal Multiobjective Optimization
Yu-Cheng Su, Yi-Ruei Chen and Chuan-Kang Ting (National Tsing Hua University, Taiwan)

9:00 Novel Genotypic Diversity Metrics for Real-coded Optimization on Multi-modal Problems
Alexandre Mascarenhas, Yuta Kobayashi and Claus Aranha (University of Tsukuba, Japan)

9:20 Success Rate of Evolution Strategies on the Multimodal Griewank Function
Lisa Schönenberger and Hans-Georg Beyer (Vorarlberg University of Applied Sciences, Austria)

8:20 – 9:40
CEC MO1-R11: SS on AI for Climate Science
Conference: CEC
Room: 416 + 417
Session Chair(s): Kehinde A. Owoeye

8:20 Forecasting Soil Moisture Using PSO-CNN-LSTM Model
Zhou Guoyuan and GuoLiang Li (Huazhong Agricultural University, China)

8:40 Harnessing Machine Learning for Reliable Weather Forecasting: Meteorological Impact on Sustainable Energy in Monterrey
Gustavo de Jesus Machado-Guillen, Jorge Mario Cruz-Duarte and Santiago Enrique Conant-Pablos (Tecnologico de Monterrey, Mexico); Katarzyna Filus (Polish Academy of Sciences, Poland)

9:00 Graph Neural Network with Quasi-Data Augmentation for Modelling Food Web Relationships
Kehinde A. Owoeye, Dr. (National Engineering Laboratory)

9:20 Lightweight Neural Ensemble Approach for Arctic Sea Ice Forecasting
Julia Borisova and Nikolay Nikitin (ITMO University, Russia)

8:20 – 9:40
CEC MO1-R12: Evolutionary Computation for Healthcare
Conference: CEC
Room: 418
Session Chair(s): Qi Chen

8:20 A Stacking Ensemble Machine Learning Strategy for COVID-19 Seroprevalence Estimations in the USA bas
Gontzal Sagastabeitia and Josu Doncel (University of the Basque Country, Spain); Antonio Fernández Anta (IMDEA Networks Institute, Spain); Jose Aguilar (Universidad de Los Andes, Venezuela & IMDEA Network Institute, Spain); Juan Marcos Ramirez (IMDEA Networks, Spain)

8:40 Genetic programming with multi-task feature selection for Alzheimer's disease diagnosis
Shanshan Tang (Northeastern University & Victoria University of Wellington, China); Qi Chen and Bing Xue (Victoria University of Wellington, New Zealand); Min Huang (Northeastern University, China); Mengjie Zhang (VUW, New Zealand)

9:00 Multi-Objective Evolutionary Optimization for Tuning Hyperparameters and Reducing Features in Prediction of Deep Vein Thrombosis
Ruslan Sorano (Østfold University College, Norway); Kazi Shah Nawaz Ripon (Oslo Metropolitan University, Norway); Lars Vidar Magnusson (Ostfold University College, Norway)

9:20 Comparing Surrogate-Assisted Evolutionary Algorithms on Optimization of a Simulation Model for Resource Planning Task for Hospitals
Jakub Kudela and Ladislav Dobrovsky (Brno University of Technology, Czech Republic); Mhd Ali Shehadeh (Bno University of Technology, Czech Republic); Tomas Hulka and Radomil Matousek (Brno University of Technology, Czech Republic)

8:20 – 9:40
CEC MO1-R13: Evolutionary Multi-objective Algorithms I
Conference: CEC
Room: 419
Session Chair(s): Lie Meng Pang

8:20 Multi-Objective Evolutionary Optimization for Large-Scale Open Pit Mine Scheduling
Ishara Hewa Pathiranage and Aneta Neumann (The University of Adelaide, Australia)

8:40 Analysis of Algorithm Comparison Results on Real-World Multi-Objective Problems
Lie Meng Pang, Hisao Ishibuchi and Ke Shang (Southern University of Science and Technology, China)

9:00 Design of Generalized and Specialized Helper Objectives for Multi-objective Continuous Optimization Problems
Keigo Mochizuki, Tomoki Ishizuka, Naoya Yatsu, Hiroyuki Sato and Keiki Takadama (The University of Electro-Communications, Japan)

9:20 Multi-Agent Reinforcement Learning with Asymmetric Representation Assisted by Multi-Objective Evolutionary Algorithms
Ye Tian, Weixin Wang, Shangshang Yang, Panpan Zhang and Xingyi Zhang (Anhui University, China)

9:40 – 18:40
Exhibition
Room: 501+502

9:40 – 9:55
Break

9:55 – 10:30
Opening Ceremony
Room: 301+302+303+304

10:30 – 11:30
WCCI 2024 Plenary Talk by Simon See
Room: 301+302+303+304
Session Chair(s): Akira Hirose

Accelerating Science Discovery - High Performance Simulation , Math and AI
Simon See
Nvidia
Modern scientific discovery relies on advances in data science, mathematics, and artificial intelligence (AI). The combination of these disciplines has led to significant breakthroughs in various fields, including materials science, drug discovery, and chip design. This talk discusses the role of AI-enriched simulation in accelerating science discovery and the use of high-performance computing, math, and AI to drive innovation.

Key aspects of AI-enriched simulation include:

Accelerating the discovery process: AI-enriched simulation uses AI to identify the most promising simulations to run on a massive dataset, reducing the computational expense and saving precious time and resources.

Automating complex simulations: AI-enriched simulation makes complex, predictive simulations automatable and user-friendly for researchers without deep computational expertise, removing a critical research bottleneck

Reducing the number of simulations needed: By using AI to analyze data and determine the most promising simulations, AI-enriched simulation can speed up screening by factors of 10-100 times.

Leveraging AI and machine learning: AI-assisted simulations use neural networks and machine learning algorithms to predict complex properties of materials and other systems, bypassing expensive physics-based routines and accelerating the discovery process.

Collaborative research: AI expertise, such as that found at Berkeley Lab, can be combined with traditional research methods to apply AI to various scientific problems, leading to innovative solutions and new discoveries.

In summary, the future of scientific discovery lies in the integration of high-performance simulation, math, and AI. By harnessing the power of these technologies, researchers can accelerate the discovery process, automate complex simulations, and unlock new possibilities in various fields.

11:30 – 13:00
Lunch Time

13:00 – 14:00
Keynote talk by Plamen Angelov
Conference: IJCNN
Room: 301+302
Session Chair(s): Robert Kozma

Learning from Data in post-Foundation Models Era: bringing learning and reasoning together
Plamen Angelov
Lancaster University, UK

Deep Learning continues to attract the attention and interest not only of the wider scientific community and industry, but also society and policy makers. Fuelled by the remarkable generalisation and separability capabilities offered by the transformers (e.g. ViT), Foundation Models (FM) offer unparalleled feature extraction opportunities. However, the mainstream approach of end-to-end iterative training of a hyper-parametric, cumbersome, and opaque model architecture led some authors to brand them “black box”. This degrades their generalisation, requires many labelled data, compute power and related energy, etc. costs. Cases were reported when such models can give wrong predictions with high confidence - something that jeopardises the safety and trust. Deep Learning is focused on accuracy and overlooks explainability and the semantic meaning of the internal model representations, reasoning and its link with the problem domain. In fact, it shortcuts from the large amount of (labelled) data to the predictions bypassing and substituting the causality with correlation and error minimisation. It relies on assumptions about the data distributions that are often not satisfied and suffers from catastrophic forgetting when faced with continual and open set learning. Once trained, such models are inflexible to new knowledge. They are good only for what they were originally trained for. Indeed, the ability to detect unseen and unexpected and start learning this new class/es in real time with no or very little supervision (zero- or few- shot learning) is critically important but is still an open problem. The challenge is to fill the gap between the high levels of accuracy and the semantically meaningful solutions.
This talk will focus on “getting the best from both worlds”: the powerful latent feature spaces formed by pre-trained deep architectures such as transformers combined with the interpretable-by-design (in linguistic, visual, semantic, and similarity-based form) models. One can see this as a fully interpretable frontend and a powerful backend working in harmony. Examples will be demonstrated from the latest projects from the area of autonomous driving, Earth Observation, health and a set of well-known benchmarks.

13:00 – 14:00
Keynote talk by Yew Soon Ong
Conference: CEC
Room: 303+304
Session Chair(s): Oscar Cordon

Multifactorial Evolutionary Computation with Applications in Machine Learning and Scientific Discovery

Yew Soon Ong
Nanyang Technological University

The human mind demonstrates an exceptional capacity to manage multiple tasks seemingly simultaneously while also exhibiting the ability to leverage knowledge acquired from solving one task and apply it to different yet related challenges. Given the exploding volume and variety of information streams, the opportunity, tendency, and (even) the need to address different tasks in quick succession is unprecedented. Yet, the design of population-based algorithms of evolutionary computation (EC) has traditionally focused on addressing a singular task (or problem) at a time. It is only recently that the idea of multifactorial evolution has come to the fore, leading to the growing popularity of transfer and multitask EC. The nomenclature signifies a search involving multiple optimization tasks, with each task contributing a unique factor influencing the evolution of a population of candidate solutions. The multifactorial evolutionary algorithm (MFEA) is distinguished by implicit genetic transfers between tasks, promising free lunches in optimization by reusing knowledge from related problems. The method makes possible the rapid discovery of diverse, high quality outcomes, and potentially out-of-the-box solutions through inter-task genetic crossovers. In this talk, some of the latest algorithmic advances of MFEAs shall be presented, encompassing both single-objective and multiobjective variants. The impact potential of algorithms designed to leverage multiple related tasks shall be showcased in the field of machine learning (through the creation of diverse sets of small but specialized models extracted from large pre-trained architectures) and in AI for scientific discovery (by facilitating fast simulations of multiple instantiations of the fundamental laws of nature). Multiobjective multitasking as a means to arrive at sets of Pareto optimal solution sets in other application domains shall also be highlighted.

13:00 – 14:00
IEEE CIS Fuzzy Systems Pioneer Award Keynote Talk by Qiang Shen
Conference: FUZZ-IEEE
Room: 503
Session Chair(s): Christian Wagner

When There Is Little Data Can AI Still Work? – Approximate Reasoning with Knowledge Interpolation and its Applications

Qiang Shen
Aberystwyth University

AI is on the brink of revolutionising industries globally, having made significant advancements in recent years. These achievements are primarily attributed to the use of deep learning techniques that process vast amounts of data. Yet, a pivotal question emerges when faced with limited data for a new problem, especially if this data is ambiguously characterised. Can AI maintain its efficacy under these constraints? This presentation delves into contributions addressing this query, highlighting how fuzzy rule interpolation (FRI) enables approximate reasoning in situations marked by sparse or incomplete knowledge.

This is particularly relevant when traditional rule-based inference mechanisms falter because observations do not align with existing rules. Research into FRI techniques has been extensive within the realm of computational intelligence, yielding multiple methodologies. This presentation will centre on a prominent subset, Transformation-based FRI (T-FRI), which operates by mathematically modifying rules that bear resemblance to unmatched observations. Every technique within this category applies linear transformations of the nearest rules, automatically chosen relative to an unmatched observation. The talk will kick off with an exploration of the foundational T-FRI approach and segue into a concise overview of its expanded repertoire: adaptive T-FRI, backward T-FRI, higher-order T-FRI, dynamic T-FRI, and weighted T-FRI. Each addresses certain shortcomings inherent to the original method. Subsequently, real-world applications of these methodologies will be showcased, exemplifying their potency in tackling formidable challenges in domains like network security and medical diagnosis. These cases will underscore AI's capability to function effectively even with incomplete knowledge and ambiguous data. The presentation will wrap up with a glimpse into prospective advancements in this crucial research domain.

14:00 – 14:20
Break

14:20 – 16:20
Paper Development Workshop
Room: 211+212

14:20 – 16:20
Workshop: The Evolutionary Computation in Health (TECH)
Room: 213

14:20 – 16:20
Panel: What will bring AI towards AGI?
Room: 301+302

14:20 – 16:20
CEC MO2-R10: Differential Evolution and Coevolutionary Systems
Conference: CEC
Room: 414+415
Session Chair(s): Alistair Benford

14:20 Bicriteria optimisation of average and worst-case performance using coevolutionary algorithms
Alistair Benford (University of Birmingham, UK (Great Britain)); Markus Olhofer and Tobias Rodemann (Honda Research Institute Europe, Germany); Per Kristian Lehre (University of Birmingham, UK (Great Britain))

14:40 Solving Simultaneous Continuous Multi-objective FlipIt Games using Co-Evolutionary Computation
Rui Leite, Hernan Aguirre and Kiyoshi Tanaka (Shinshu University, Japan)

15:00 Tri-objective Differential Evolution with Gradient Information Reused for Constrained Optimization
Sen Yang, Zusheng Tan, Jingyu Ji, Haoran Xie, Man Leung Wong and Sam Tak Wu Kwong (Lingnan University, Hong Kong)

15:20 IDEL: An Improved Differential Evolution with Lissajous Mutation
Angel Casas-Ordaz, Arturo Valdivia, Eduardo H. Haro, Diego Oliva, Luis A. Beltran and Itzel Aranguren (Universidad de Guadalajara, Mexico); Erick Rodriguez-Esparza (University of Deusto, Spain); Diego Campos-Peña (Universidad de Guadalajara, Mexico)

15:40 Differential Evolution Search Strategy Enhancement Through Evolutionary Game Theory
Hector Joaquin Escobar-Cuevas, Erik Cuevas, Alberto L. Chang, Marco Perez Cisneros, Daniel Zaldivar, Oscar Barba-Toscano, Mario Vásquez, Nahum Aguirre and Eric L. Marin (Universidad de Guadalajara, Mexico)

16:00 Quantifying Individual and Joint Module Impact in Modular Optimization Frameworks
Ana Nikolikj and Ana Kostovska (Jožef Stefan Institute, Slovenia); Diederick Vermetten (Leiden University, The Netherlands); Carola Doerr (Sorbonne University, France); Tome Eftimov (Jožef Stefan Institute, Slovenia)

14:20 – 16:20
CEC MO2-R11: Real-world Applications I
Conference: CEC
Room: 416 + 417
Session Chair(s): Thomas Runarsson

14:20 Improved Discrete Cat Swarm Optimization for Optimal Multi-Trip Vehicle Routing in Case of a Natural Disaster
Takumi Abe and Yoshikazu Fukuyama (Meiji University, Japan)

14:40 Evolving Submodels for Column Generation in Cutting and Packing for Glulam Production
Helga Ingimundardottir and Thomas Runarsson (University of Iceland, Iceland)

15:00 Optimizing Maritime Propeller Design with Continuous Evolutionary Algorithms
Joe Jonas Vogel (Federal University of Santa Catarina, Brazil); Paulo Barbato Fogaça De Almeida (Federal University of Santa Catarina - UFSC, Brazil); Paulo Lilles Jorge Drews, Jr. (Universidade Federal do Rio Grande, Brazil); Cristofer Hood Marques (Federal University of Rio Grande - FURG, Brazil); Jonata Tyska Carvalho (Federal University of Santa Catarina, Brazil)

15:20 Learning Agents' Behavioral Patterns in Agent-based Modeling by Means of Evolutionary Algorithms
Péricles Miranda (Universidade Federal Rural de Pernambuco, Brazil); Jesús Giráldez-Cru (Universidad de Granada, Spain); Moésio Wenceslau Filho (Universidade Federal Rural de Pernambuco, Brazil); Carmen Zarco (Universidad de Granada, Spain); Oscar Cordon (University of Granada, Spain)

15:40 Multi-objective virtual network functions placement and traffic routing problem
Tam Thi Nguyen (VNU University of Science & Hanoi University of Science and Technology, Vietnam); Tran Ho Khanh Ly, Bùi Trọng Đức, Trần Huy Hùng and Huynh Thi Thanh Binh (Hanoi University of Science and Technology, Vietnam)

16:00 **Control of JADE Population in Limited Number of Searches for Realistic Situations**
Tomoya Matsuki (Osaka Prefecture University, Japan); Akira Notsu, Katsuhiro Honda, Takuya Kato and Masakazu Shibahara (Osaka Metropolitan University, Japan)

14:20 – 16:20
CEC MO2-R12: Genetic Programming I
Conference: CEC
Room: 418
Session Chair(s): Joao Eduardo Batista

14:20 Full Inclusive Genetic Programming
Francesco Marchetti (DLR - Deutsches Zentrum Für Luft- Und Raumfahrt, Germany); Mauro Castelli (Universidade Nova de Lisboa, Portugal); Illya Bakurov (Michigan State University, USA); Leonardo Vanneschi (NOVA IMS Information Management School, Portugal)

14:40 A Novel Symbolic Regressor Enhancer Using Genetic Programming
Tu-Chin Chiang, Chi-Hsien Chang and Tian-Li Yu (National Taiwan University, Taiwan)

15:00 Program Synthesis on Single-Layer Loop Behavior in Pure Functional Programming
Tzu-Hao Hsu, Chi-Hsien Chang and Tian-Li Yu (National Taiwan University, Taiwan)

15:20 A New Concordance Correlation Coefficient based Fitness Function for Genetic Programming for Symbolic Regression
Jizhong Xu, Qi Chen and Bing Xue (Victoria University of Wellington, New Zealand); Mengjie Zhang (VUW, New Zealand)

