CONFERENCE
>>> PROGRAM

7th ISMSI 2023

2023 7th International Conference on Intelligent Systems, Metaheuristics & Swarm Intelligence

Kuala Lumpur, Malaysia

April 23-24, 2023 ▪ GMT+ 8 || Virtual

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WELCOME MESSAGE

It is my pleasure to welcome all the delegates and release the program of the 2023 7th International Conference on Intelligent Systems, Metaheuristics & Swarm Intelligence (ISMSI 2023), an annual event of India International Congress on Computational Intelligence (IICCI). Hope the participants will find it interesting. Although the Program Chairs and IPC Members aimed to offer a balanced representation of Intelligent Systems, Metaheuristics as well as Swarm Intelligence, a slight deviation had to be made based on review outcomes of the submitted manuscripts. Hope this conference will generate meaningful deliberations and introduce solutions to hitherto unsolved issues in these challenging and constantly evolving areas. It is also heartening to note that the program consists of outcomes of investigations of the peers encompassing Asia, Africa, Australia, Europe, Middle East and USA.

Since it's inception in the year 2017 in Hong Kong, ISMSI is going from strength-to-strength. The 2023 edition of this conference was able to evoke overwhelming response from the peers all over the globe. Program Chairs and IPC Members faced a very challenging task in shortlisting the papers. Due to various constraints, some interesting manuscripts could not be accommodated in the final program. In addition to the usual paper presentations (both oral as well as poster), the program consists of deliverance of Keynote speeches from 3 Distinguished Scientists from Italy, South Africa and UK. Am sure the participants will find those stimulating and educative & will make the most of the same.

After encountering onslaught due to pandemic since 2020, this year we were all set to revert to on-site meeting in Kuala Lumpur, Malaysia. Unfortunately, sudden spike in Coronavirus cases in China from late last year forced us to go online once again. Nevertheless, we do hope the participants will find this conference enjoyable and fruitful for furthering their research activities.

I take this opportunity of thanking all the peers who shared their recent research findings for possible presentations at ISMSI 2023. My sincere congratulations go to the authors of the accepted manuscripts. Hope to meet you in person in the future editions of this event.

With my warm personal regards and best wishes for all.

Prof. Suash Deb
(General Chair, ISMSI 2023)
April 10, 2023

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Online Presentation Guideline

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The meeting invitation link:
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login to Zoom
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Online Presentation Guideline