15:40 M6GP: Multiobjective Feature Engineering
Joao Eduardo Batista (RIKEN-CCS, HPAIS, Japan); Nuno Miguel Rodrigues (LASIGE, Portugal); Leonardo Vanneschi (NOVA IMS Information Management School, Portugal); Sara Silva (University of Lisbon, Portugal)

16:00 Evaluating Machine Learning Techniques for Predicting Salinity in Oyster Estuaries
Matthew R S Harper, Ivy Liu and Bing Xue (Victoria University of Wellington, New Zealand); Mengjie Zhang (VUW, New Zealand); Ross Vennell (Coastal and Freshwater Group Cawthron Institute, New Zealand)

14:20 – 16:20
CEC MO2-R13: Evolutionary Multi-objective Algorithms II
Conference: CEC
Room: 419
Session Chair(s): Markus Wagner

14:20 From multipoint search to multiarea search: Novelty-based multi-objectivization for unbounded search space optimization
Ryuki Ishizawa, Hiroyuki Sato and Keiki Takadama (The University of Electro-Communications, Japan)

14:40 Should Multi-objective Evolutionary Algorithms Use Always Best Non-dominated Solutions as Parents?
Kazuma Sato, Naru Okumura, Keiki Takadama and Hiroyuki Sato (The University of Electro-Communications, Japan)

15:00 Interactive Final Solution Selection in Multi-Objective Optimization
Cheng Gong (City University of Hong Kong, China); Yang Nan (Southern University of Science and Technology, China); Tianye Shu (Southern University of Science and Techinology, China); Lie Meng Pang and Hisao Ishibuchi (Southern University of Science and Technology, China); Qingfu Zhang (City University of Hong Kong, Mexico)

15:20 High-throughput Multi-objective Bayesian Optimization Using Gradients
Yiming Yao (City University of Hong Kong (Dongguan) & City University of Hong Kong, China); Fei Liu (City University of Hong Kong, Hong Kong); Qingfu Zhang (City University of Hong Kong, Mexico)

15:40 Designing Helper Objectives in Multi-objectivization
Shoichiro Tanaka (The University of Fukuchiyama, Japan); Arnaud Liefooghe (University of the Littoral Opal Coast, France); Keiki Takadama and Hiroyuki Sato (The University of Electro-Communications, Japan)

16:00 Towards Adaptation in Multiobjective Evolutionary Algorithms for Integer Problems
Guenter Rudolph (TU Dortmund University, Germany); Markus Wagner (Monash University, Australia)

16:20 – 16:40
Break

16:40 – 18:40
CEC MO3-R10: Discrete and Combinatorial Optimization
Conference: CEC
Room: 414+415
Session Chair(s): Hendrik Richter

16:40 A Q-Learning Hybrid BRKGA Applied to the Knapsack Problem with Forfeits
Gabriel Souto (Federal University of Rio de Janeiro, Brazil); Masayoshi Aritsugi and Israel Mendonca (Kumamoto University, Japan); Pedro Henrique González and Luidi Simonetti (Federal University of Rio de Janeiro, Brazil)

17:00 Synchronous parallel heuristics for solving the joint order batching and picker routing problem
Son Thai Tran and Rui Jorge Almeida (Maastricht University, The Netherlands); Christof Defryn (University of Antwerp, Belgium); Inneke Van Nieuwenhuyse (Hasselt University, Belgium)

17:20 Information flow and Laplacian dynamics on local optima networks
Hendrik Richter (HTWK Leipzig University of Applied Sciences, Germany); Sarah L Thomson (Edinburgh Napier University, UK (Great Britain))

17:40 The Multi-Objective Vehicle Routing Problems with Parcel Lockers for Simultaneous Pick-up and Delivery
Weimin Chen, Yuxin Liu and Jin Liu (Shanghai Maritime University, China)

18:00 Structural Fusion of Bayesian Networks with Limited Treewidth using Genetic Algorithms
Pablo Torrijos (Universidad de Castilla-La Mancha, Spain); Jose Gamez and José Puerta (University of Castilla-La Mancha, Spain)

16:40 – 18:40
CEC MO3-R11: Real-world Applications II
Conference: CEC
Room: 416+417
Session Chair(s): Eric O Scott

16:40 Realistic Tax Planning with Evolutionary Algorithms
Eric O Scott (MITRE, USA); Anmol Srivastava, Abby Pusateri, Andy Taylor and Karen Jones (The MITRE Corporation, USA); Hahnemann Ortiz (University of Minnesota & Internal Revenue Service, USA)

17:00 An Unsupervised Evolutionary Approach for Indian Regional Language Summarization
Jiten Parmar (IIIT Lucknow, India); Naveen Saini (IIIT Allahabad, India); Dhananjoy Dey (India)

17:20 Free-Form Coverage Path Planning of Quadcopter Swarms for Search and Rescue Missions using Multi-Objective Optimization
Lukas Bostelmann-Arp (Otto Von Guericke University Magdeburg, Germany); Christoph Steup (Otto-Von-Guericke University of Magdeburg, Germany); Sanaz Mostaghim (Otto von Guericke University Magdeburg, Germany)

17:40 A Hybrid Approach with BRKGA and Data Mining for the Early/Tardy Scheduling Problem
Israel Mendonca (Kumamoto University, Japan); Tirana Noor Fatyanosa (Brawijaya University, Indonesia); Masayoshi Aritsugi (Kumamoto University, Japan); Pedro Henrique González (Federal University of Rio de Janeiro, Brazil)

18:00 A quality diversity study in EvoDevo processes for engineering design
Edgar Buchanan and Simon Hickinbotham (University of York, UK (Great Britain)); Rahul Dubey (Missouri State University, USA); Imelda Friel (Queens University Belfast, UK (Great Britain)); Andrew Robert Colligan and Mark Price (Queen's University Belfast, UK (Great Britain)); Andy Tyrrell (University of York, UK (Great Britain))

16:40 – 18:40
CEC MO3-R12: Genetic Programming II
Conference: CEC
Room: 418
Session Chair(s): Oscar Cordon

16:40 A Hierarchical Cooperative Genetic Programming for Complex Piecewise Symbolic Regression
Xinan Chen (Xi'an Jiaotong-Liverpool University, China); Wenjie Yi (Shenzhen University, China); Ruibin Bai (University of Nottingham Ningbo, China); Rong Qu (University of Nottingham, UK (Great Britain)); Yaochu Jin (Westlake University, China)

17:00 Semi-stable Periodic Orbits of The Deterministic Chaotic Systems Designed by means of Genetic Programming
Radomil Matousek and Tomas Hulka (Brno University of Technology, Czech Republic); René Lozi (University of Nice-Sophia Antipolis, France); Jakub Kudela (Brno University of Technology, Czech Republic)

17:20 Age-at-death Estimation based on Symbolic Regression Ensemble Learning from Multiple Annotations
Enrique Bermejo, Oscar Cordon, Javier Irurita and Inmaculada Alemán (University of Granada, Spain); Ángel Rubio Salvador (Rovira i Virgili University, Spain)

17:40 Searching Search Spaces: Meta-evolving a Geometric Encoding for Neural Networks
Tarek Kunze (University of Toulouse - ISAE-SUPAERO, France); Paul Templier (University of Toulouse & ISAE-SUPAERO, France); Dennis G Wilson (ISAE-Supaero & University of Toulouse, France)

18:00 Enhanced Genetic Programming Models with Multiple Equations for Accurate Semi-Autogenous Grinding Mill Throughput Prediction
Zahra Ghasemi (The University of Adelaide, Australia); Mehdi Neshat (Centre for Artificial Intelligence Research and Optimisation Torrens University, Australia); Chris Aldrich (Curtin University, Australia); John Karageorgos (Manta Controls Pty Ltd, Australia); Max Zanin, Frank Neumann and Lei Chen (The University of Adelaide, Australia)

16:40 – 18:40
CEC MO3-R13: Evolutionary Multi-objective Algorithms III
Conference: CEC
Room: 419
Session Chair(s): Haoran Gu

16:40 A Time Window Sequence-Based Evolutionary Algorithm for Solving Large-Scale Daily Task Planning Problems
Peng Wu (Chinese Academy of Science, China); Shuai Shao (Anhui University, China)

17:00 Test Suites and Performance of Algorithms in Large-Scale Multiobjective Evolutionary Optimization
Haoran Gu, Handing Wang and Jingjing Ma (Xidian University, China)

17:20 An Analysis of the Preferences of Distribution Indicators in Evolutionary Multi-Objective Optimization
Jesús Guillermo Falcón-Cardona (Tecnologico de Monterrey, Mexico); Mahboubeh Nezhadmoghaddam (Tecnológico de Monterrey, Mexico); Emilio Bernal-Zubieta (Tecnologico de Monterrey, Mexico)

17:40 Performance Evaluation of Evolutionary Multi-Objective Algorithms using Real-World Problems with an Additional Total Constraint Violation Objective
Yang Nan and Hisao Ishibuchi (Southern University of Science and Technology, China); Tianye Shu (Southern University of Science and Techinology, China)

18:00 Last-X-Generation Archiving Strategy for Multi-Objective Evolutionary Algorithms
Tianye Shu (Southern University of Science and Techinology, China); Yang Nan, Ke Shang and Hisao Ishibuchi (Southern University of Science and Technology, China)

18:50 – 20:30
Virtual: Multi-objective Optimization
Conference: CEC
Room: Zoom 24
Session Chair(s): Anqi Pan

18:50 Feature-based Coevolution Algorithm for Multimodal Multi-objective Optimization
Shanshan Yang, Anqi Pan and Xue Feng (Donghua University, China)

19:10 A Dual-Model Assisted Evolutionary Algorithm Based on Decomposition for Expensive Multi-Objective Optimization
Yanyan Tan, Zhaomin Zhai and Yukun Zhang (Shandong Normal University, China)

19:30 Two-stage evolutionary algorithm with two population for constrained multi-objective optimization
Lupeng Hao and Junhua Liu (Xi'an Polytechnic University, China); Wei Zhang (Northeastern University, China); Meng Wang (Xi'an Polytechnic University, China); Xiaoli Wang (Xidian University, China); Fengping Wang (Xi an Polytechnic University, China)

19:50 A Two-stage Optimization Framework for Sparse Large-scale Multiobjective Optimization
Huoyuan Wang and Jing Jiang (Anqing Normal University, China)

20:10 A Multi-modal Multi-objective Evolutionary Algorithm Considering Boundary Information
Hongze Wang (University of Chinese Academy of Sciences, China); Jinxin Zhang (Chinese Academy of Sciences, China)

18:50 – 20:30
Virtual: Applications 1
Conference: CEC
Room: Zoom 25
Session Chair(s): Christina Plump

18:50 Finding the perfect MRI sequence for your patient --- Towards an optimisation workflow for MRI-sequences
Christina Plump (DFKI GmbH, Germany); Daniel C. Hoinkiss (Mevis Fraunhofer, Germany); Jörn Huber (Fraunhofer Mevis, Germany); Bernhard J. Berger (Hamburg University of Technology, Germany); Matthias Günther (Fraunhofer Mevis, Bremen, Germany); Christoph Lueth (DFKI, Germany); Rolf Drechsler (University of Bremen/DFKI, Germany)

19:10 Intelligent Blocking and Prevention of SARS-CoV-2 Based on Evolutionary Reinforcement Learning
Chengwei He, Huaping Hong, Lijia Ma and Qingling Zhu (Shenzhen University, China); Yuan Bai (The University of Hong Kong, Hong Kong)

19:30 Inferring Gene Regulatory Networks from Single-Cell RNA-Sequencing Experimental Data using Cartesian Genetic Programming
José Eduardo Henriques da Silva, Sr., Heder Bernardino, Itamar Leite De Oliveira, José Jerônimo Camata and Patrick de Carvalho (Universidade Federal de Juiz de Fora, Brazil)

19:50 EvolBA: Evolutionary Boundary Attack under Hard-label Black Box condition
Ayane Tajima and Satoshi Ono (Kagoshima University, Japan)

20:40 – 21:40
Virtual: Invited Talk I Erik Cambria
Room: Zoom 1
Session Chair(s): Koichiro Yamauchi

Seven Pillars for the Future of AI
Erik Cambria

In recent years, AI research has showcased tremendous potential to impact positively humanity and society. Although AI frequently outperforms humans in tasks related to classification and pattern recognition, it continues to face challenges when dealing with complex tasks such as intuitive decision-making, sense disambiguation, sarcasm detection, and narrative understanding, as these require advanced kinds of reasoning, e.g., commonsense reasoning and causal reasoning, which have not been emulated satisfactorily yet. To address these shortcomings, we propose seven pillars (https://sentic.net/seven-pillars-for-the-future-of-artificial-intelligence.pdf) that we believe represent the key hallmark features for the future of AI, namely: Multidisciplinarity, Task Decomposition, Parallel Analogy, Symbol Grounding, Similarity Measure, Intention Awareness, and Trustworthiness.

21:50 – 22:50
Virtual: Invited Talk II Hussein Abbass
Room: Zoom 1
Session Chair(s): Hisashi Handa

Explaining Explainable Artificial Intelligence

Hussein Abbass
School of Systems and Computing, University of New South Wales

Explainable Artificial Intelligence (XAI) is one of the hottest topics in AI today. Ironically, one would think that a motivation for the importance of XAI is for people to better understand AI and the AI models in use. However, diversity of opinions and perspectives on XAI has created more ambiguities and confusions than helping in any meaningful way. To even explain what an explanation is, some papers in the literature have confused the term, making it close to impossible to newcomers to the field to find coherence or aspire for consistency. The diversity is reaching unhealthy state with orthogonal definitions and taking antonyms and incommensurable concepts making them synonyms. The aim of this presentation is to disambiguate XAI, taking the audience into a trip that will start from the basics, travel through contemporary literature, land on current challenges of XAI and providing food for thoughts along the way. My aim is not to unify XAI or create a universal agreement. My aim is to maximise people understanding of XAI and to have the basis for those who disagree with me to communicate their disagreement in concise statements.

23:00 – 24:40
Virtual: Multi-/Many-objective Optimization
Conference: CEC
Room: Zoom 24
Session Chair(s):

23:00 Scalable Polynomial RegEM(a)O for Multi-/Many-objective Platform-based Design Optimization Problems
Ritam Guha and Kalyanmoy Deb (Michigan State University, USA)

23:20 Well Trajectory Design Based on Constrained Many-objective Optimization Algorithms
Zhaojun Wang, Chenwen Ding, Wenji Li and Yifeng Qiu (Shantou University, China); Dong Chen (China University of Petroleum, China); Biao Xu and Jiafan Zhuang (Shantou University, China); Yun Li (Shenzhen Institute for Advanced Study of UESTC, China); Zhun Fan (Shantou University, China)

23:40 Sequential Transfer with Multi-Objective Genetic Algorithm for Feature Selection of Small, High-Dimensional Datasets
Parth C Upadhyay (University of Missouri- Columbia, USA); Guilherme N. DeSouza (University of Missouri-Columbia, USA); John A. Lory (University of Missouri - Columbia, USA)

24:00 Biased Dyadic Crossover for Variable-Length Multi-Objective Optimal Control Problems
Ben Parsonage and Christie Maddock (University of Strathclyde, UK (Great Britain))

24:20 A mobile application for Hypoglycemia and Hyperglycemia prediction by Genetic Programming
J. Ignacio Hidalgo and Marina de la Cruz (Universidad Complutense de Madrid, Spain); Esther Maqueda (Hospital Universitario de Toledo, Spain); Oscar Garnica (Complutense U. of Madrid, Spain); J. Manuel Velasco (Universidad Complutense de Madrid, Spain)

23:00 – 24:40
Virtual: Applications 2
Conference: CEC
Room: Zoom 25
Session Chair(s): Wenjing Hong

23:00 An Elite Archive-Assisted Multi-Objective Evolutionary Algorithm for mRNA Design
Wenjing Hong (Shenzhen University, China); Cheng Chen (Southern University of Science and Technology, China); Zexuan Zhu (Shenzhen University, China); Ke Tang (Southern University of Science and Technology, China)

23:20 Neural network agents trained by declarative programming tutors
Julian Szymański and Jan Dobrosolski (Gdansk University of Technology, Poland); Higinio Mora (University of Alicante, Spain)

23:40 Emotion-Conditioned MusicLM: Enhancing Emotional Resonance in Music Generation
Yuelang Sun (Auckland University of Auckland, New Zealand); Matthew M.Y. Kuo (Auckland University of Technology, New Zealand); Xiaodan Wang (Yanbian University, China); Weihua Li (Auckland University of Technology, New Zealand); Quan Bai (University of Tasmania, Australia)

24:00 Evolutionary Multitasking with Compatibility Graph for Point Cloud Registration
Hangqi Ding, Jun Jiang, Yue Wu, Hao Li, Maoguo Gong, Wenping Ma and Qiguang Miao (Xidian University, China)

24:20 Evaluation Framework for AI-driven Molecular Design of Multi-target Drugs: Brain Diseases as a Case Study
Arthur Cerveira, Frederico Kremer, Darling de Andrade Lourenço and Ulisses B Corrêa (Universidade Federal de Pelotas, Brazil)

July 2, 2024

8:20 – 10:00
Workshop: International Workshop on Forging Trust in Artificial Intelligence
Room: 211+212

8:20 – 10:00
Workshop: Workshop on Computational Intelligence Applications
Room: 213