Name Setting before Entry

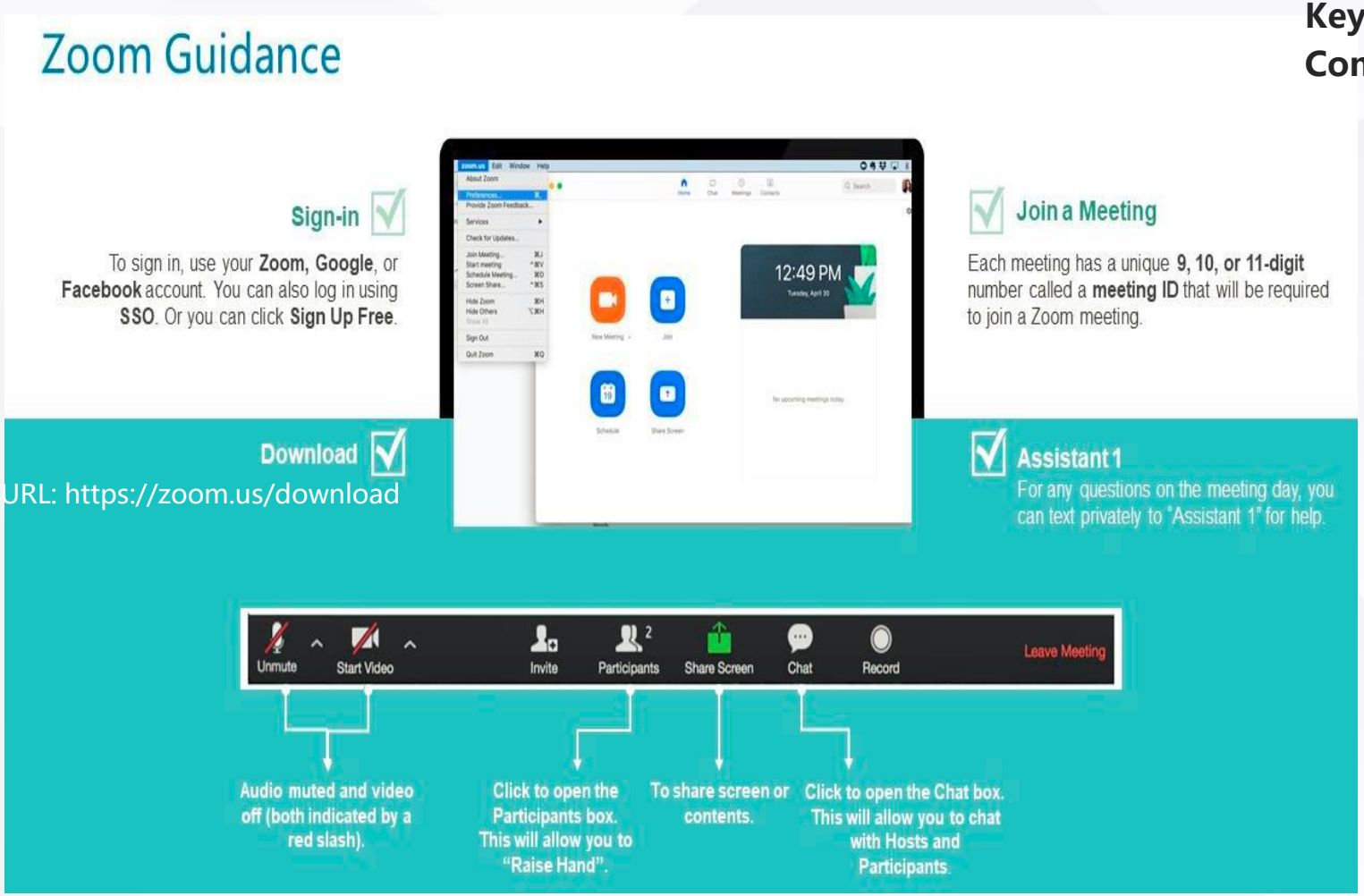
Keynote Speaker: Keynote-Name **Author**: Paper ID-Name
Committee: Position-Name **Listener**: Listener-Name

Zoom Pre-Test on April 23

- Participants who are going to do an online presentation are required to join the Zoom test session on Sunday, **April 23** start from 10:00am.
- Please download the Zoom App and prepare your presentation slides before you do the test.

Note

- The meeting room normally will be opened 30 minutes before the scheduled time. Please enter the room 10-15 minutes earlier.
- For online participants, the certificate will be sent to you by e-mail after the conference.



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Conference Committees

Conference Committees

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Man Leung Wong, Lingnan University, Hong Kong
Shixiong Zhang, Xidian University, China

03

Program at a Glance

The meeting invitation link:
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Zoom ID: 895 3659 7573

Program at a Glance

April 23, 2023 (Sunday), [Greenwich Mean Time (GMT+8) – Kuala Lumpur Local Time]		
Zoom Online Test		
Time	**Agenda**	**Zoom ID**
10:00am- 17:00pm	**Keynote Speakers, Committee Members & Session Chairs**	**Zoom ID: 895 3659 7573**
10:00am-12:00pm	**Session 1 & Session 2**	**Zoom ID: 895 3659 7573**
13:30pm-:14:30pm	**Session 3**	**Zoom ID: 895 3659 7573**

For All Online Presentations

- Participants who are going to do an online presentation are required to join the Zoom test session on Sunday, April 23, 2023.
- Duration: 3~5 minutes apiece. Feel free to leave after your rehearsal is done.

Program at a Glance

April 24, 2023 (Monday), [Greenwich Mean Time (GMT+8) – Kuala Lumpur Local Time]		
Time	**Agenda**	**Zoom ID**
9:30am-9:35am	**Welcome Address-Prof. Suash Deb** General Chair, ISMSI2023 Founding Secretary General, IICCI	**Meeting ID:** **895 3659 7573**
9:35am-9:40am	**Welcome Address-Prof. Yaroslav D. Sergeyev (Chief Guest)** University of Calabria, Italy	
9:40am-9:45am	**Welcome Address-Prof. Andries Engelbrecht (Guest-of-Honor)** University of Stellenbosch, South Africa	
9:45am-10:25am	**Keynote Speech 1-Prof. Yaroslav D. Sergeyev** University of Calabria, Italy "The Infinity Computer for Single- and Multi-Objective Optimization"	
10:25am-11:05am	**Keynote Speech 2-Associate Prof. Ka-Chun Wong** City University of Hong Kong, China "Disruptive AI Technologies for Bioinformatics: DNA Motifs, CRISPR-Cas9 Off-Targets, and Cancer Screening from Blood"	
11:05am-11:20am	**Break Time**	
11:20am-12:00pm	**Keynote Speech 3-Prof. Shengxiang Yang** De Montfort University, UK "Swarm Intelligence in Dynamic Environments"	
12:00pm-13:30pm	**Lunch Time**	

Program at a Glance

April 24, 2023 (Monday), [Greenwich Mean Time (GMT+8) – Kuala Lumpur Local Time]		
Time	**Agenda**	**venue**
13:30pm-15:30pm	**Session 1- Smart algorithm and calculation model** Session Chair - Prof. Masahiro Kanazaki, Tokyo Metropolitan University, Japan	**Meeting ID:** **895 3659 7573**
15:30pm-15:40pm	**Break Time**	
15:40pm-17:40pm	**Session 2- Computer model and computing analysis in engineering applications** Session Chair – Associate Prof. Ka Chun Wong, City University of Hong Kong, China	
17:40pm-17:50pm	**Break Time**	
17:50pm-19:50pm	**Session 3- Artificial Intelligence and Smart Computing** Session Chair - Dr.-Ing. Ahmed Rabee Sadik, Honda Research Institute Europe, Germany	

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Keynote Speakers

The meeting invitation link:
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Keynote Speaker-1

9:45am-10:25am, April 24 (GMT+8)
Meeting ID: 895 3659 7573

Prof. Yaroslav D. Sergeyev

University of Calabria, Italy

Biography: Yaroslav D. Sergeyev, Ph.D., D.Sc., D.H.C. is Distinguished Professor at the University of Calabria, Italy (chiamata diretta per "chiara fama") and Head of Numerical Calculus Laboratory at the same university. His research interests include numerical analysis, global optimization (in 2017-2021 he was President of the International Society of Global Optimization), infinity computing and calculus, philosophy of computations, set theory, number theory, fractals, parallel computing, and interval analysis. Prof. Sergeyev was awarded several research prizes (Khwarizmi International Award, 2017; Pythagoras International Prize in Mathematics, Italy, 2010; EUROPT Fellow, 2016; Outstanding Achievement Award from the 2015 World Congress in Computer Science, Computer Engineering, and Applied Computing, USA; Honorary Fellowship, the highest distinction of the European Society of Computational Methods in Sciences, Engineering and Technology, 2015; The 2015 Journal of Global Optimization (Springer) Best Paper Award; Lagrange Lecture, Turin University, Italy, 2010; MAIK Prize for the best scientific monograph published in Russian, Moscow, 2008, etc.). His list of publications contains more than 290 items (among them 6 books). He is a member of editorial boards of 12 international journals and co-editor of 11 special issues. He delivered more than 70 plenary and keynote lectures at prestigious international congresses. He was (Co-)Chairman of 11 international conferences and a member of Scientific Committees of more than 70 international congresses.