8:20 – 10:00
Panel: Inside the Editorial Room: Conversations with CIS Editors-in-Chief
Room: 301+302+303+304

8:20 – 10:00
CEC TU1-R10: Biometrics, Bioinformatics and Biomedical Applications
Conference: CEC
Room: 414+415
Session Chair(s): Wilfried Segretier

8:20 A Survey of Applications of Multi-Objective Evolutionary Algorithms in Biotechnology
Carlos Felipe Coello Castillo (UAM Cuajimalpa, Mexico); Carlos Coello Coello (Cinvestav, Mexico)

8:40 Leveraging Latent Evolutionary Optimization for Targeted Molecule Generation
Siddartha Reddy, Mukkamala Venkata Sai Prakash, Varun V and Saisubramaniam Gopalakrishnan (Quantiphi Analytics, India); Vishal Vaddina (Quantiphi, Canada)

9:00 Prediction of Mycobacterium tuberculosis lineages from annotated whole genome sequences: An evolutionary approach
Wilfried Segretier (University of French West Indies, Guadeloupe); Erick Stattner (University of the French West Indies and Guiana & LAMIA Lab., Martinique); David Couvin (University of French West Indies, Guadeloupe); Nalin Rastogi (Institut Pasteur, France)

9:20 Data sampling via Active Learning in Cartesian Genetic Programming for Biomedical Data
Yuri Lavinas (University of Toulouse, France); Nathaniel Haut (Michigan State University, France); Bill Punch (USA); Wolfgang Banzhaf (Memorial University of Newfoundland, Canada); Sylvain Cussat-Blanc (University of Toulouse 1 Capitole- Irit, France)

8:20 – 10:00
CEC TU1-R11: Real-world Applications III
Conference: CEC
Room: 416+417
Session Chair(s): Takafumi Fukase

8:20 Optimization of Node Reduction Using BRKGA for GNN-Based Traffic Speed Forecasting
Yuto Inokuchi (Kumamoto University, Japan); Pedro Henrique González (Federal University of Rio de Janeiro, Brazil); Israel Mendonca and Masayoshi Aritsugi (Kumamoto University, Japan)

8:40 Evolving Design For Engineering Structures
Rahul Dubey (Missouri State University, USA); Simon Hickinbotham and Edgar Buchanan (University of York, UK (Great Britain)); Andrew Robert Colligan (Queen's University Belfast, UK (Great Britain)); Imelda Friel (Queens University Belfast, UK (Great Britain)); Mark Price (Queen's University Belfast, UK (Great Britain)); Andy Tyrrell (University of York, UK (Great Britain))

9:00 Extending Lexicase DE for a Multi-Niche Constraint Satisfaction Industrial Design Problem
Takafumi Fukase (TDK Corporation, Japan); Yuta Kobayashi and Claus Aranha (University of Tsukuba, Japan)

9:20 Dynamic Multi-Workflow Scheduling: A Comparative Analysis of Real-time Data
Sugandha Rathi (Amity University, India); Deepti Mehrotra (AMITY School of Engineering and Technology & Amity Univerisity, India); Renuka Nagpal (Amity University, India); Gautam Srivastava (Brandon University & China Medical University, Canada)

9:40 MVBA_TSC: Majority Voting and Bayesian Average-based Trustful Service Composition in Cloud and Edge Environments
Faten Sebri (University of Jaén, Spain); Rocío Pérez de Prado (University of Jaen, Spain); Zaki Brahmi (Higher Institute of Computer and Communication Techniques, Tunisia)

8:20 – 10:00
CEC TU1-R12: SS on Adaptive EC and SI Algorithms
Conference: CEC
Room: 418
Session Chair(s):

8:20 An Adaptive Metaheuristic Framework for Changing Environments
Bestoun S. Ahmed (Karlstad University, Sweden)

8:40 Effectiveness of an ACO algorithm with Levy Flight for Large-scale Constraint Satisfaction Problems
Takuma Onagi, Kazunori Mizuno and Koichiro Sato (Takushoku University, Japan)

9:00 Q-Learning-Driven Framework for High-Dimensional Optimization Problems
Kanchan Rajwar and Kusum Deep (Indian Institute of Technology Roorkee, India)

9:20 Deep Reinforcement Learning Based Adaptive Environmental Selection for Evolutionary Multi-Objective Optimization
Ye Tian, Lianjie Yao, Shuai Shao, Yajie Zhang and Xingyi Zhang (Anhui University, China)

9:40 Bias in Standard Self-Adaptive Evolution Strategies
Amir Omeradzic and Hans-Georg Beyer (Vorarlberg University of Applied Sciences, Austria)

8:20 – 10:00
CEC TU1-R13: Evolutionary Multi-objective Algorithms IV
Conference: CEC
Room: 419
Session Chair(s): Arnaud Liefooghe

8:20 MOW-P: A Simple yet Efficient Partial Neighborhood Walk for Multiobjective Optimization
Matthieu Basseur, Arnaud Liefooghe and Sara Tari (University of the Littoral Opal Coast, France)

8:40 Repeated ε-Sampling for Many-objective Optimization
Yu Takei, Hernan Aguirre and Kiyoshi Tanaka (Shinshu University, Japan)

9:00 An Effective Algorithm Based on Space Net Optimization for Multi-Objective Optimization
Chun-Wei Tsai, Cheng-Hao Lin and Wei-Hong Wang (National Sun Yat-sen University, Taiwan)

9:20 Pareto Front Estimation Model Optimization for Aggregative Solution Set Representation
Naru Okumura, Keiki Takadama and Hiroyuki Sato (The University of Electro-Communications, Japan)

9:40 A Federated Data-driven Multiobjective Evolutionary Algorithm via Continual Learnable Clustering
Takato Kinoshita, Naoki Masuyama and Yusuke Nojima (Osaka Metropolitan University, Japan)

8:20 – 18:40
Exhibition
Room: 501+502

10:00 – 10:20
Break

10:20 – 11:30
IEEE Frank Rosenblatt Award Ceremony and Recipient Plenary Talk by Marios M. Polycarpou
Room: 301+302+303+304
Session Chair(s): Yaochu Jin

Connecting Computational Intelligence to the Cyber-Physical World
Marios M. Polycarpou
University of Cyprus

The development of cyber-physical systems with multiple sensor/actuator components and feedback loops has given rise to advanced automation applications, including energy and power, intelligent transportation, water systems, manufacturing, etc. Traditionally, feedback control has focused on enhancing the tracking and robustness performance of the closed-loop system; however, as cyber-physical systems become more complex and interconnected and more interdependent, there is a need to refocus our attention not only on performance but also on the resilience of cyber-physical systems. In situations of unexpected events and faults, computational intelligence can play a key role in improving the fault tolerance of cyber-physical systems and preventing serious degradation or a catastrophic system failure. The goal of this presentation is to provide insight into the design and analysis of intelligent monitoring methods for cyber-physical systems, which will ultimately lead to more resilient societies.

11:30 – 13:00
Lunch

13:00 – 14:00
Keynote talk by Masashi Sugiyama
Conference: IJCNN
Room: 301+302
Session Chair(s): Petia Georgieva

Towards More Robust and Reliable Machine Learning
Masashi Sugiyama
Riken, The University of Tokyo

In statistical machine learning, training data is often full of uncertainties due to insufficient information, label noise, and bias. In this talk, I will give an overview of our research on reliable machine learning, including weakly supervised learning, noise-robust learning, and transfer learning. Then, I will discuss our recent challenges to integrate these approaches and develop a generic machine learning methodology with fewer modeling assumptions.

13:00 – 14:00
Keynote talk by Handing Wang
Conference: CEC
Room: 303+304
Session Chair(s): Yaochu Jin

Challenges in Data-Driven Evolutionary Optimization
Handing Wang
Xidian University

Many real-world problems that are optimized based on data collected from historical records, numerical simulations, or physical experiments are called data-driven optimization problems. The interdisciplinary research area of data-driven evolutionary optimization involves techniques in data science, machine learning, and evolutionary algorithms. In an evolutionary data-driven optimization framework, data will be collected at first. Then, surrogate models, which are machine learning models, are built from the data to approximate the real objective functions and / or constraint functions. Given the approximated objective or constraint functions, evolutionary algorithms can then be applied to perform optimization. This talk will highlight the current challenges of data-driven evolutionary optimization based on the view of real-world applications. Also, the techniques to address those challenges will be introduced.

13:00 – 14:00
Keynote Talk by Francisco Herrera
Conference: FUZZ-IEEE
Room: 503
Session Chair(s): Susana Vieira

Fuzzy Systems to Support Safe and Trustworthy Artificial Intelligence
Francisco Herrera
University of Granada

Artificial Intelligence (AI) has matured as a technology, AI has quietly entered our lives, and it has taken a giant leap in the last year. Image generative AI models or the latest evolutions of large language models have meant that AI has gone, in just a few months, practically from science fiction to being an essential part of the daily lives of hundreds of millions of people around the world.

This emergence goes hand in hand with a growing global debate on the ethical dimension of AI which raises the need for responsible, fair, inclusive, trustworthy, safe, transparent and accountable frameworks. Two essential concepts emerge in this scenario. 1) Trustworthy AI, supported on the legal, ethical, and technical robustness pillars, including seven technical requirements. 2) AI safety, which encompass machine ethics and AI alignment, aiming to make AI systems moral and beneficial, and robustness technical problems (including monitoring systems for risks, robustness against adversaries, detecting malicious use, attacks and backdoors, …) Safe and trustworthy AI is a critical area to meet upcoming regulations, the necessary auditability metrics for their analysis and compliance, address ethical issues, manage risk analysis in human-AI system interaction, and ensure the technical soundness of responsible AI systems (auditability and accountability during its design, development and use). This talk addresses the role that fuzzy systems can play in supporting the technical requirements of safe and trustworthy AI. The use of fuzzy sets and systems can support auditability and accountability metrics, to address different technical requirements for trustworthy (explainability, privacy and federated learning, fairness, ...), and to design fuzzy monitoring systems for robustness, ... Finally, we should delve into another essential aspect, discuss and think about the development of fuzzy technologies that fit into the design requirements for auditability and design frameworks for accountable AI systems. This is a great opportunity to explore in today's emerging safe and trustworthy AI scenario.

14:00 – 14:20
Break

14:20 – 18:40
Workshop: International Workshop on Forging Trust in Artificial Intelligence
Room: 211+212

14:20 – 18:40
Workshop on Computational Intelligence Applications
Room: 213

14:20 – 16:20
CEC TU2-R10: SS on The 2nd Edition of the Quantum Artificial Intelligence
Conference: CEC
Room: 414+415
Session Chair(s):

14:20 An Innovative Knowledge Learning Adaptive Quantum-inspired Algorithm for Trend Ratio-Based Portfolio Construction Model
Shu-Yu Kuo (National Taiwan University, Taiwan); Yu-Chi Jiang (Princeton University, USA); Ching-Hsuan Wu, Cheng-Yen Hua and Yun-Ting Lai (National Chi Nan University, Taiwan); Yao-Hsin Chou (National Chi-Nan University, Taiwan)

14:40 A Quantum-inspired Multi-objective Portfolio Strategy Based on Trend Ratio Model in Global Financial Network
Yao-Hsin Chou (National Chi-Nan University, Taiwan); Yun-Ting Lai, Yong Feng Tong, Alvin Young, Ming-Ho Chang and Kun-Min Wu (National Chi Nan University, Taiwan); Yu-Chi Jiang (Princeton University, USA); Shu-Yu Kuo (National Taiwan University, Taiwan)

15:00 Urban Land Cover Classification with Efficient Hybrid Quantum Machine Learning Model
Fan Fan (Technical University of Munich & German Aerospace Center, Germany); Yilei Shi (Technical University of Munich, Germany); Xiao Xiang Zhu (German Aerospace Center (DLR), Remote Sensing Technology & Technical University of Munich (TUM), Signal Processing in Earth Observation, Germany)

15:20 Hybrid Quantum Annealing with Innovative Trend Ratio Model for Portfolio Optimization
Yao-Hsin Chou (National Chi-Nan University, Taiwan); Ching-Hsuan Wu and Pei-Shin Huang (National Chi Nan University, Taiwan); Shu-Yu Kuo (National Taiwan University, Taiwan); Yu-Chi Jiang (Princeton University, USA); Sy-Yen Kuo and Ching-Ray Chang (National Taiwan University, Taiwan)

15:40 Improving Quantum Genetic Algorithms through Recursive Search Space Exploration
Giovanni Acampora (University of Naples Federico II & Istituto Nazionale di Fisica Nucleare, Italy); Autilia Vitiello (University of Naples Federico II, Italy)

14:20 – 16:20
CEC TU2-R11: SS on Advances in CI in Health and Medicine (ACIHM)
Conference: CEC
Room: 416+417
Session Chair(s): Yasin Mamatjan and Tayo Obafemi-Ajayi

14:20 Indoor Area Location System Using UWB Technology and Axis-Linear Bounding Boxes
José Luis López Ruiz, Sr. and Jose María Jiménez Villar (University of Jaén, Spain); Antonio Pedro Albín Rodríguez (Education and Sports Council, Spain); Macarena Espinilla Estevez (University of Jaen, Spain)

14:40 Optimized Drug Design using Multi-Objective Evolutionary Algorithms with SELFIES
Tomoya Hömberg (Otto-Von-Guericke University, Germany); Sanaz Mostaghim (Otto von Guericke University Magdeburg, Germany); Satoru Hiwa and Tomoyuki Hiroyasu (Doshisha University, Japan)

15:00 Hyperdimensional Computing Approaches in Single Cell RNA Sequencing Classification
Petros Barmpas, Sotiris K. Tasoulis and Spiros Georgakopoulos (University of Thessaly, Greece); Vassilis Plagianakos (University Of Thessaly, Greece)

15:20 Pan-Cancer Classification System with Explainable AI Interpretation: A Feasibility Study
Yasin Mamatjan (Thompson Rivers University & Princess Margaret Cancer Centre, Canada)

15:40 Introducing the RSNA-VR and the RSNA-DE algorithms for Diagnosing Alzheimer's Disease
Antonio Della Cioppa, Angelo Marcelli and Antonio Iannaccone (University of Salerno, Italy)

16:00 Promoting Diversity in the Evolution of Biological Sequence Data
Michael Dube (University of Guelph, Canada); Sheridan Houghten (Brock University, Canada); Steffen Graether (University of Guelph, Canada)

14:20 – 16:20
Panel: How to Improve and Promote EC Research and EC Conferences
Conference: CEC
Room: 418

14:20 – 16:20
CEC TU2-R13: SS on Generative AI and Heuristic Optimization
Conference: CEC
Room: 419
Session Chair(s):

14:20 Generating Interior Images with Latent User Preferences through GANs
Sakabe Kentaro and Keiko Ono (Doshisha University, Japan); Panagiotis Adamidis (International Hellenic University, Greece); Naohiro Masuda (Doshisha University, Japan)

14:40 Exploring Generative AIs as Population Variation Operator in Multi-objective Optimization Problems
Gerardo Ibarra-Vazquez and Hugo Terashima-Marín (Tecnologico de Monterrey, Mexico); Carlos Coello Coello (Cinvestav, Mexico)

15:00 Prompt Evolutionary Design Optimization with Generative Shape and Vision-Language models
Melvin Wong (Nanyang Technological University, Singapore); Thiago Rios and Stefan Menzel (Honda Research Institute Europe, Germany); Yew Soon Ong (School of Computer Engineering, Nanyang Technological University, Singapore)

15:20 ROIL: Rule Optimization via Large Language Model for Imitation Learning
Yossathorn Tianrungroj (The University of Tokyo, Japan); Hitoshi Iba (University of Tokyo, Japan)

15:40 Assembling Fragmented Domain Knowledge: A LLM-Powered QA System for Taiwan Cinema
Enchun Kuo and Yea-Huey Su (National Central University, Taiwan)

14:20 – 16:40
Poster Session
Conference: CEC
Room: 501+502
Session Chair(s): Petia Georgieva, Zenglin Xu, and Spiros Georgakopoulos

61: Large Language Models as Evolutionary Optimizers
Shengcai Liu (Agency for Science, Technology and Research & Southern University of Science and Technology, Singapore); Caishun Chen (ASTAR, Singapore); Xinghua Qu (Shanda Group, Singapore); Ke Tang (Southern University of Science and Technology, China); Yew Soon Ong (School of Computer Engineering, Nanyang Technological University, Singapore)

62: A Hypervolume Contribution Approximation Method Based on Angular Points
Chengxin Wen (Beijing Institute of Tecnoligy, China); Lihua Li and Hongbin Ma (Beijing Institute of Technology, China)

63: Evolving Priority Rules for Online Yard Crane Scheduling with Incomplete Tasks Data
Chenwei Jin (University of Nottingham Ningbo China, China); Ruibin Bai (University of Nottingham Ningbo, China); Huayan Zhang (University of Nottingham Ningbo China, China)

64: A Niching-based Reproduction and Preselection-based Multiobjective Differential Evolution for Multimodal Multiobjective Optimization
Hongyu Lin, Jing Liang and Caitong Yue (Zhengzhou University, China); Yaonan Wang (Hunan University, China)

65: Exploring multi-objective evolutionary approaches for path planning of autonomous mobile robots
Miguel Angel Jiménez-Domínguez, Néstor Andrés García-Rojas and Saúl Zapotecas-Martínez (National Institute of Astrophysics Optics and Electronics, Mexico); Raquel Díaz Hernández (Instituto Nacional de Astrofisica, Optica y Electronica, Mexico); Leopoldo Altamirano (National Institute for Astrophysics, Optics and Electronics, Mexico)

66: A Q-learning Evolutionary Multiobjective Framework for Multiobjective Optimization with Separable and Interacting Variables
Hui Li (Xi'an Jiaotong University, China); Yanhui Tang (Xi'an Jiaotong University, China); Yuxiang Shui (Xi'an Jiaotong University, China); Jianyong Sun (Xi'an Jiaotong University, China)

67: An Enhanced Particle Swarm Algorithm Based on Fitness Landscape Information
Zhenya Diao (Minnan Normal University, China)

68: Multiobjective Bayesian Optimization for Antenna Placement in In-building Distributed Antenna System

Xilei Wu (City University of Hong Kong, Hong Kong); Pei-Qiu Huang (Central South University, China); Linqi Song (City University of Hong Kong, Hong Kong); Hai-Lin Liu (Guangdong University of Technology, China); Qingfu Zhang (City University of Hong Kong, Hong Kong)

69: QGAPHEnsemble: Combining Hybrid QLSTM Network Ensemble via Adaptive Weighting for Short Term Weather Forecasting

Anuvab Sen, Mayukhi Paul and Ananya Sutradhar (Indian Institute of Engineering Science and Technology, India); Sujith Sripadam Sai (National Institute of Technology Rourkela, India); Chhandak Mallick (Jadavpur University, India); Aakash Mallik (National Institute of Technology Karnataka Surathkal, India)

70: A Bilevel Evolutionary Algorithm Based on Upper-level-driven Lower-level Search

Ning Yang, Hai-Lin Liu and Lei Chen (Guangdong University of Technology, China); Yuping Wang (Xidian University, China); Yiu-ming Cheung (Hong Kong Baptist University, Hong Kong)

71: A Survey on Multi-Objective Optimization in Microgrid Systems

Saiful Islam (Otto-von-Guericke-University Magdeburg, Germany); Sanaz Mostaghim (Otto von Guericke University Magdeburg, Germany); Michael Hartmann (SRH University of Applied Sciences, Germany)

72: Harnessing LSTMs for Enhanced Prediction of Psychotic Episodes in Schizophrenia Spectrum

Paraskevi V. Tsakmaki, Sotiris K. Tasoulis and Spiros Georgakopoulos (University of Thessaly, Greece); Vassilis Plagianakos (University Of Thessaly, Greece)

16:40 – 18:40
CEC TU3-R10: SS on Evolutionary Deep Learning and Applications
Conference: CEC
Room: 414+415
Session Chair(s): Seyed Jalaleddin Mousavirad

16:40 An Evolutionary Compact Deep Transfer Learning with CNN for Hyper-parameter Tuning in Temporal Sorting of Plant Growth
Seyed Jalaleddin Mousavirad (Mid Sweden University, USA); Irida Shallari and Mattias O'Nils (Mid Sweden University, Sweden)

17:00 Automatic design of LSTM networks with skip connections through evolutionary and differentiable architecture search
Ramya Anasseriyil Viswambaran (ESR, New Zealand); Seyed Mohammad Nekooei, Gang Chen and Bing Xue (Victoria University of Wellington, New Zealand)

17:20 Multi-Optimiser Training for GANs based on Evolutionary Computation
Yixia Zhang and Yu Xue (Nanjing University of Information Science and Technology, China); Ferrante Neri (University of Surrey, UK (Great Britain))

17:40 Characterising Deep Learning Loss Landscapes with Local Optima Networks
Yuyang Zhou (University of Nottingham Ningbo China, China); Ferrante Neri (University of Surrey, UK (Great Britain)); Ruibin Bai (University of Nottingham Ningbo, China)

18:00 Genetic Drift Regularization: on preventing Actor Injection from breaking Evolution Strategies
Paul Templier (University of Toulouse & ISAE-SUPAERO, France); Emmanuel Rachelson (ISAE-SUPAERO, Université de Toulouse, France); Antoine Cully (Imperial College London, UK (Great Britain)); Dennis G Wilson (ISAE-Supaero & University of Toulouse, France)

18:20 Evolutionary Design of Long Short Term Memory Networks and Ensembles through Genetic Algorithms
Ramya Anasseriyil Viswambaran (ESR, New Zealand); Seyed Mohammad Nekooei, Gang Chen and Bing Xue (Victoria University of Wellington, New Zealand)

16:40 – 18:40
CEC TU3-R11: SS on Advances in Decomposition-based EMO
Conference: CEC
Room: 416+417
Session Chair(s): Yunpeng Ba

16:40 MOEA/D-CMA Made Better with (1+1)-CMA-ES
Chengyu Lu and Yilu Liu (City University of Hong Kong, Hong Kong); Qingfu Zhang (City University of Hong Kong, Mexico)

17:00 Decomposition-Based Memetic Algorithm for Multi-Objective Fleet Size and Mix Vehicle Routing Problem
Yunpeng Ba, Ruihao Zheng and Zhenkun Wang (Southern University of Science and Technology, China)

17:20 Push and Pull Search with Directed Mating for Constrained Multi-objective Optimization
Ryo Takamiya, Minami Miyakawa, Keiki Takadama and Hiroyuki Sato (The University of Electro-Communications, Japan)

17:40 On a Better Understanding of Unique Identifiers of Pareto Solutions for Multi-criterion Optimization, Visualization, and Decision-making
Anirudh Suresh and Kalyanmoy Deb (Michigan State University, USA)

18:00 Distributed Bit Climbing Algorithm for Binary Multi-objective Optimization
Yudai Tagawa, Hernan Aguirre and Kiyoshi Tanaka (Shinshu University, Japan)

16:40 – 18:40
CEC TU3-R12: Evolutionary Robotics
Conference: CEC
Room: 418
Session Chair(s): Radomil Matousek

16:40 Benchmarking Derivative-Free Global Optimization Methods on Variable Dimension Robotics Problems
Jakub Kudela, Martin Juricek and Roman Parak (Brno University of Technology, Czech Republic); Alexandros Tzanetos (Jönköping University, Sweden); Radomil Matousek (Brno University of Technology, Czech Republic)

17:00 Genetic Algorithm-based Robot Path Planning with the Extraction of Topological Map
Zhen Liu (The University of Tokyo, Japan); Jinglue Xu (the University of Tokyo, Japan); Hitoshi Iba (University of Tokyo, Japan)

17:20 The Virtual Programmable Logic Device, a Novel Machine Learning Architecture
Fraser Borrett and Mark Beckerleg (Auckland University of Technology, New Zealand)

17:40 A Comparison of a Digital and Floating-Point Virtual Programmable Logic Device and an Artifical Neural Network Evolved for Robotic Navigation
Fraser Borrett and Mark Beckerleg (Auckland University of Technology, New Zealand)

18:00 Heterogeneous UAV Swarm Task Allocation via Hierarchy Tolerance Pigeon-Inspired Optimization
Zhiqiang Zheng, Haibin Duan and Yongbin Sun (Beihang University, China)

16:40 – 18:40
CEC TU3-R13: Evolutionary Multitasking and Transfer Learning
Conference: CEC
Room: 419
Session Chair(s): Eric O Scott

16:40 Evolutionary Constrained Multi-Factorial Optimization Based on Task Similarity
Shio Kawakami, Keiki Takadama and Hiroyuki Sato (The University of Electro-Communications, Japan)

17:00 Surrogate-Assisted Adaptive Knowledge Transfer for Expensive Multitasking Optimization
Jiangtao Shen, Huachao Dong, Peng Wang, Xinjing Wang and Wenxin Wang (Northwestern Polytechnical University, China)

17:20 Similar Locality based Transfer Evolutionary Optimization for Minimalistic Attacks
Wenqiang Ma, Yaqing Hou and Hua Yu (Dalian University of Technology, China); Xiangrong Tong (Yantai University, China); Qiang Zhang (Dalian University of Technology, China)

17:40 Varying Difficulty of Knowledge Reuse in Benchmarks for Evolutionary Knowledge Transfer
Eric O Scott (MITRE, USA); Kenneth A De Jong (George Mason University, USA)

18:00 One-Shot Surrogate for Evolutionary Multiobjective Neural Architecture Search
Kuangda Lyu, Maoguo Gong, Hao Li, Yuan Gao and Yue Wu (Xidian University, China); Dan Feng (Xi'an University of Posts and Telecommunications, China); Jiao Shi and Yu Lei (Northwestern Polytechnical University, China)

18:20 A Review on Evolutionary Multiform Transfer Optimization
Yinglan Feng (The Hong Kong Polytechnic University, Hong Kong); Liang Feng (Chongqing University, China); Xiaoming Xue (City University of Hong Kong, Hong Kong); Sam Tak Wu Kwong (Lingnan University, Hong Kong); Kay Chen Tan (The Hong Kong Polytechnic University, Hong Kong)

19:00 – 20:40
Virtual: Neural Networks
Conference: CEC
Room: Zoom 25
Session Chair(s): Ngoc Hoang Luong

19:00 Zero-Cost Proxy-Based Hierarchical Initialization for Evolutionary Neural Architecture Search
Minh Le and An Vo (University of Information Technology, Vietnam); Ngoc Hoang Luong (University of Information Technology (UIT), VNU-HCM, Vietnam)

19:20 Effective Training of PINNs by Combining CMA-ES with Gradient Descent
Lin Liu (Beihang University, China); Yuan Yuan (Beihang University Zhongguancun Laboratory, China)

19:40 Neural Network-Assisted Particle Swarm Dynamic Optimization
Zhi Liu, Wei Song and Mingshuo Song (Jiangnan University, China)

20:00 Evolutionary Deep Reinforcement Learning via Hybridizing Estimation-of-Distribution Algorithms with Policy Gradients
Thai Bao Tran (University of Information Technology - UIT, Vietnam); Ngoc Hoang Luong (University of Information Technology (UIT), VNU-HCM, Vietnam)

21:00 – 22:40
Virtual: Evolutionary Computation for Feature Selection, Extraction and Dimensionality Reduction
Conference: CEC
Room: Zoom 25
Session Chair(s): Songbai Liu

21:00 Evolutionary Multiobjective Feature Selection Assisted by Unselected Features
Xuan Duan (ShenZhen University, China); Songbai Liu, Junkai Ji, Lingjie Li and Qiuzhen Lin (Shenzhen University, China); Kay Chen Tan (The Hong Kong Polytechnic University, Hong Kong)

21:20 Feature selection for computer-aided diagnosis via a novelty designed binary harris hawk algorithm
Minhui Dong and Yuki Todo (Kanazawa University, Japan)

21:40 Feature Selection for GPSR based on Maximal Information Coefficient and Shapley Values
Mohamad Rimas Mohamad Anfar and Qi Chen (Victoria University of Wellington, New Zealand); Mengjie Zhang (VUW, New Zealand)

22:10 Enhancing Diversity in Multi-objective Feature Selection
Sevil Zanjani Miyandoab (Ontario Tech University, Canada); Shahryar Rahnamayan (Brock University, Canada); Azam Asilian Bidgoli (Wilfrid Laurier University, Canada); Sevda Ebrahimi (Ontario Tech University, Canada); Masoud Makrehchi (University of Ontario Tech, Canada)

23:00 – 24:40
Virtual: Evolutionary Computation in Healthcare Industry
Conference: CEC
Room: Zoom 25
Session Chair(s):

23:00 Lightweight Detection Architecture Adapted to Small Lesions Using Multiscale Sampling Method
Ayu Karasudani, Masaki Ishihara, Tatsuya Yamaguchi, Ayaka Oka, Yu Hasome, Nobuhiro Miyazaki, Hiroaki Takebe and Takayuki Baba (Fujitsu Limited, Japan); Shogo Maeda, Yuko Nakamura, Toru Higaki and Kazuo Awai (Hiroshima University, Japan)

23:20 COR-MFS: A Correlation-based Multi-objective Feature Selection on EEG Signals
Ananda Sutradhar (Daffodil International University, Bangladesh); Azam Asilian Bidgoli (Wilfrid Laurier University, Canada); Shahryar Rahnamayan (Brock University, Canada)

23:40 A surrogate-assisted genetic algorithm framework to discover peptides against COVID-19 virus

Elias Silva (Federal Institute of Education Science and Technology of Rondônia, Brazil); Lucas Palmeira (Federal University of Minas Gerais, Brazil); Marcelo Garcia-Junior and Luiz Gustavo A. Martins (Federal University of Uberlândia, Brazil); Yaochu Jin (Westlake University, China); Bruno S. Andrade (State University of Southwestern Bahia, Brazil); Robinson Sabino-Silva and Murillo G. Carneiro (Federal University of Uberlândia, Brazil)

24:00 Feature Selection-driven Bias Deduction in Histopathology Images: Tackling Site-Specific Influences

Farnaz Kheiri (University of Ontario Tech, Canada); Azam Asilian Bidgoli (Wilfrid Laurier University, Canada); Masoud Makrehchi (University of Ontario Tech, Canada); Shahryar Rahnamayan (Brock University, Canada)

24:20 MiRNN: A mutual information augmented recurrent neural network framework for reconstruction of gene regulatory networks

Prianka Dey (University of Calcutta & Narula Institute of Technology, India); Abhinandan Khan (ARP Engineering & University of Calcutta, India); Goutam Saha (North Eastern Hill University, India); Rajat Pal (University of Calcutta, India)

July 3, 2024

8:20 – 10:00
CEC WE1-R10: SS on Bilevel Optimization: Methods and Applications
Conference: CEC
Room: 414+415
Session Chair(s): Hemant K Singh

8:20 A Bi-level Evolutionary Model Tree Induction Approach for Regression
Safa Mahouachi (SMART Lab, ISG, University of Tunis, Tunisia); Maha Elarbi (SMART Lab, ISG-Tunis, University of Tunis, Tunisia); Khaled Sethom (SMART Lab ISG Tunis University of Tunis, Tunisia); Slim Bechikh (SMART Lab, University of Tunis, ISG, Tunisia); Carlos Coello Coello (Cinvestav, Mexico)

8:40 Decomposition of Difficulties in Complex Optimization Problems Using a Bilevel Approach
Ankur Sinha (Indian Institute of Management Ahmedabad, India); Dhaval Pujara (Indian Institute of Managment Ahmedabad, India); Hemant K Singh (The University of New South Wales, Australia)

9:00 Improving the Performance of Bilevel Evolutionary Algorithms using Variable Associations
Bing Wang (University of New South Wales, Australia); Hemant K Singh (The University of New South Wales, Australia); Tapabrata Ray (University of New South Wales at ADFA, Australia)

9:20 A Bi-Level Multi-Objective Energy Management System for Renewable Energy Self-Consumption
Thalis Papakyriakou, Andreas Pamboris and Andreas Konstantinidis (Frederick University, Cyprus)

9:40 A Nested Evolutionary Algorithm for Solving a Bilevel Competitive Location Problem: Optimistic vs. Pessimistic Approaches
José-Fernando Camacho-Vallejo (Tecnologico de Monterrey, Mexico); Carlos E. Corpus (Universidad de Nuevo Leon, Mexico)

8:20 – 10:00
CEC WE1-R11: SS on Nature-Inspired Constrained Optimization
Conference: CEC
Room: 416+417
Session Chair(s): Efrén Mezura-Montes

8:20 Natural Evolution Strategy for Black-Box Function Optimization with Implicit Constraint
Masato Nishikubo and Isao Ono (Tokyo Institute of Technology, Japan)

8:40 Chance Constrained Optimization for Wind Power Curve Fitting with Unclean Data
Xun Shen (Osaka University & Tokyo Institute of Technology, Japan)

9:00 Constraint Consensus for Solving Large-scale Constrained Optimization Problems
Noha Hamza (University of New South Wales Canberra, Australia); Sarker Amin Ruhul (University of New South Wales, Australia); Daryl Essam (University of New South Wales at the Australian Defence Force Academy UNSW@ADFA, Australia); Saber Elsayed (University of New South Wales, Australia)

9:20 An Improved Gradient-based Repair Method for Constrained Numerical Optimization
Jingyu Ji, Sen Yang, Kester Kwan Yeung Lee, Hon Wing Billy Chiu, Man Leung Wong and Sam Tak Wu Kwong (Lingnan University, Hong Kong)

8:20 – 10:00
CEC WE1-R12: J2C Paper Presentation I
Conference: CEC
Room: 418
Session Chair(s): Lie Meng Pang

8:20 Introducing Anti-Dominance Structures in Multi-objective Optimization
Kalyanmoy Deb (Michigan State University, USA); Mathias Ehrgott (Lancaster University, USA)

8:40 Multi-Objective Ensemble Learning for Product Quality Prediction in Iron and Steel Industry
Xianpeng Wang (Northeastern University, China); Lixin Tang (China); Yao Wang (Northeastern University, China); Qingfu Zhang (City University of Hong Kong, Mexico)

9:00 Mitigating Unfairness via Evolutionary Multi-objective Ensemble Learning
Qingquan Zhang and Jialin Liu (Southern University of Science and Technology, China); Zeqi Zhang (Huawei, China); Junyi Wen (Huawei Technologies, China); Bifei Mao (Huawei, China); Xin Yao (Lingnan University)

9:20 Hypervolume-Based Cooperative Coevolution with Two Reference Points for Multi-Objective Optimization
Lie Meng Pang, Hisao Ishibuchi, Linjun He, Ke Shang and Longcan Chen (Southern University of Science and Technology, China)

9:40 Quality Indicators for Preference-based Evolutionary Multi-objective Optimization Using a Reference Point: A Review and Analysis (J2C track in WCCI2024)
Ryoji Tanabe (Yokohama National University, Japan); Ke Li (University of Exeter, UK (Great Britain))

8:20 – 10:00
CEC WE1-R13: SS on Data-Driven Evolutionary Optimization of Computationally Expensive Problems
Conference: CEC
Room: 419
Session Chair(s): Chaoli Sun

8:20 Expensive Many-objective Optimization Assisted by Adaptive Modeling
Shufen Qin (Taiyuan University of Science and Technology, China); Chaoli Sun (Taiyuan University of Science and Technology, Hong Kong); Zongchao Xie (University of Melbourne, Australia)

8:40 Empirical Study on Averaging-based Noise-Tolerant Methods for Expensive Combinatorial Optimization
Shulei Liu and Handing Wang (Xidian University, China); Wen Yao and Wei Peng (Chinese Academy of Military Science, China); Jingjing Ma (Xidian University, China)

9:00 Analysis of the Impact of Prediction Accuracy on Search Performance in Surrogate-assisted Evolutionary Algorithms
Yuki Hanawa (Tokyo Metropolitan University, Japan); Tomohiro Harada (Saitama University, Japan); Yukiya Miura (Tokyo Metropolitan University, Japan)

9:20 Surrogate-Assisted Particle Swarm Optimization with Dual-Subspace Search for Large-Scale Expensive Optimization
Jiajia Zhang (Taiyuan University of Science and Technology, China); Chaoli Sun (Taiyuan University of Science and Technology, Hong Kong); Guochen Zhang, Jing Li and Hui Shi (Taiyuan University of Science and Technology, China); Zongchao Xie (University of Melbourne, Australia)

9:40 A Meta-Learning-Based Surrogate-Assisted Evolutionary Algorithm for Expensive Multi-Objective Optimization Problems
Liqun Wen and Hongfeng Wang (Northeastern University, China)

8:20 – 18:00
Exhibition
Room: 501+502

10:00 -10:20
Break

10:20 – 11:30
IEEE Frank Rosenblatt Award Ceremony and Recipient Plenary Talk by Bernadette Bouchon-Meunier
Room: 301+302+303+304
Session Chair(s): Yaochu Jin

Can intelligent systems be conscious?