Abstract of Keynote Speech

9:45am-10:25am, April 24 (GMT+8)
Meeting ID: 895 3659 7573

Prof. Yaroslav D. Sergeyev

University of Calabria, Italy

Speech Title: The Infinity Computer for Single- and Multi-Objective Optimization

Abstract: In this talk, a recent computational methodology is described. It has been introduced with the intention to allow one to work with infinities and infinitesimals numerically in a unique computational framework. It is based on the principle 'The part is less than the whole' applied to all quantities (finite, infinite, and infinitesimal) and to all sets and processes (finite and infinite). The methodology uses as a computational device the Infinity Computer (a new kind of supercomputer patented in USA and EU) working numerically with infinite and infinitesimal numbers that can be written in a positional system with an infinite radix. On a number of examples (numerical differentiation, divergent series, ordinary differential equations, fractals, set theory, etc.) it is shown that the new approach can be useful from both theoretical and computational points of view. The main attention is dedicated to applications in optimization (local, global, and multi-objective). The accuracy of the obtained results is continuously compared with results obtained by traditional tools used to work with mathematical objects involving infinity. The Infinity Calculator working with infinities and infinitesimals numerically is shown during the lecture. For more information see the dedicated web page http://www.theinfinitycomputer.com and this survey: Sergeyev Ya.D. Numerical infinities and infinitesimals: Methodology, applications, and repercussions on two Hilbert problems, EMS Surveys in Mathematical Sciences, 2017, 4(2), 219–320. The web page developed at the University of East Anglia, UK is dedicated to teaching the methodology: https://www.numericalinfinities.com/

Keynote Speaker-2

10:25am-11:05am, April 24 (GMT+8)
Meeting ID: 895 3659 7573

Associate Prof.
Ka-Chun Wong

City University of Hong Kong, China

Biography: Ka-Chun Wong is an Associate Professor in Computer Science at City University of Hong Kong since 2021. He has finished his PhD degree in Department of Computer Science at University of Toronto (where deep learning AI was popularized in 2010s) by the end of 2014. For now, he serves as the associate editors of open-peer-review BioData Mining and Computer Modeling in Engineering and Sciences. He is also on the editorial boards of Applied Soft Computing, Journal of Biomedical Informatics, and PeerJ Computer Science. His current interests include Bioinformatics, Data Science, Natural Computing, and High-impact Interdisciplinary Research. More details can be found at **http://www.cs.toronto.edu/~wkc/**

Abstract of Keynote Speech

10:25am-11:05am, April 24 (GMT+8)
Meeting ID: 895 3659 7573

Associate Prof.
Ka-Chun Wong

City University of Hong Kong, China

Speech Title :
Disruptive AI Technologies for Bioinformatics: DNA Motifs, CRISPR-Cas9 Off-Targets, and Cancer Screening from Blood

Abstract: In genomics, the DNA binding of transcription factors is central to gene regulation and stem cell development. The DNA binding pattern (i.e. DNA motif) elucidation of transcription factors forms the basis for downstream research. Therefore, I will present our breakthroughs in elucidating DNA binding patterns from the protein-coding sequences of transcription factors using AI as well as our synthetic biology approach to synthesize a heterodimeric DNA motif from two monomeric DNA motifs. A DNA motif published on Nature has been rescued. Secondly, CRISPR-Cas9 is the predominant tool for gene editing and raised substantial concerns on its clinical implications. To avoid any side effect, its off-target predictions are fundamentally essential. I will present our recent work in predicting CRISPR-Cas9 off-targets using deep learning, the latest AI technology. Finally, I will present our very recent work in screening cancers from blood. Our proposed AI approach (CancerA1DE) can outperform the existing approach (CancerSEEK) proposed in John Hopkins University. In particular, it can double the existing sensitivity from 38% to 77% for the earliest cancer detection (i.e., Stage I) at the 99% specificity level.

Keynote Speaker-3

11:20am-12:00pm, April 24 (GMT+8)
Meeting ID: 895 3659 7573

Prof. Shengxiang Yang

De Montfort University, UK

Biography: Shengxiang Yang (http://www.tech.dmu.ac.uk/~syang/) got his PhD degree in Control Theory and Control Engineering from Northeastern University, China in 1999. He is now a Professor of Computational Intelligence (CI) and Deputy Director of the Institute of Artificial Intelligence (IAI), School of Computer Science and Informatics, De Montfort University, UK. He has worked extensively for many years in the areas of CI methods, including evolutionary computation, artificial neural networks, data mining and data stream analysis, and their applications for real-world problems. He has over 360 publications with an H-index of 64 according to Google Scholar. His work has been supported by UK research councils, EU FP7 and Horizon 2020, and industry partners. He serves as an Associate Editor or Editorial Board Member of several international journals, including IEEE Transactions on Evolutionary Computation, IEEE Transactions on Cybernetics, Information Sciences, and Enterprise Information Systems, etc. He was the founding chair of the Task Force on Intelligent Network Systems (TF-INS, 2012-2017) and the chair of the Task Force on EC in Dynamic and Uncertain Environments (ECiDUEs, 2011-2017) of the IEEE Computational Intelligence Society (CIS). He has given around 30 invited keynote speeches and tutorials at international conferences.