Bernadette Bouchon-Meunier
CNRS-Sorbonne Université

The concept of consciousness is complex and takes various forms. The fact that an intelligent system can be conscious has long been discussed and the questions are getting louder as we see systems springing up everywhere that seem capable of dialoguing with humans in a very natural way. We propose to look at several facets of consciousness, from phenomenological consciousness linked to perceptions to access consciousness, which gives us information about one's actions. In 1982 already, Marvin Minsky 1 was considering that self-conscious systems could be done by providing machines with ways to examine their own mechanisms while they are working. Then Jacques Pitrat 2 in 2009 claimed that, for a conscious artificial being, the possibility of monitoring its own thought enables it to explain its decisions so that they can be accepted by others, which goes in the direction of eXplainable AI. A recent study 3 provides a list of indicator properties derived from scientific theories to assess consciousness for an intelligent system. We offer an overview of some interesting aspects of consciousness from the angle of intelligent systems, which can be different from human consciousness, and we wonder to what extent a present or a future system can have such a form of consciousness and what the advantages and drawbacks are.

11:30 – 13:00
Lunch Time

13:00 – 14:00
Networks Pioneer Award Keynote Talk by Johan Suykens
Conference: IJCNN
Room: 301+302
Session Chair(s): Robert Kozma

Least Squares Support Vector Machines and Deep Learning
Johan Suykens
Katholieke Universiteit Leuven

While powerful architectures have been proposed in deep learning, with support vector machines and kernel-based methods solid foundations have been obtained from the perspective of statistical learning theory and optimization. Simple core models were obtained within the least squares support vector machines framework, related to classification, regression, kernel principal component analysis, kernel canonical correlation analysis, kernel spectral clustering, recurrent models, approximate solutions to partial differential equations and optimal control problems, etc. The representations of the models are understood in terms of primal and dual representations, respectively related to feature maps and kernels. The insights have been exploited for tailoring representations to given data characteristics, both for high dimensional input data and large scale data sets. One can either work with explicit feature maps (such as e.g. convolutional feature maps) or implicit feature maps through the kernel functions.

Within this talk we will mainly focus on new insights connecting deep learning and least squares support vector machines. Related to Restricted Boltzmann machines and Deep Boltzmann machines we show how least squares support vector machine models can be transformed into so-called Restricted Kernel Machine representations. It enables to conceive new deep kernel machines, generative models, multi-view and tensor based models with latent space exploration, and obtain improved robustness and explainability. On most recent work, we will explain how the attention mechanism in transformers can be seen within the least squares support vector machine framework. More precisely it can be represented as an extension to asymmetric kernel singular value decomposition with primal and dual model representations, related to two feature maps (queries and keys) and an asymmetric kernel. In the resulting method of "Primal-Attention" a regularized loss is employed to achieve low-rank representations for efficient training in the primal.

Finally, these newly obtained synergies are very promising in order to obtain the bigger and unifying picture. Several future challenges will be outlined from this perspective.

13:00 – 14:00
Keynote talk by Mengjie Zhang
Conference: CEC
Room: 303+304
Session Chair(s): Sanaz Mostaghim

Evolutionary Machine Learning: 50 Years of Progress
Mengjie Zhang
Victoria University of Wellington

Evolutionary machine learning have been very popular over the recent years. In this talk, I will firstly provide a brief overview of the history of evolutionary machine learning with the major developments over the past 50 years, then focus on the main paradigms of evolutionary machine learning and their successes in classification, feature selection, regression, clustering, computer vision and image analysis, scheduling and combinatorial optimisation, deep learning, transfer learning and explainable/interpretable machine learning. The main applications, challenges and lessons as well as potential opportunities will be also discussed.

13:00 – 14:00
Keynote Talk by Jie Lu
Conference: FUZZ-IEEE
Room: 503
Session Chair(s): Marie-Jeanne Lesot

Fuzzy Machine learning
Jie Lu
University of Technology Sydney

The talk will present the concepts, methodologies, and algorithms of fuzzy machine learning, including fuzzy transfer learning, fuzzy concept drift detection and adaptation, and fuzzy recommender systems. It will also present how the fuzzy machine learning techniques can effectively support data-driven prediction and decision-making in uncertain, complex, and dynamic situations.

14:00 – 14:20
Break

14:20 – 18:00
Workshop: Computational Intelligence in Human Informatics
Room: 213

14:20 – 16:20
Panel: Can AI Craft AI Inspired by the Brain?: Insights from the Fathers
Room: 301+302

14:20 – 16:20
CEC WE2-R10: SS on Explainable AI and Green Computing for Human-Centered EC
Conference: CEC
Room: 414+415
Session Chair(s): Guilherme N. DeSouza

14:20 Outlier Interpretation Using Regularized Auto Encoders and Genetic Algorithm
Seyed Mohamad Ali Tousi (University of Missouri - Columbia, USA); Guilherme N. DeSouza (University of Missouri-Columbia, USA)

14:40 Energy and Quality of Surrogate-Assisted Search Algorithms: a First Analysis
Tomohiro Harada (Saitama University, Japan); Enrique Alba (University of Malaga, Spain); Gabriel Luque (University of Málaga, Spain)

15:00 Prototype Generation with the sUpervised Classifier System on kNN Matching
Naoya Yatsu (The University of Electro-Communications, Japan); Hiroki Shiraishi (Yokohama National University, Japan); Hiroyuki Sato and Keiki Takadama (The University of Electro-Communications, Japan)

15:20 A Random Forest-Assisted Local Search for Expensive Permutation-based Combinatorial Optimization Problems
Takashi Ikeguchi and Shun Sudo (Yokohama National University, Japan); Yuji Koguma (IHI Corporation, Japan); Masaya Nakata (Yokohama National University, Japan)

15:40 A Dual Surrogate-based Evolutionary Algorithm for High-Dimensional Expensive Multiobjective Optimization Problems
Yuma Horaguchi and Masaya Nakata (Yokohama National University, Japan)

16:00 Oversampling-Guided Search for Evolutionary Multiobjective Optimization
Norihiro Kimoto, Yuma Horaguchi and Masaya Nakata (Yokohama National University, Japan)

14:20 – 16:20
CEC WE2-R11: SS on EC for Feature Selection, Extraction and Dimensionality Reduction
Conference: CEC
Room: 416+417
Session Chair(s): Bach Hoai Nguye

14:20 Dimensionality Reduction for Classification Using Divide-and-Conquer Based Genetic Programming
Peng Wang and Bing Xue (Victoria University of Wellington, New Zealand); Jing Liang (Zhengzhou University, China); Mengjie Zhang (VUW, New Zealand)

14:40 Measuring Structural Complexity of GP Models for Feature Engineering over the Generations
Joao Eduardo Batista (RIKEN-CCS, HPAIS, Japan); Adam Kotaro Pindur and Hitoshi Iba (University of Tokyo, Japan); Sara Silva (Universidade de Lisboa, Portugal)

15:00 Surrogate-Assisted Flip for Evolutionary High-Dimensional Multiobjective Feature Selection
Qi-Te Yang (South China University of Technology, China); Liu-Yue Luo (South China University of Techonlogy, China); Chunhua Chen (South China University of Technology & School of Computer Science and Engineering, South China University of Technology, China); Jian-Yu Li (Nankai University, China); Jinghui Zhong (South China University of Technology, China); Jun Zhang (SUN Yat-sen University, China); Zhi-Hui Zhan (Nankai University, China)

15:20 Computational Cost Reduction in Wrapper Approaches for Feature Selection: A Case of Study Using Permutational-Based Differential Evolution
Jesús-Arnulfo Barradas-Palmeros and Efrén Mezura-Montes (Universidad Veracruzana, Mexico); Rafael Rivera-Lopez (Tecnológico Nacional de Mexico. Instituto Tecnológico de Veracruz, Mexico); Héctor Gabriel Acosta Mesa (University of Veracruz, Mexico)

15:40 Evolutionary Label Selection for Multi-label Classification
Bach Hoai Nguyen and Bing Xue (Victoria University of Wellington, New Zealand); Mengjie Zhang (VUW, New Zealand)

14:20 – 16:20
CEC WE2-R12: J2C Paper Presentation II
Conference: CEC
Room: 418
Session Chair(s): Xiao-Fang Liu

14:20 A Steady-State Algorithm for Solving Expensive Multiobjective Optimization Problems With Nonparallelizable Evaluations
Kamrul Hasan Rahi (University of New South Wales, Australia); Hemant K Singh (The University of New South Wales, Australia); Tapabrata Ray (University of New South Wales at ADFA, Australia)

14:40 TinyTLA: Topological Landscape Analysis for Optimization Problem Classification in a Limited Sample Setting
Gašper Petelin and Gjorgjina Cenikj (Jožef Stefan Institute & Jožef Stefan International Postgraduate School, Slovenia); Tome Eftimov (Jožef Stefan Institute, Slovenia)

15:00 Transfer-Based Particle Swarm Optimization with Dynamic Differential Grouping for Large-Scale Dynamic Optimization Problems
Xiao-Fang Liu and Zhi-Hui Zhan (Nankai University, China); Jun Zhang (SUN Yat-sen University, China)

15:20 Evolutionary Multitask Multimodal Optimization Based on Distributed Knowledge Transfer
Gao Kailai (Northeastern University, China)

15:40 A Data-Driven Evolutionary Transfer Optimization for Expensive Problems in Dynamic Environments
Ke Li (University of Exeter, UK (Great Britain)); Xin Yao (University of Birmingham, UK (Great Britain)); Renzhi Chen (Tsinghua University, China)

14:20 – 16:20
CEC WE2-R13: Surrogate-Assisted Evolutionary Computation
Conference: CEC
Room: 419
Session Chair(s): Chaoli Sun and Cuie Yang

14:20 Infill Criterion Ensemble in Multi-Objective Evolutionary Algorithm for Mixed-Variable Problems
Yongcun Liu, Handing Wang and Jingjing Ma (Xidian University, China)

14:40 Surrogate Assisted Large-scale Expensive Optimization With Difference-based Infill Criterion
Wang Lu (Taiyuan University of Science and Technology, China); Chaoli Sun (Taiyuan University of Science and Technology, Hong Kong); Guochen Zhang, Kaili Zhao and Hui Shi (Taiyuan University of Science and Technology, China); Zongchao Xie (University of Melbourne, Australia)

15:00 Surrogate-Assisted Multi-Objective Optimization for Handling Objectives with Heterogeneous Evaluation Times: Unconstrained Problems
Balija Santoshkumar and Kalyanmoy Deb (Michigan State University, USA)

15:20 A Surrogate-Assisted Coevolutionary Algorithm for Expensive Constrained Multiobjective Optimization
Haofeng Wu, Qingda Chen, Cuie Yang and Jinliang Ding (Northeastern University, China); Yaochu Jin (Westlake University, China)

15:40 A Hybrid CMA-ES Method with Convex Hull Surrogate Model
Wenwen Liu, Shiu Yin Yuen and Chi Wan Sung (City University of Hong Kong, China)

14:20 – 16:40
Poster Session
Conference: IJCNN+CEC
Room: 501+502
Session Chair(s): Thomas Trappenberg and Hongyu Lin

59: Predictive control of a multi-energy building-integrated microgrid: a case study
Romain Mannini (University Perpignan via Domitia, France); Julien Eynard (University of Perpignan, France); Stéphane Grieu (University Perpignan via Domitia, France)

60: Nonlinear model-based predictive control of electric water heaters in individual dwellings
Laguili Oumaima (University of Perpignan & PROMES Laboratory, France); Julien Eynard (University of Perpignan, France); Stéphane Grieu (University Perpignan via Domitia, France)

61: Multiobjective Optimization Problems in Switching Power Converters with Photovoltaic Inputs
Ryunosuke Numata (HOSEI University, Japan); Toshimichi Saito (Hosei University, Japan)

62: The Constrained Niching Differential Evolution Algorithm for Satellite Layout Optimization Design
Zhongneng Zhang (National University of Defense Technology, China); Xianqi Chen (Chinese Academy of Military Science, China); Yufeng Xia (National University of Defense Technology, China); Wen Yao (Chinese Academy of Military Science, China); Weien Zhou (Chinese Academy of Military Sciences, China); Yu Li (Chinese Academy of Military Science, China); Bingxiao Du (National University of Defense Technology, China)

63: Multi-Agent Collaborative Search with Adaptive Heuristics and Weight Vectors for Aerospace Multi-objective Optimal Control Problems
Li Cao (China University of Geosciences (Wuhan) & University of Strathclyde, UK (Great Britain)); Maocai Wang (China University of Geosciences, China); Ben Parsonage and Christie Maddock (University of Strathclyde, UK (Great Britain)); Guangming Dai (China University of Geosciences, China)

64: An Evolutionary Algorithm with Feasibility Tracking Strategy for Constrained Multi-objective Optimization Problems
Lei Yang, Jinglin Tian, Jiale Cao, Kangshun Li and Chaoda Peng (South China Agricultural University, China)

65: A Scalable High-Dimensional Constrained Multiobjective Benchmark
Kangjia Qiao, Jing Liang, Kunjie Yu, Caitong Yue, Hongyu Lin and Dezheng Zhang (Zhengzhou University, China); Boyang Qu (Zhongyuan University of Technology, China)

66: Model Uncertainty in Evolutionary Optimization and Bayesian Optimization: A Comparative Analysis

Hao Hao and Xiaoqun Zhang (Shanghai Jiao Tong University, China); Aimin Zhou (East China Normal University, China)

67: Reference Vector Guided Variables Selection for Expensive Large-scale Multiobjective Optimization

Jianqing Lin, Cheng He, Xueming Liu and Linqiang Pan (Huazhong University of Science and Technology, China)

68: Balancing Convergence and Diversity in Meta-heuristics for Calibration of Instrument Transformers

Zihan Gao, Cheng He, Chuanji Zhang and Hongbin Li (Huazhong University of Science and Technology, China)

69: A Surrogate-Assisted Clustering-Based Evolutionary Algorithm for Expensive Optimization

Chunlong Hai, Jiazhen Wang and Liquan Mei (Xi'an Jiaotong University, China)

70: NSMD-NAS: Retinal Image Segmentation with Neural Architecture Search and Non-Subsampled Multiscale Decomposition

Hanyu Zhang, Lixin Tang, Xiangman Song and Te Xu (Northeastern University, China)

16:20 – 16:40
Break

16:40 – 18:00
CEC WE3-R10: SS on CI for Music, Art, and Creativity
Conference: CEC
Room:414+415
Session Chair(s): Arya Kumar Bhattacharya

16:40 Emotion Aligned Music Composition from Sound Fundamentals using Differential Evolution
Prafulla Kalapatapu, Ishaan Chigilli Palli, Ravi Teja Gangavarapu, Arya Kumar Bhattacharya and Nartkannai K (Mahindra University, India)

17:00 A Language-free Evolutionary Framework for Text-to-image Generation
Ming-You Ying (National Yang Ming Chiao Tung University, Taiwan); Rung-Tzuo Liaw (Fu Jen Catholic University, Taiwan)