Abstract of Keynote Speech

11:20am-12:00pm, April 24 (GMT+8)
Meeting ID: 895 3659 7573

Prof. Shengxiang Yang

De Montfort University, UK

Speech Title: Swarm Intelligence in Dynamic Environments

Abstract: Swarm intelligence (SI) in biology represents the property that the collective behavior of a swarm of agents that interact locally with their environment causes coherent functional global patterns to emerge. SI algorithms are optimization algorithms inspired from the SI phenomena in biology, such as ant foraging and bird flocking, and have been applied in different fields. Most SI algorithms have been developed to address stationary problems. However, many real-world problems are dynamic optimization problems (DOPs) that are subject to changes over time. DOPs have attracted a growing interest from the SI community in recent years due to the importance in the real-world applications of SI algorithms. This talk will first briefly introduce the concepts of SI and DOPs, review the enhancement strategies integrated into SI algorithms to address DOPs, and then describe several detailed case studies on SI methods for DOPs. Finally, some conclusions will be made and the future work on SI for DOPs will be briefly discussed.

05

Contents of Sessions

Note: Please find out which session your paper is included in and enter the meeting room at least 10 minutes before the session starts.

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Session Chair

Prof. Masahiro Kanazaki

Tokyo Metropolitan University, Japan

Session

1

April 24, 2023

13:30 pm — 15:30 pm (GMT+8)

Topic: Smart algorithm and calculation model

- Please join the conference room 15 minutes in advance before the session starts.
- 1 Best Presentation Award will be selected and announced at the end of this session.
- Presentation certificates will be sent by emails after the conference.

MS004 **13:30-13:45**	**Title:** Optimized Computational Diabetes Prediction with Feature Selection Algorithms **Authors:** Xi Li, Michèle Curiger, Rolf Dornberger and Thomas Hanne **Presenter:** Thomas Hanne, University of Applied Sciences and Arts Northwestern Switzerland **Abstract:** Diabetes is a life-threatening disease that should be diagnosed and treated as early as possible. In this paper, Recursive Feature Elimination (RFE) and a Genetic Algorithm (GA) have been used for the Feature Selection (FS) of two different diabetes datasets of different patient heritages, in combination with K-Nearest Neighbors (KNN) and Random Forest (RF) classifiers for an optimized diabetes prediction. In our paper, RF shows a better performance compared to KNN. The level of accuracy also highly depends on the dataset used. The Iraqi Society Diabetes (ISD) dataset results in a notably higher accuracy than the Pima Indian Diabetes (PID) dataset using the same FS and classification method. The performance of KNN has been improved by combining it with RFE or GA for the FS, while RF deteriorates when applied in combination with. GA is computationally less efficient than RFE and shows a lower accuracy.
MS020 **13:45-14:00**	**Title:** Feature Selection using Gravitational Search Algorithm in customer Churn Prediction **Authors:** Hendro and Ary Mazharuddin Shiddiqi **Presenter:** Hendro, Universitas Widya Dharma Pontianak, Indonesia & Institut Teknologi Sepuluh Nopember Surabaya, Indonesia **Abstract:** Customer churn prediction is an essential strategy for companies, especially in telecommunications. Such industries face the challenge that customers frequently switch operators. Due to the higher cost of acquiring new customers compared to retaining existing ones, companies put considerable effort into keeping their current customers. Improving service quality and identifying the point at which customers are likely to terminate their engagement with the company are crucial in retaining customers. Customer Churn Prediction aims to predict potential customer churn by building an effective predictive model. However, the model's performance is sensitive to unnecessary and irrelevant features. Feature selection is used to eliminate irrelevant features while emphasizing significant ones. This study suggests utilizing a feature selection method to identify significant features and enhance the accuracy of the customer churn prediction model. We propose employing a recently developed evolutionary computation method known as the gravitational search algorithm (GSA) for the feature selection approaches. We elaborate on GSA and the SVM as the classifier to find the optimum features and to improve the prediction accuracy. Our method produced higher precision and AUC scores than the baseline model (without feature selection).

MS027 **14:00-14:15**	**Title:** Chaos Gray Wolf global optimization algorithm based on Opposition-based Learning **Authors:** Zhiyong Luo, Mingxiang Tan, Zhengwen Huang, Guoquan Li **Presenter:** Mingxiang Tan, Chongqing University of Posts and Telecommunications, China **Abstract:** Gray wolf optimizer (GWO) is a new heuristic algorithm. It has few parameters and strong optimization ability and is used in many fields. However, when solving complex and multimodal functions, it is also easy to trap into the local optimum and premature convergence. In order to boost the performance of GWO, a tent chaotic map and opposition-based learning Grey Wolf Optimizer (CO-GWO) is proposed. Firstly, some better values of the population in the current generation are retained to avoid deterioration in the next generation. Secondly, tent chaotic map and opposition-based (OBL)are introduced to generate values that can traverse the whole feasible region as much as possible, which is conducive to jumping out of local optimization and accelerating convergence. Then, the coefficient $\vec{a}$ is dynamically adjusted by the polynomial attenuation function of the 2-decay method. Finally, the proposed algorithm is tested on 23 benchmark functions. The results show that the proposed algorithm is superior to the conventional heuristic algorithms, GWO and its variants in search-efficiency, solution accuracy and convergence rate.
MS028-A **14:15-14:30**	**Title:** Data-driven Framework for Estimating Nonlinear Neural Dynamics Based on Non-uniform Sparse Modeling **Authors:** TAKUMA IHARA, TOSHIAKI OMORI **Presenter:** Takuma Ihara, Department of Electrical and Electronic Engineering, Graduate School of Engineering, Kobe University, Kobe, Japan **Abstract:** In recent years, we can obtain various observed data due to improvements of measurement technology in neural activities. Here, it is necessary to establish data-driven framework for estimating neural dynamics from time-series observed data in an inverse problem. Neural dynamics are known to consist of many kinds of nonlinear currents. The response of membrane potential changes in a complex pattern depending on the membrane currents. Therefore, for estimating neural dynamics, it is important to extract appropriate membrane currents. In particular, in the case of different scale of membrane currents, it is difficult to extract only important membrane currents. Therefore, it is necessary to establish data-driven framework corresponding to the scale of membrane currents. **(continued on next page)**

MS028-A **14:15-14:30**	**(continued)** In this study, we propose data-driven framework for estimating neural dynamics under a situation with different scale of membrane currents. We first derive a state-space model of conductance-based neuron model. Considering partial observation problem, we estimate high-dimensional latent variables such as membrane potential and channel variables from noisy one-dimensional membrane potential observed data by introducing sequential Monte Carlo method. Moreover, we extract important membrane currents from candidates by means of sparse modeling approach. In particular, in order to adapt different scale of membrane currents, we propose non-uniform sparse modeling applying different regularization constants to each element of the vector Instead of uniformly imposing constraints. We evaluated the effectiveness of the proposed method using simulation data based on conductance-based neuron model. From noisy one-dimensional membrane potential observation data, we were able to accurately estimate the high-dimensional latent variables. Moreover, in the case of different scale of membrane currents, we were able to extract only important membrane currents from many candidates using non-uniform sparse modeling even though uniform sparse modeling was not accurately estimated. These results show that the proposed method successfully estimates neural dynamics in the case of different scale of membrane currents.
MS047 **14:30-14:45**	**Title:** A Meta-heuristic Approach for Strategic Fair Division Problems **Authors:** Koosha Samieefar **Presenter:** Koosha Samieefar, University of Victoria, Canada **Abstract:** Fair division of resources emerges in a variety of different contexts in real-world problems, some of which can be seen through the lens of game theory. Many equilibrium notions for simple fair division problems with indivisible items have been considered, and many of these notions are hard to compute. Strategic fair division is a branch of fair division in which participants may act uncooperatively to maximize their utility. In the presence of participants who have strategic behavior, it is essential to have a suitable algorithm in place to allocate resources in a fair and equitable manner. We propose a new approach to solve strategic fair division problems where fairness is attained by finding a constrained Nash equilibrium in a specific game. We show that computational complexity barriers also hold. More broadly, the theoretical results of this paper could potentially be applied to related general game theory problems and complex fair division problems. Finally, we propose an algorithm for finding a constrained Nash equilibrium in the game that we introduce. Our focus will be on one particular meta-heuristic – the bus transportation algorithm – as an approach to improve the running time of the search.