17:20 SCAPE: Searching Conceptual Architecture Prompts using Evolution
Soo Ling Lim (University College London (UCL), UK (Great Britain)); Peter J Bentley (University College London (UCL) and Autodesk Research, UK (Great Britain)); Fuyuki Ishikawa (National Institute of Informatics, Japan)

17:40 Revisiting the Formation of Harmonic Progressions from the Perspective of Voice-Leading with Evolutionary Computation
Chun-yien Chang and Ying-ping Chen (National Yang Ming Chiao Tung University, Taiwan)

16:40 – 18:00
CEC WE3-R11: SS on CI with Human Factors
Conference: CEC
Room:416+417
Session Chair(s): Tadashi Onishi

16:40 Preference-Based Evolutionary Multi-Objective Optimization Using Non-Preference Information
Tadashi Onishi and Mamoru Doi (Mitsubishi Electric Corporation, Japan)

17:00 A Method for Revealing Implicit Emphasized Criteria for Decision Makers on Social Issues
Toshio Ito, Shizuko Matsuzoe, Tadashi Iwahashi, Hisatoshi Yamaoka and Miwa Ueki (Fujitsu Limited, Japan); Kota Nagakane, Hideaki Morozumi, Koki Ikeda and Isao Ono (Tokyo Institute of Technology, Japan)

17:20 Computational Study of Dream Interpretations: Psychoanalytic Human vs Artificial Analyses
Mayte H Laureano and Hiram Calvo (Instituto Politécnico Nacional, Mexico)

17:40 Model Editing-based Feedback for Interactive Machine Learning in Surrogative Digital Twin
Nurfadhlina Mohd Sharef and Anahita Ghazvini (Universiti Putra Malaysia, Malaysia)

16:40 – 18:00
CEC WE3-R12: J2C Paper Presentation III
Conference: CEC
Room:418
Session Chair(s): Zhi-Hui Zhan

16:40 Evolutionary GAN Compression for Image Translation
Yao Zhou and Zhang Yi (Sichuan University, China); Gary G Yen (Oklahoma State University, USA)

17:00 Learning Plus Evolution for Optimization Towards A New Artificial Intelligence Approach
Zhi-Hui Zhan and Jian-Yu Li (Nankai University, China); Sam Kwong (City University of Hong Kong, Hong Kong); Jun Zhang (SUN Yat-sen University, China)

17:20 Evolutionary multi-objective design of autoencoders for compact representation of pathology images
Shahryar Rahnamayan (Brock University, Canada)

16:40 – 18:00
CEC Competition Session 2
Room:419

18:30 – 21:30
WCCI 2024 Banquet
Room: Pacifico Yokohama North

July 4, 2024

8:30 – 10:10
IEEE WCCI2024 Young Professionals Session
Room: 211+212

8:30 – 10:10
Workshop: Privacy- Preserving and Fairness-Aware Optimization
Room: 213

8:30 – 10:10
CEC TH1-R10: SS on EC for Electric Vehicle Routing and Charging
Conference: CEC
Room: 414+415
Session Chair(s): Yahui Jia

8:30 A Bilevel Hybrid Genetic Algorithm for Capacitated Electric Vehicle Routing Problem
Chang-Tao Feng and Yahui Jia (South China University of Technology, China); Qiang Yang (Nanjing University of Information Science and Technology, China); Wei-Neng Chen and Huaiguang Jiang (South China University of Technology, China)

8:50 Improved methods for solving the electric vehicle charging scheduling problem to maximize the delive
Abdennour Azerine (Université de Haute-Alsace & IRIMAS, Mulhouse, France); Ammar Oulamara (LORIA Laboratory Universite de Lorraine, France); Michel Basset (University of Haute Alsace, France); Lhassane Idoumghar (University of Haute Alsace & IRIMAS Institute, France)

9:10 A Confidence-based Bilevel Memetic Algorithm with Adaptive Selection Scheme for Capacitated Electric Vehicle Routing Problem
Yinghao Qin and Jun Chen (Queen Mary University of London, UK (Great Britain))

9:30 Evolution-Assisted Deep Reinforcement Learning for Fast Charging Station Coordinated Operation
Xiaoying Yang (University of Nottingham Ningbo China, China); Yujing Gu (State Grid Nantong Power Supply Company, China); Fuhua Jia and Yiran Li (University of Nottingham Ningbo China, China); Hongru Wang (Southeast University, China); Nanjiang Du and Tianxiang Cui (University of Nottingham Ningbo China, China); Yujian Ye (Southeast University, China); Ruibin Bai (University of Nottingham Ningbo, China)

9:50 Adaptive NEH with constrained Nearest Neighbor subtours for the Electric Vehicle Routing Problem with Time Windows
Donald D Davendra and Andrew Struthers (Central Washington University, USA)

8:30 – 10:10
CEC TH1-R11: SS on Artificial Life
Conference: CEC
Room: 416+417
Session Chair(s): Hiroki Sayama

8:30 Non-Spatial Hash Chemistry as a Minimalistic Open-Ended Evolutionary System
Hiroki Sayama (Binghamton University, USA)

8:50 Exploration of reservoir properties in molecular computing systems
Nathanael Aubert-Kato (Ochanomizu University, Japan); Mika Ito (Nikkei Inc., Japan)

9:10 Automating Robot Design with Multi-Level Evolution
Geoff Nitschke and Bilal Aslan (University of Cape Town, South Africa)

9:30 An Open-Ended Approach to Understanding Local, Emergent Conservation Laws in Biological Evolution
Alyssa M Adams (Cross Labs & Cross Compass, Algorithmic Nature Lab, Japan); Eliott Jacopin (RIKEN, Japan); Praful Gagrani (University of Wisconsin-Madison, USA); Olaf Witkowski (University of Tokyo, Japan)

9:50 Evolution of developmental plasticity of soft virtual creatures in changing environments
Ryusnouke Higashinaka, Reiji Suzuki and Takaya Arita (Nagoya University, Japan)

8:30 – 10:10
CEC TH1-R12: SS on Evolutionary Optimization on Digital Economy Applications
Conference: CEC
Room: 418
Session Chair(s): Lingjie Li

8:30 Many Objectives Autonomous Robot Path Planning with Improved MOEA/D
Jin Zhou (University of Nottingham, China); David Chieng (University of Nottingham Ningbo China, China); Boon Giin Lee (University of Nottingham Ningbo China & Nottingham Ningbo China Beacons of Excellence Research and Innovation Institute, China); Junkai Ji and Jianqiang Li (Shenzhen University, China)

8:50 Deep Reinforcement Learning for Solving the Vehicle Routing Problem in Practical Logistics
Junchuang Cai, Xinzhi Zhang and Qiuzhen Lin (Shenzhen University, China); Lisha Dong (Shenzhen Institute of Information Technology, China); Wei-Neng Chen (South China University of Technoloqy, China); Zhong Ming (Shenzhen University, China)

9:10 Generative Evolution Attacks Portfolio Selection
Chen Li, Zidong Han, Jinrong Jiang, Lian Zhao, Yidi Bai and ZhongHua Lu (Computer Network Information Center, Chinese Academy of Sciences, China); Xuebin Chi (Computer Network Information Center, Chinese Academy of Sciences)

9:30 A cooperative co-evolution algorithm with variable-importance grouping for large-scale optimization
Yongfeng Li, Yuze Zhang, Lijia Ma and Junkai Ji (Shenzhen University, China); Dugang Liu (Guangdong Laboratory of Artificial Intelligence and Digital Economy, China); Victor C.M. Leung (Shenzhen University, China & The University of British Columbia, Canada); Jianqiang Li (Shenzhen University, China)

9:50 A Surrogate-assisted Evolutionary Algorithm for Expensive Dynamic Multimodal Optimzation
Xunfeng Wu, Songbai Liu, Junkai Ji and Lijia Ma (Shenzhen University, China); Victor C.M. Leung (Shenzhen University, China & The University of British Columbia, Canada)

8:30 – 10:10
CEC TH1-R13: SS on Evolutionary Computer Vision and Image Processing
Conference: CEC
Room: 419
Session Chair(s): Ying Bi

8:30 A Two-stage Approach Using Genetic Algorithm and Genetic Programming for Remote Sensing Crop Classification
Jing Liang, Zexuan Yang, Tuo Zhang and Ying Bi (Zhengzhou University, China)

8:50 QRPatch: A Deceptive Texture-based Black-box Adversarial Attacks with Genetic Algorithm
Chao Li (Xidian University, China); Wen Yao (Chinese Academy of Military Science, China); Handing Wang (Xidian University, China); Tingsong Jiang (Chinese Academy of Military Science, China); Donghua Wang (Zhejiang University, China); Jialiang Sun (Chinese Academy of Military Science, China)

9:10 Exploring Genetic Programming Models in Computer-Aided Diagnosis of Skin Cancer Images
Qurrat Ul Ain, Harith Al-Sahaf and Bing Xue (Victoria University of Wellington, New Zealand); Mengjie Zhang (VUW, New Zealand)

9:30 Black-Box Optimization Based Adaptive Image Anonymization
Arcadi Llanza (University Paris Est Créteil, France); Nadiya Shvai (Cyclope.ai & National University of Kyiv-Mohyla Academy, France); Amir Nakib (University of Paris-Est Créteil, France)

9:50 ESC: Evolutionary Stitched Camera Calibration in the Wild
Grzegorz Rypeść (Warsaw University of Technology & Sports Algorithmics and Gaming, Poland); Grzegorz Kurzejamski (Sport Algorithmics and Gaming Sp. z o. o., Poland)

8:20 – 18:40
Exhibition
Room: 501+502

10:10 – 10:30
Break

10:30 – 11:30
WCCI 2024 Plenary talk by Akira Oyama
Room: 301+302+303+304
Session Chair(s): Hisao Ishibuchi

Multiobjective evolutionary optimization in space engineering and spin-off to industry
Akira Oyama
Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency

Multiobjective evolutionary computation (MOEC) is getting popular in Japan because it has various advantages such as capability of finding wide variety of Pareto-optimal designs. In Japan Aerospace Exploration Agency (JAXA), I have been engaged in multiobjective design optimizations in space engineering such as rocket engine turbopump design, spacecraft trajectory design, reusable space transportation system design, spacecraft landing system design, selection of Moon landing site. In this talk, I will introduce some examples of these applications of MOEC in JAXA.

Then, I will introduce spinoff of the multiobjective design optimization technology to industry. Here, I will present the collaboration work with Mazda, Kobe University, and Hiroshima University for aerodynamic car shape design and the collaboration work with Central Japan Railway Company for aerodynamic and aeroacoustics design of superconducting maglev. Finally, I will discuss current issues in using MOEC for real-world design problems and our recent approaches to overcome these issues.

11:30 – 13:00
Lunch Time

13:00 – 14:00
Keynote talk by Yukie Nagai
Conference: IJCNN
Room: 301+302
Session Chair(s): Huajin Tang

Predictive Processing: Illuminating and Modeling Cognitive Development
Yukie Nagai
University of Tokyo

Cognitive development is an intricate and multifaceted process that has captivated researchers for decades. Human abilities related to perception and action continually evolve during development, exhibiting remarkable diversity among individuals.

This presentation explores the concept of predictive processing as a promising unified theory for illuminating and modeling cognitive development. Rooted in neuroscience, predictive processing offers a unique perspective for understanding how the brain constructs its perception of the world. The core idea posits that the brain continually generates internal models to predict the world and refines them in response to sensory input to minimize prediction errors. This dynamic process underlies the acquisition of cognitive abilities, from self-recognition to goal-directed actions, and even fosters the emergence of social behaviors like imitation and altruism, facilitated through multimodal predictions.

Moreover, this presentation sheds light on how disruptions in predictive processing lead to individual diversities, including developmental disorders. By emphasizing the concept of predictive processing and showcasing its practical application in robotic experiments, we aim to demonstrate its potential as a unifying framework for cognitive development. This presentation opens doors to exciting opportunities for creating more adaptive and intelligent systems.

13:00 – 14:00
Keynote talk by Jialin Liu
Conference: CEC
Room: 303+304
Session Chair(s): Carlos A. Coello Coello

Designing and playing games with computational intelligence

Jialin Liu
Southern University of Science and Technology (SUSTech)

Games provide an ideal playground for AI researchers to study, explore, evaluate, and experiment with different ideas in a controllable and safe environment. As an important application and product, games also involve complex decision-making and creative design tasks. Games have played important roles in the development of computational intelligence, while different computational intelligence methods have been widely applied to playing and designing games. In this talk, I will show how different computational intelligence methods (e.g., generative models, reinforcement learning and evolutionary computation) could be harnessed to procedurally generate new game contents, from game levels to accompanying music that correlates with game difficulties. In addition, I will also show how novel computational intelligence techniques, especially evolutionary reinforcement learning, could be used to play a range of different games. I will conclude the talk by discussing current challenges and potential research directions.

13:00 – 14:00
Keynote Talk by Jim Torresen
Conference: FUZZ-IEEE
Room: 503
Session Chair(s): Keeley Crockett

AI Ethics – Challenges and Opportunities
Jim Tørresen
University of Oslo

Artificial intelligence (AI) has entered an increasing number of different domains. A growing number of people – in the general public as well as in research – have started to consider a number of potential ethical challenges and legal issues related to the development and use of AI technologies. This keynote will give an overview of the most commonly expressed ethical challenges and ways being undertaken to reduce their negative impact.

Among the most important challenges are those related to privacy, fairness, transparency, safety and security. Countermeasures can be taken first at design time, second, when a user should decide where and when to apply a system and third, when a system is in use in its environment. In the latter case, there will be a need for the system by itself to perform some ethical reasoning if operating in an autonomous mode. This keynote will introduce some examples from our own and others´ work and how the challenges can be addressed both from a technical and human side with special attention to problems relevant when working with AI research and development. AI ethical issues should not be seen only as challenges but also as new research opportunities contributing to more sustainable, socially beneficial services and systems.

14:00 – 14:20
Break

14:20 – 18:40
Workshop: Workshop on Multimodal Optimization for Machine Learning
Room: 211+212

14:20 – 16:20
Workshop: Privacy-Preserving and Fairness-Aware Optimization
Room: 213

14:20 – 16:20
CEC TH2-R10: SS on EC and CI for Scheduling and Combinatorial Optimization I
Conference: CEC
Room: 414+415
Session Chair(s): Yi Mei

14:20 Learning Heuristics via Genetic Programming for Multi-mode Resource-constrained Project Scheduling
Yuan Tian and Yi Mei (Victoria University of Wellington, New Zealand); Mengjie Zhang (VUW, New Zealand)

14:40 Constructing ensembles of automatically designed relocation rules for the container relocation problem
Marko Đurasević (University of Zagreb, Croatia); Mateja Đumić (J. J. Strossmayer University Osijek, Croatia); Francisco Javier Gil-Gala (University of Oviedo, Spain)

15:00 On the Effects of Smoothing Rugged Landscape by Different Toy Problems: A Case Study on UBQP
Wei Wang (Xi'an Jiaotong University, China); Jialong Shi (Xi'an Jiaotong University, China & Sichuan Digital Economy Industry Development Research Institute, China); Jianyong Sun (Xi'an Jiaotong University, China); Arnaud Liefooghe (University of the Littoral Opal Coast, France); Qingfu Zhang (City University of Hong Kong, Mexico); Ye Fan (Northwestern Polytechnical University, China)

15:20 ACSLs for large-scale bounded single depot multiple travelling salesman problem
Shanu Verma and Millie Pant (Indian Institute of Technology Roorkee, India)

15:40 Large-scale Project Portfolio Selection and Scheduling Problem: A Comparison of Exact Solvers and Metaheuristics
Jing Liu and Saber Elsayed (University of New South Wales, Australia); Daryl Essam (University of New South Wales at the Australian Defence Force Academy UNSW@ADFA, Australia); Ruhul Sarker (University of New South Wales, Australia); Ivan Garanovich and Terence Weir (Defence Science and Technology Organisation, Australia)

16:00 Prediction of Distributed Ultrasound Simulation Execution Time Using Machine Learning
Jiri Jaros, Marta Jaros and Martin Buchta (Brno University of Technology, Czech Republic)

14:20 – 16:20
CEC TH2-R11: SS on Evolutionary Algorithms for Neural Architecture Search from Theory to Practice
Conference: CEC
Room: 416+417
Session Chair(s): Jesús Guillermo Falcón-Cardona

14:20 A novel surrogate model for variable-length encoding and its application in optimising deep learning architecture
Truong Dang (National Subsea Centre, UK (Great Britain)); Tien Thanh Nguyen and John McCall (Robert Gordon University, UK (Great Britain)); Kate Han (Unviersity of Salford, UK (Great Britain)); Alan Wee-Chung Liew (Griffith University, Australia)

14:40 Image segmentation enhanced by heuristic assistance for retinal vessels case
Katarzyna Prokop and Dawid Polap (Silesian University of Technology, Poland)

15:00 A Lightweight Training-Free Method for Neural Architecture Search
Jhih-Cian Lin (National Sun Yat-Sen University, Taiwan); Chun-Wei Tsai (National Sun Yat-sen University, Taiwan)

15:20 Chaotic Map-Coded Evolutionary Algorithms for Dendritic Neuron Model Optimization
Haichuan Yang (Tokushima University, Japan); Yifei Yang (Hirosaki University, Japan); Yuxin Zhang (Wesoft Company Ltd., Japan); Cheng Tang (Kyushu University, Japan); Koichi Hashimoto (Tohoku University, Japan); Yuichi Nagata (Tokushima University, Japan)

15:40 Towards evolution of Deep Neural Networks through contrastive Self-Supervised learning
Adriano Vinhas (University of Coimbra, Portugal); João Correia (University of Coimbra CISUC LASI, Portugal); Penousal Machado (University of Coimbra, Portugal)

16:00 NeuroLGP-SM: Scalable Surrogate-Assisted Neuroevolution for Deep Neural Networks
Fergal Stapleton and Edgar Galvan (Maynooth University, Ireland)

14:20 – 16:20
CEC TH2-R12: Uncertain and Dynamic Environments
Conference: CEC
Room: 418
Session Chair(s): Marde Helbig and Michalis Mavrovouniotis

14:20 Dynamic Multi-Task Interactive Evolutionary Optimization Algorithm with Search Space Alignment
WeiDong Wu, Xiaoyan Sun and Yong Zhang (China University of Mining and Technology, China); Wei Song (Jiangnan University, China)

14:40 Multi-Object Tracking as Continuous Dynamic Environment and its Exploration by Particle Swarm Optimization
Ryo Takano (Toyama Prefectural University, Japan)

15:00 Generate a Single Heuristic for Multiple Dynamic Flexible Job Shop Scheduling Tasks by Genetic Programming
Jiayin Chen and Yahui Jia (South China University of Technology, China); Ying Bi (Zhengzhou University, China); Wei-Neng Chen (South China University of Technology, China)

15:20 Exchange Strategies for Multi-Colony Ant Algorithms in Dynamic Environments
Michalis Mavrovouniotis (Eratosthenes Centre of Excellence & Cyprus University of Technology, Cyprus); Changhe Li (Anhui University of Sciences & Technology, China); Danial Yazdani (University of Technology Sydney, Australia); Diofantos Hadjimitsis (Cyprus University of Technology, Cyprus)

15:40 Dynamic NSGA-III with KRR-ANOVA Kernel Predictor for In-Motion Sonar Image Segmentation
Aakansha Agarwal and Satyasai Jagannath Nanda (Malaviya National Institute of Technology Jaipur, India)

16:00 Dynamic Multi-objective Optimisation Problems with Changes of Varying Frequency and Severity
Marde Helbig (Griffith University, Australia)

14:20 – 16:20
CEC TH2-R13: SS on CI in Space and Aerospace I
Conference: CEC
Room: 419
Session Chair(s): Victor Rodriguez

14:20 Robust Classification with Belief Functions and Deep Learning Applied to STM
Luis Sanchez (University of Strathclyde, UK (Great Britain)); Victor Rodriguez (UPM, Spain); Massimiliano Vasile (University of Strathclyde, UK (Great Britain))

14:40 Satellite Collision Avoidance Maneuver Planning in Low Earth Orbit using Proximal Policy Optimization
Sajjad Kazemi, Nasser L Azad and Katharine Andrea Scott (University of Waterloo, Canada); Haroon B. Oqab and George B. Dietrich (Columbiad Launch Services Inc., Canada)

15:00 Deep Learning based Nonlinear Dimensionality Reduction for Emulators of Numerical Thermosphere Densi
Richard Licata and Piyush M Mehta (West Virginia University, USA)

15:20 Clustering of Earth–Moon transfers in Sun-perturbed environment
Claudio Toquinho Campana and Francesco Topputo (Politecnico di Milano, Italy)

15:40 Path Planning in a dynamic environment using Spherical Particle Swarm Optimization
Mohssen Elshaar (King Fahd University of Petroleum and Minerals & KFUPM - Aerosapce Engineering, Saudi Arabia); Mohammed Reda Elbalshy (King Fahd University of Petroleum and Minerals, Saudi Arabia); Mohammad A. Abido and Alaa El-Din Hussein (KFUPM, Saudi Arabia)

16:00 A Learning Classifier System Approach to Time-Critical Decision-Making in Dynamic Alternate Airport Selection
Boris Djartov (FL-SEG BS - Systemergonomie, Germany); Sanaz Mostaghim (Otto von Guericke University Magdeburg, Germany); Anne Papenfuss (German Aerospace Center, Germany); Matthias Wies (German Aerospace Center (DLR), Germany)

14:20 – 16:40
Poster Session
Conference: CEC
Room: 501+502
Session Chair(s): Zeng-Guang Hou and Caitong Yue

61: Multipopulation evolutionary algorithm via seed transfer for multitasking traveling salesman problem
Haoyuan Lv, Ruochen Liu and Handing Wang (Xidian University, China)

62: Improved Discrete Fireworks Algorithm for Large Scale Knapsack Problem
Yifan Liu and Ying Tan (Peking University, China)

63: Multimodal Multi-objective Flexible Job Shop Scheduling: A preliminary study
Caitong Yue, Liming Liu, Jing Liang, Gongping Li, Ying Bi and Mingyuan Yu (Zhengzhou University, China)

64: A Historical Evolution Learning based Framework for Dynamic Multiobjective Optimization
Dezheng Zhang, Kunjie Yu and Jing Liang (Zhengzhou University, China); Boyang Qu (Zhongyuan University of Technology, China); Caitong Yue (Zhengzhou University, China); Ling Wang (Tsinghua University, China); Ke Chen (Zhengzhou University & School of Electrical and Information Engineering, China); Mengnan Liu (YTO Group Corporation, China)

65: A Cooperative Coevolutionary Approach to Designing Acceptance Tests for Jobs With Weakly Hard Real-Time Constraints
Karla Salamun and Hrvoje Džapo (University of Zagreb, Croatia)

66: Reliability-aware Network Slicing based on Multi-objective Optimization
Qiqi Xia (Southern University of Science and Technology, China); Jin Wang (Huawei Technologies Co. Ltd, China); Chengqiang Huang (Huawei, China); Xin Yao (Southern University of Science and Technology, China)

67: Multi-objective Optimization for Joint Communication and Computing Resource Allocation in NOMA-based MEC System
Hongzhe Wang and Lixin Tang (Northeastern University, China); Min Xiao (Xinyu Iron and Steel Co Ltd, China); Qingxin Guo (Northeastern University, China)

68: Evolutionary Dynamic Optimization-Based Calibration Framework for Agent-Based Financial Market Simulators
Zhenhua Yang, Muyao Zhong and Peng Yang (Southern University of Science and Technology, China)

69: Schizophrenia Detection using EEG: A Study on Frequency Relevance
Luís Alexandre (University of Beira Interior, Portugal); Wlodzislaw Duch (Nicolaus Copernicus University, Poland)

70: Brain Storm Optimization Based Swarm Learning for Diabetic Retinopathy Image Classification
Liang Qu (The University of Queensland, Australia); Cunze Wang (Fujian Medical University, China); Yuhui Shi (Southern University of Science and Technology, China)

71: NMT vs MLM: Which is the best paradigm for APR?
Chen YiHeng (Xidian University, China); Kai Huang (University of Chinese Academy of Sciences, China); He Wang and Zhang Yu qing (Xidian University, China)

72: Evolving Continuous Filter Convolutional Network Based on a Novel Multi-Objective Optimization Algorithm for Molecular Property Prediction
Yaguo Dong, Meiling Xu and Lixin Tang (Northeastern University, China)

16:20 – 16:40
Break

16:40 – 18:40
CEC TH3-R10: SS on EC and CI for Scheduling and Combinatorial Optimization II
Conference: CEC
Room: 414+415
Session Chair(s): Fangfang Zhang

16:40 Multi-Objective Genetic-Programming Hyper-Heuristic for Evolving Interpretable Flexible Job Shop Scheduling Rules
Junwei Pang and Yi Mei (Victoria University of Wellington, New Zealand); Mengjie Zhang (VUW, New Zealand)

17:00 Crossover Operators Between Multiple Scheduling Heuristics with Genetic Programming for Dynamic Flexible Job Shop Scheduling
Luyao Zhu (Zhengzhou University, China); Fangfang Zhang (Victoria University of Wellington, New Zealand); Mengyuan Feng (China); Ke Chen (Zhengzhou University & School of Electrical and Information Engineering, China); Xiaodong Zhu (Zhengzhou University, China); Mengjie Zhang (VUW, New Zealand)

17:20 Designing Relocation Rules with Genetic Programming for the Online Container Relocation Problem
Marko Đurasević (University of Zagreb, Croatia); Mateja Đumić (J. J. Strossmayer University Osijek, Croatia); Francisco Javier Gil-Gala (University of Oviedo, Spain)

17:40 The Vehicle Routing Problem with Drones and Flexibility Demands
Hue Thi Tran (Banking Academy of Vietnam & Hanoi University of Science and Technology, Vietnam); Nguyen Ngoc Bao, Nguyen Tran Nhat Quoc, Pham Phu Manh, Nguyen Khanh Phuong, Huynh Thi Thanh Binh and Dang Quang Thang (Hanoi University of Science and Technology, Vietnam)

18:00 A Deep Reinforcement Learning Assisted Heuristic for Solving Traveling Salesman Problems
Ye Tian, Qinghui Zhu, Shuai Shao, Langchun Si and Xingyi Zhang (Anhui University, China)

18:20 An Interior-point Genetic Algorithm with Restarts for Flexible Job Shop Scheduling Problems
David Hutter (University of Applied Sciences Vorarlberg, Austria); Michael Hellwig and Thomas Steinberger (Vorarlberg University of Applied Sciences, Austria)

16:40 – 18:40
CEC TH3-R11: SS on Evolutionary Multi-Objective Machine Learning
Conference: CEC
Room: 416+417
Session Chair(s):

16:40 Recombination Operators for the Multi-objective Team Formation Problem in Social Networks
Julio Antonio Juárez (Tecnologico de Monterrey, Mexico); Carlos Brizuela (CICESE RESEARCH CENTER, Mexico); Hugo Terashima-Marín (Tecnologico de Monterrey, Mexico); Carlos Coello Coello (Cinvestav, Mexico)

17:00 Multiobjective Optimization with Mating Restriction via Wasserstein Generative Adversarial Networks
Honglei Cheng and Gai-Ge Wang (Ocean University of China, China); Ying Tian (College of Information Technology, China)

17:20 Enhanced Soil Property Estimations from Earth Observation Data with Differential Evolution-based Mul
Nikolaos L. Tsakiridis, Nikiforos Samarinas, Eleni Kalopesa, John Theocharis and George C Zalidis (Aristotle University of Thessaloniki, Greece)

17:40 Opposition-based Multi-objective ADAM Optimizer (OMAdam) for Training ANNs
Farzaneh Nikbakhtsarvestani (University of Ontario Institute of Technology, Canada); Shahryar Rahnamayan (Brock University, Canada); Mehran Ebrahimi (University of Ontario Institute of Technology, Canada)

18:00 A Multiobjective Particle Swarm Optimizer based Localized Feature Selection for Imbalanced Fault Diagnosis
Lin Gao, Yu Zhou and Hainan Guo (Shenzhen University, China); Sam Tak Wu Kwong (Lingnan University, Hong Kong)

16:40 – 18:40
CEC TH3-R12: SS on Numerical Optimization
Conference: CEC
Room: 418
Session Chair(s): Ponnuthurai Nagaratnam Suganthan

16:40 Performance of Beta Mutation on CEC 2017 and CEC 2022 Benchmarks
Yogesh Kumar and Kusum Deep (Indian Institute of Technology Roorkee, India)

17:00 Confidence Bands Based on Rating Demonstrated on the CEC 2021 Competition Results
Miha Ravber and Marjan Mernik (University of Maribor, Slovenia); Shih-Hsi Liu (California State University, USA); Marko Šmid and Matej Črepinšek (University of Maribor, Slovenia)

17:20 Differential Evolution with Success Rate-based adaptation CL-SRDE for Constrained Optimization
Vladimir Stanovov and Eugene Semenkin (Siberian State Aerospace University, Russia)

17:40 A modified EACOP implementation for Real-Parameter Single Objective Optimization Problems
Andrea Tangherloni (Bocconi University, Italy); Vasco Coelho (University of Milano-Bicocca, Italy); Francesca M. Buffa (Bocconi University, Italy); Paolo Cazzaniga (University of Bergamo, Italy)

18:00 Random and Chaotic Sequences, and the Effect of their Distributions on PSO Performance
Hendrik Richter and Paul M Nörenberg (HTWK Leipzig University of Applied Sciences, Germany)

18:20 Success Rate-based Adaptive Differential Evolution L-SRTDE for CEC 2024 Competition
Vladimir Stanovov and Eugene Semenkin (Siberian State Aerospace University, Russia)

16:40 – 18:40
CEC TH3-R13: SS on CI in Space and Aerospace II
Conference: CEC
Room: 419
Session Chair(s): Josy John

16:40 Multi-Objective Optimisation strategy for On-Orbit Fault-Tolerant Decision Making
Robert Cowlishaw, Ashwin Arulselvan and Annalisa Riccardi (University of Strathclyde, UK (Great Britain))

17:00 FlexKalmanNet: A Modular AI-Enhanced Kalman Filter Framework Applied to Spacecraft Motion Estimation
Moritz Duarte Pinheiro-Torres Vogt, Markus Huwald, Mohamed Khalil Ben-Larbi and Enrico Stoll (TU Berlin, Germany)

17:20 Neural Network-based Synchronisation of Free-Floating Space Manipulator's Joint Motion and Mother Spacecraft's Attitude for Active Debris Removal
Shabadini Sampath and Jinglang Feng (University of Strathclyde, UK (Great Britain))

17:40 A Neural Network Symbolic Approach to Structural Health Monitoring in Aerospace Applications
Federica Angeletti, Federico Succetti and Massimo Panella (University of Rome "La Sapienza", Italy); Antonello Rosato (Universita di Roma "La Sapienza", Italy)

18:00 Precise and Efficient Orbit Prediction in LEO with Machine Learning using Exogenous Variables

Francisco M. Caldas (NOVA University, Portugal); Cláudia Soares (NOVA University of Lisbon, Portugal)

18:20 Genetic Algorithm-based Routing and Scheduling for Wildfire Suppression using a Team of UAVs

Josy John and V Sundaram Suresh (Indian Institute of Science, India)

July 5, 2024

8:30 – 10:10
CEC FR1-R10: SS on Automating CI Systems: Trends, Challenges, and Future Directions I
Conference: CEC
Room: 414+415
Session Chair(s): Nelishia Pillay

8:30 Beyond `Novel' Metaphor-based Metaheuristics: An Interactive Algorithm Design Software
Diego Acosta-Ugalde, Jorge Mario Cruz-Duarte, Santiago Enrique Conant-Pablos and Jesús Guillermo Falcón-Cardona (Tecnologico de Monterrey, Mexico)

8:50 Impact of Scaling in ELA Feature Calculation on Algorithm Selection Cross-Benchmark Transferability
Gjorgjina Cenikj and Gašper Petelin (Jožef Stefan Institute & Jožef Stefan International Postgraduate School, Slovenia); Tome Eftimov (Jožef Stefan Institute, Slovenia)

9:10 Tailoring Metaheuristics for Designing Thermodynamic-Optimal Cooling Devices for Microelectronic Thermal Management Applications
Guillermo Perez-Espinosa, Jorge Mario Cruz-Duarte, Ivan Amaya, Jose Carlos Ortiz-Bayliss and Hugo Terashima-Marín (Tecnologico de Monterrey, Mexico); Nelishia Pillay (University of Pretoria, South Africa)

9:30 Dynamic Function Generation for Text Classification
Mia Gerber (University of Pretoria, South Africa); Nelishia Pillay (University of Pretoria, USA)

9:50 Dynamic Algorithm Composition for Image Segmentation
Mia Gerber (University of Pretoria, South Africa); Nelishia Pillay (University of Pretoria, USA)

8:30 – 10:10
CEC FR1-R11: Intelligent Network Systems and Cyber Security
Conference: CEC
Room: 416+417
Session Chair(s): Antonio M. Mora

8:30 Two-level Software Obfuscation with Cooperative Co-evolutionary Algorithms
José Miguel Aragón-Jurado, Javier Jareño, Juan Carlos de la Torre and Patricia Ruiz (University of Cádiz, Spain); Bernabe Dorronsoro (Universidad de Cádiz, Spain)

8:50 Differential Evolution Algorithm for Battlefield Surveillance Sensor Placement
Ehab Elfeky (University of New South Wales, Australia); Gregory D Sherman (DST Edinburgh, Australia); Saber Elsayed (University of New South Wales, Australia); Md Hedayetul Islam Shovon and Riley Lodge (DST Edinbrugh, Australia); Benjamin Campbell (Defence Science and Technology Group, Australia); Daryl Essam and Ruhul Sarker (University of New South Wales, Australia)

9:10 Applying Evolutionary Algorithms for Service Function Chaining in 5G Networks
Antonio M. Mora, Javier Victoria Mohammed and Nuria Medina Medina (University of Granada, Spain); Juan Valenzuela-Valdés (Universidad de Granada, Spain)

9:30 Application of a Bi-objective EA for RAN Resources Optimization in a Dynamic Scenario
Markus Rothkoetter (Otto-Von-Guericke University Magdeburg, Germany); Niklas Kluge (Otto Von Guericke University Magdeburg, Germany); Sanaz Mostaghim (Otto von Guericke University Magdeburg, Germany)