MS046 **14:45-15:00**	**Title:** Cuckoo Search Algorithm with Lévy Flights for Surface Reconstruction from Point Clouds with Applications to Reverse Engineering **Authors:** Akemi Gálvez, Iztok Fister, Suash Deb, Iztok Fister Jr, Andres Iglesias **Presenter:** Andres Iglesias, University of Cantabria, Spain **Abstract:** Surface reconstruction is a classical task in industrial en-gineering and manufacturing, particularly in reverse engi-neering, where the goal is to obtain a digital model from a physical object. For that purpose, the real object is typ-ically scanned and the resulting point cloud is then fitted through mathematical surfaces via numerical optimization. The choice of the approximating functions is crucial for the accuracy of the process. Unfortunately, real-world objects often require complex nonlinear approximating functions, which are not well suited for standard numerical optimiza-tion methods. In this paper, we overcome this limitation by using a cuckoo search algorithm with Levy ights, a swarm intelligence technique envisioned for global optimiza- tion. The method is applied to three illustrative examples of point clouds tted by using a combination of exponen-tial, polynomial and logarithmic functions. The experimen-tal results show that the method performs well in recovering the shape of the point clouds accurately. We conclude that the method is promising towards its application to manu-factured workpieces in real industrial settings.
MS041 **15:00-15:15**	**Title:** A Learnheuristic Approach to A Constrained Multi-Objective Portfolio Optimisation Problem **Authors:** Sonia Bullah, Terence L. van Zyl **Presenter:** Sonia Bullah, University of the Witwatersrand, South Africa **Abstract:** Multi-objective portfolio optimisation is a critical problem researched across various fields of study as it achieves the objective of maximising the expected return while minimising the risk of a given portfolio at the same time. However, many studies fail to include realistic constraints in the model, which limits practical trading strategies. This study introduces realistic constraints, such as transaction and holding costs, into an optimisation model. Due to the non-convex nature of this problem, metaheuristic algorithms, such as NSGA-II, R-NSGA-II, NSGA-III and U-NSGA-III, will play a vital role in solving the problem. Furthermore, a learnheuristic approach is taken as surrogate models enhance the metaheuristics employed. These algorithms are then compared to the baseline metaheuristic algorithms, which solve a constrained, multi-objective optimisation problem without using learnheuristics. The results of this study show that, despite taking significantly longer to run to completion, the learnheuristic algorithms outperform the baseline algorithms in terms of hypervolume and rate of convergence. Furthermore, the backtesting results indicate that utilising learnheuristics to generate weights for asset allocation leads to a lower risk percentage, higher expected return and higher Sharpe ratio than backtesting without using learnheuristics. This leads us to conclude that using learnheuristics to solve a constrained, multi-objective portfolio optimisation problem produces superior and preferable results than solving the problem without using learnheuristics.

MS044
15:15-15:30

Title: MetaEmb: A novel technique to embed audio data using metaheuristic algorithm

Authors: Sahil Nokhwal, Saurabh Pahune, Ankit Chaudhary
Presenter: Sahil Nokhwal, Dept. Computer Science University of Memphis Memphis, Tennessee, USA

Abstract: To protect sensitive information in transit as well as after it has been exchanged, the cryptographic technique of steganography is employed. The aim of steganographic algorithms is to identify the appropriate pixel positions in the host or cover image, where bits of sensitive information can be concealed for data encryption. Furthermore work is being done to improve the capacity to integrate sensitive information and to maintain the visual appearance of the steganographic image. Consequently, steganography is challenging research area.

In our currently proposed image steganographic technique, we used the Shuffled Frog Leaping Algorithm (SFLA) to determine the order of pixels by which sensitive information can be placed in the cover image. To achieve greater embedding capacity, pixels from the spatial domain of the cover image are carefully chosen and used for placing the sensitive data. Bolstered via image steganography, the final image after embedding is resistant to steganalytic attacks. The SFLA algorithm mentioned above serves us in the optimal pixels selection of any colored (RGB) cover image for secret bit embedding. Using the fitness function, the SFLA benefits us by reaching a minimum cost value in an acceptable amount of time. The pixels for embedding are meticulously chosen to minimize the host image's distortion upon embedding. Moreover, an effort has been taken to make the detection of embedded data in the steganographic image a formidable challenge.