8:30 – 10:10
CEC FR1-R12: Late Breaking I
Conference: CEC
Room: 418
Session Chair(s): Raul de Celis

8:30 Generalized Carrier Phase Ambiguity Resolution for Precise Attitude Estimation Using Neural Networks and GNSS Sensors
Raul de Celis (Aerospace Systems and Transport Research Group, Spain)

8:50 Hyper-Heuristics for a Two-Echelon Location-Routing Problem with Different Intermediate Facilities
Rebecca M Hamm (Lancaster University (Lancaster), UK (Great Britain)); Ahmed Kheiri and Burak Boyaci (Lancaster University, UK (Great Britain))

9:10 Advanced Transformer-Based Model for Phishing Attack Detection using Tokenization and Fine-Tuning
Rachana Potpelwar (Shri Guru Gobind Singhji Institute of Engineering and Technolog, India)

9:30 Computational Intelligence for Automatically Labeling Human Somatosensory Types and Decoding Human Somatosensory Sensitivity
Li-Wei Ko, Congying He, Cheng-Hua Su, Hao-Yuan Lin and Li-Ling Hope Pan (National Yang Ming Chiao Tung University, Taiwan); Shuu-Jiun Wang (Taipei Veterans General Hospital, Taiwan)

8:30 – 10:10
CEC FR1-R13: Late Breaking II
Conference: CEC
Room: 419
Session Chair(s):

8:30 Towards Generalization of Multi-Objective Optimization for Flux Balance Analysis Problems in Genome Scale Metabolic Models
Carlos Felipe Coello Castillo (UAM Cuajimalpa, Mexico); Carlos Coello Coello (Cinvestav, Mexico)

8:50 A Multi-Objective Evolutionary Learning Method for Bearing Fault Diagnosis
Dan Wang (Northeastern University & National Frontiers Science Center for Industrial Intelligence and Systems Optimization, China); Chang Liu and Lixin Tang (Northeastern University, China)

9:10 Realising chiller plant optimisation via Artificial Neural Networks and hybrid Genetic Algorithm and Particle Swarm Optimisation Algorithm
Kam Chun Lam (Electrical and Mechanical Services Department, HKSAR, Hong Kong); Wai Leuk Chiu and Wing Hung Lam (Electrical and Mechanical Services Department, Hong Kong); Wing Kwan Yu (Electrical and Mechanical Services Department, Hong Kong Special Administrative Region Government, Hong Kong); Tsz Yan Ip (Electrical and Mechanical Services Department, Hong Kong)

9:30 Evolutionary Multi-Objective Optimization and Pareto Solution Trade-Off Strategy for Edge Computing Task Offloading
Yingying Sun (Northeastern University, China)

8:20 – 17:00
Exhibition
Room: 501+502

10:10 – 10:30
Break

10:30 – 11:30
WCCI 2024 Plenary talk by Saori Tanaka
Room: 301+302+303+304
Session Chair(s): Kazushi Ikeda

Utilization of large-scale brain image database for digitalization of psychiatric and neurological disorders

Saori Tanaka
NAIST, ATR

In recent years, neuroimaging databases for psychiatric and neurological disorders have enabled users to find common and disease-specific features and redefine disease spectra using data-driven approaches. In the Brain/MINDs beyond (2018-2023), the neuroimaging database projects have established the multiple sites, multiple disorders MRI database.

A remarkable feature of this database is the traveling-subjects dataset; each participant was scanned at each multisite. This led to the development of a harmonization method to reduce site differences and the development of a generalizable diagnostic marker with brain networks of major depressive disorder (Yamashita, et al., 2020). This database has expanded to 14 disorders and over 16 sites, and over 5,000 MRI data will be collected by the end of the project. This will be the largest MRI database of multiple neurological and psychiatric disorders from multiple sites. In addition, this database includes longitudinal patient data, allowing for the evaluation of treatment effects. This database is expected to lead to the stratification and the development of new treatment methods. Here, as a potential use of the database, I will suggest an integration with approaches based on the computational theory of the brain in addition to data-driven approaches. Computational neuroscience studies understanding the brain mathematically focused on the neural mechanisms of information processing. In recent years, these approaches have been applied to understanding psychiatric disorders. I will show some previous studies using large-scale behavioral data and computational models of psychiatric disorders and demonstrate possibilities of fusion with computational models and neuro-behavioral databases.

11:30 – 13:00
Lunch Time

13:00 – 14:00
Keynote talk by Divyashree-Shivakumar Sreepathihalli
Conference: IJCNN
Room: 301+302
Session Chair(s): Seiichi Ozawa

Keras, A shortcut to master AI
Divyashree-Shivakumar Sreepathihalli
Google

Discover the transformative capabilities of the Keras 3 API. Delve into deep learning best practices, where you'll gain insights into crafting uncomplicated models and executing them with your preferred backend—be it PyTorch, TensorFlow, or JAX. Explore the dynamic potentials of KerasNLP and KerasCV modules, unveiling the art of constructing powerful AI applications. Witness the seamless creation of generative image and language models, empowering you to achieve remarkable feats with just a few lines of code.

13:00 – 14:00
Keynote talk by Tobias Rodemann
Conference: CEC
Room: 303+304
Session Chair(s): Bing Xue

Trust in Optimization Algorithms – The End User Perspective
Tobias Rodemann
Honda Research Institute Europe

Evolutionary Algorithms have a potentially wide-spread usage. They can deal with various types of design parameters, constraints and objectives; non-linear, discontinuous, noisy fitness landscapes and many, even conflicting objectives can be handled. There are numerous open-source software packages for quickly applying EA methods on various problems. In practice, however, EAs are not used as frequently as we would hope. In this talk I would like to provide some insights from industrial projects and focus especially on the perspective of the end user. I will argue that hot topics in ML like trust, transparency and explainability, also need to be considered in Computational Intelligence.

13:00 – 14:00
Keynote Talk by Gabriella Pasi
Conference: FUZZ-IEEE
Room: 503
Session Chair(s): Annabel Latham

Large Language models: contextual knowledge matter
Gabriella Pasi
University of Milano Bicocca

The last few years have witnessed an increasing development of generative AI and its applications, which culminated in the large-scale sharing of ChatGPT on the Web, with its related potentials, risks and limitations. Large Language Models are one of the possible technologies at the basis of generative AI; they are nowadays successfully applied to a variety of NLP tasks, among which are machine translation, conversational agents, and several others. Despite this, LLMs are affected by some limitations, among which a lack in accounting for contextual knowledge related to the task at hand. A research trend is to inject such knowledge (in-context) into LLMs via prompting techniques. A more recent and promising research direction is to make use of neuro-symbolic approaches, to better model and control the process. In this talk, after a short introduction to LLMs, I will present some possible approaches finalized to this latter aim. I will also present the research issue of defining personal language models, i.e. LLMs tailored on the language of specific users or groups of users.

14:00 – 14:20
Break

14:20 – 16:20
CEC FR2-R10: SS on Automating CI Systems: Trends, Challenges, and Future Directions II
Conference: CEC
Room: 414+415
Session Chair(s): Jorge Mario Cruz-Duarte

14:20 Neural Combinatorial Optimization by means of Partial Solution Strategies
Andoni Irazusta Garmendia (University of the Basque Country, Canada); Josu Ceberio (UPV/EHU, Spain); Alexander Mendiburu (University of the Basque Country, Spain)

14:40 Beyond Traditional Tuning: Unveiling Metaheuristic Operator Trends in PID Control Tuning for Automatic Voltage Regulation
Daniel Fernando Zambrano-Gutierrez, Jorge Mario Cruz-Duarte, Jose Carlos Ortiz-Bayliss and Ivan Amaya (Tecnologico de Monterrey, Mexico); Gabriel Aviña-Cervantes (Universidad de Guanajuato, Mexico)

15:00 An Experimental Analysis on Automated Machine Learning for Software Defect Prediction
Márcio Basgalupp (Universidade Federal de São Paulo, Brazil); Rodrigo C Barros (PUCRS, Brazil & Teia Labs, Brazil); Tiago Silva (Universidade Federal de São Paulo, Brazil); Fábio Silveira (Federal University of Sao Paulo, Brazil); Péricles Miranda (Universidade Federal Rural de Pernambuco, Brazil); Ferrante Neri (University of Surrey, UK (Great Britain))

15:20 Evolving Benchmark Functions to Compare Evolutionary Algorithms via Genetic Programming
Yifan He (Zhejiang University of Finance and Economics, China); Claus Aranha (University of Tsukuba, Japan)

15:40 Generalization Ability of Feature-based Performance Prediction Models: A Statistical Analysis across Benchmarks
Ana Nikolikj and Ana Kostovska (Jožef Stefan Institute, Slovenia); Gjorgjina Cenikj (Jožef Stefan Institute & Jožef Stefan International Postgraduate School, Slovenia); Carola Doerr (Sorbonne University, France); Tome Eftimov (Jožef Stefan Institute, Slovenia)

14:20 – 16:20
CEC FR2-R11: SS on Games
Conference: CEC
Room: 416+417
Session Chair(s): Zehua Jiang

14:20 Improving Generalization in Game Agents with Data Augmentation in Imitation Learning
Derek Yadgaroff (Uppsala University, Sweden); Alessandro Sestini and Konrad Tollmar (SEED - Electronic Arts, Sweden); Ayca Ozcelikkale (Uppsala University, Sweden); Linus Gisslen (SEED - Electronic Arts, Sweden)

14:40 GEEvo: Game Economy Generation and Balancing with Evolutionary Algorithms
Florian Rupp and Kai Eckert (University of Applied Sciences Mannheim, Germany)

15:00 Amorphous Fortress: Exploring Emergent Behavior and Complexity in Multi-Agent 0-Player Games
M Charity and Sam Earle (New York University, USA); Dipika Rajesh (Independent Researcher, India); Mayu Wilson (Independent Researcher, USA); Julian Togelius (NYU, USA)

15:20 Capitalizing on the Opponent's Uncertainty in Reconnaissance Blind Chess
Jacek Czupyt, Mikołaj Małkiński and Jacek Mańdziuk (Warsaw University of Technology, Poland)

15:40 Extended Generative Adversarial Imitation Learning for Autonomous Agents in Minecraft Game
Hyung-Jun Moon (University of Computing & Yonsei University, Korea (South)); Sung-Bae Cho (Yonsei University, Korea (South))

16:00 Fuzzy Utility AI for Handling Uncertainty in Video Game Bots Implementation
Maciej Swiechowski (QED Games & Information Technologies for Psychiatry Foundation, Poland)

14:20 – 16:20
CEC FR2-R12: SS on Machine Learning assisted Heuristics for Combinatorial Optimization
Conference: CEC
Room: 418
Session Chair(s): Xiangyu Wang

14:20 A Graph Neural Network Assisted Evolutionary Algorithm for Expensive Multi-objective Optimization
Xiangyu Wang and Xilu Wang (Bielefeld University, Germany); Yaochu Jin (Westlake University, China); Ulrich Rückert (Bielefeld University, Germany)

14:40 Cluster-centric Local Search Strategies for Enhanced Multi-Objective Logistics Optimization
Wei Liu, Thomas Bäck and Yingjie Fan (Leiden University, The Netherlands)

15:00 Learning-based Problem Reduction for Large-scale Uncapacitated Facility Location Problems
Shuaixiang Zhang, Yixuan Yang, Hao Tong and Xin Yao (Southern University of Science and Technology, China)

15:20 Surrogate-Assisted Evolutionary Computation for Distributed Simulation-Based Inventory Optimization in Serial Supply Chains
Ziang Liu and Tatsushi Nishi (Okayama University, Japan)

15:40 Efficient Hyperparameter Optimization Using Deep Q-Network and BRKGA
Kosei Kobayashi and Masayoshi Aritsugi (Kumamoto University, Japan); Pedro Henrique González (Federal University of Rio de Janeiro, Brazil); Israel Mendonca (Kumamoto University, Japan)

16:00 ACO with Reinforcement Learning applied to Rescues Operations on Urban Forests
Claudio Andre da Silva Alves (Federal University of Rio de Janeiro, Brazil); Israel Mendonca (Kumamoto University, Japan); Vanessa de Almeida Guimaraes and Pedro Henrique González (Federal University of Rio de Janeiro, Brazil)

14:20 – 16:20
CEC FR2-R13: Machine Learning for Evolutionary Computation
Conference: CEC
Room: 419
Session Chair(s): Vojtech Uher

14:20 Fitness Landscape k-Nearest Neighbors Classification Based on Fitness Values Distribution
Vojtech Uher and Pavel Kromer (VSB - Technical University of Ostrava, Czech Republic)

14:40 A Data-Driven Optimization Method for Strongly Non-Separable Mixed-Integer Problems
Takahiro Sato (Muroran Institute of Technology, Japan)

15:00 A Reinforcement Learning Method Based on Natural Evolution Strategies
Koki Kimura and Isao Ono (Tokyo Institute of Technology, Japan)

15:20 VISTA: A Variable Length Genetic Algorithm and LSTM-Based Surrogate Assisted Ensemble Selection algorithm in Multiple Layers Ensemble System
Kate Han (Unviersity of Salford, UK (Great Britain)); Truong Thanh Nguyen and Viet Anh Vu (School of ICT, Vietnam); Alan Wee-Chung Liew (Griffith University, Australia); Truong Dang and Tien Thanh Nguyen (National Subsea Centre, Robert Gordon University)

15:40 Exploring Self-Adaptive Genetic Algorithms to Combine Compact Sets of Rules
Michael Heider, Maximilian Krischan, Roman Sraj and Jörg Hähner (University of Augsburg, Germany)

16:00 Legal Text Retrieval with Contrastive Representation Learning and Evolutionary Data Augmentation
Youhua Zhou (South China University of Technology, China); Xueming Yan (Guangdong University of Foreign Studies, China); Han Huang, Haowen Yan and Minghao Chen (South China University of Technology, China)

14:20 – 16:40
Poster Session
Conference: IJCNN+CEC
Room: 501+502
Session Chair(s): Seiichi Ozawa and Bing Xue

61: A Triple Network Knowledge Learning Framework for Particle Swarm Optimization
Zhao Zhang, Lingda Wang and Chen Chen (Beijing Institute of Technology, China)

62: Evolutionary Multitasking Collaborative Neural Architecture Search for Scene Classification
Shanfeng Wang, Zaitian Liu, Jianzhao Li, Maoguo Gong and Rui Yang (Xidian University, China)

63: Finding Sets of Pareto Sets in Real-World Scenarios - A Multitask Multiobjective Perspective
Jiao Liu (Nanyang Technological University & College of Computing & Data Science, Singapore); Yew Soon Ong (School of Computer Engineering, Nanyang Technological University, Singapore); Melvin Wong (Nanyang Technological University, Singapore)

64: Multi-Stage Transfer Learning Evolutionary Algorithm for Dynamic Multiobjective Optimization
Qianhui Wang, Qingling Zhu and Junkai Ji (Shenzhen University, China)

65: Multiobjective Sequential Transfer Optimization: Benchmark Problems and Preliminary Results
Xiaoming Xue (City University of Hong Kong, Hong Kong); Liang Feng (Chongqing University, China); Cuie Yang (Northeastern University, China); Songbai Liu (Shenzhen University, China); Linqi Song (City University of Hong Kong, Hong Kong); Kay Chen Tan (The Hong Kong Polytechnic University, Hong Kong)

66: Language Evolution for Evading Social Media Regulation via LLM-based Multi-agent Simulation
Jinyu Cai and Jialong Li (Waseda University, Japan); Mingyue Zhang (Southwest University, China); Munan Li (Dalian Maritime University, China); Chen-Shu Wang (National Taipei University of Technology, Taiwan); Kenji Tei (Waseda University / National Institute of Informatics, Japan)

67: Reinforcement Learning with Safe Action Generation for Autonomous Racing
Jiacheng Yang, Yuanda Wang, Lu Dong and Xin Yuan (Southeast University, China)

68: FOG: A Unified Framework for Federated Combinatorial Optimization on Graphs
Shiqing Liu and Ulrich Rückert (Bielefeld University, Germany); Yaochu Jin (Westlake University, China)

69: Expensive optimization based on evolutionary multi-tasking and hybrid restart strategy
Zhenyuan Li, Xiao-Liang Ma, Zexuan Zhu and Yueyue Li (Shenzhen University, China)

70: Multi-Objective Finite-Frequency H-infinity/GH-2 Static Output Feedback Control for Input-Delayed Active Suspension System of In-Wheel Motor-Driven Electric Full-Vehicle
Suhwan Choi, Yeongjae Kim and Tae-Hyoung Kim (Chung-Ang University, Korea (South))

71: A Novel Subspace Construction Method for Large-scale Evolutionary Multi-objective Optimization
Wenping Wang, Yang Zhang and Shuwei Zhu (Jiangnan University, China); Meiji Cui (Nanjing University of Science and Technology, China)

72: A Two-stage Evolutionary Framework For Multi-objective Optimization
Peng Chen, Jing Liang and Kangjia Qiao (Zhengzhou University, China); Ponnuthurai Nagaratnam Suganthan (Qatar University, Qatar); Xuanxuan Ban (Zhengzhou University, China)

16:20 – 16:40
Break

18:10 – 18:40
Closing Ceremony
Room: 301+302

18:40 – 20:00
Farewell Party
Room: 303+304

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