Due to the enormous need for audio data encryption in the current world, we feel that our suggested method has significant potential in real-world applications. In this paper, we also compare our proposed strategy to existing steganographic methods.

Session Chair

Associate Prof. Ka Chun Wong

City University of Hong Kong, China

Session

2

April 24, 2023

15:40 pm — 17:40 pm (GMT+8)

Topic: Computer model and computing analysis in engineering applications

- Please join the conference room 15 minutes in advance before the session starts.
- 1 Best Presentation Award will be selected and announced at the end of this session.
- Presentation certificates will be sent by emails after the conference.

MS005 **15:40-15:55**	**Title:** A self-adaptive system of systems architecture to enable its ad-hoc scalability **Authors:** Ahmed R. Sadik, Bram Bolder, Pero Subasic **Presenter:** Ahmed Rabee Sadik, Honda Research Institute Europe, Germany **Abstract:** The concept of System of Systems (SoS) refers to a collection of Constituent Systems (CSs) that interact to deliver an emergent behavior that cannot be achieved by any individual CS on its own. The focus of this research is on the ad-hoc scalability of SoS, meaning that the size of the system can change during operation by adding or removing a CS or changing the size of existing CSs. The Unmanned Vehicle Fleet (UVF) is selected as a practical example to showcase the challenge and solution of ad-hoc scalability. UVF has various applications in fields such as search and rescue, intelligent transportation and mobility, but it operates in a dynamic environment that is prone to uncertainties like changing missions, increasing range and capacity, UV failures, and battery requirements. The proposed solution to overcome these uncertainties is a self-adaptive system that can dynamically change the UVF architecture in real-time, allowing for upscaling or downscaling the size of the UVF. The Mission Control Center (MCC) can control this change either through fully-automatic mode based on performance criteria like battery utilization and communication traffic, or through manual mode where the operator makes the decision. A multi-agent environment and rule management engine are implemented to simulate the UVF behavior and validate the proposed solution in both automatic and manual modes.
MS006 **15:55-16:10**	**Title:** Feedback-circulating design space exploration by multi-sampling Kriging model: Exploitation for the lift rise by an aircraft flap with yaw-wise rotation **Authors:** Kazuhisa Chiba and Masahiro Kanazaki **Presenter:** Kazuhisa Chiba, University of Electro-Communications, Japan **Abstract:** an aircraft flap improves lift performance and elucidated its improvement mechanism. The aircraft is optimized for cruising conditions and lacks takeoff and landing performance. Hence, highlift devices, such as slats and flaps, compensate for the lift performance. Since flaps move along rails, the gap between the wing and the flap is spanwise constant. However, since the flowfield is threedimensional, the gap should also have a spanwise distribution to raise the lift. Thus, this study defined a design problem for lift maximization with the gap and the yaw-wise rotation angle as design variables. This problem adopted a surrogate model because of the small number of objective functions and design variables. A Kriging model modified to add multiple sample points optimized this problem. Furthermore, the study utilized a feedback-circulating exploration to reach the physical essence of the problem. The result eventually revealed that adding a rotation angle ameliorated the lift. The acceleration of the flow velocity through the gap at the appropriate spanwise position causes the separation of the flap's upper surface to recede, further reducing the pressure on the wing's upper surface and growing the lift on both the flap and the wing.

MS009 **16:10-16:25**	**-16： Title:** Dynamic Self-Attention with Guided-Attention Network for Visual Question Answering using Capsules Dynamic Routing **Authors:** DOAA B. EBAID , Magda M. Madbouly, Adel A. El-Zoghabi **Presenter:** DOAA B. EBAID, Institute of Graduate Studies and Research, Alexandria University, Egypt **Abstract:** Visual Question Answering (VQA) takes an active role in aiding people specially with visual issues. Since, QVA answers questions about a specific image, it needs a deep understanding of the image and question content together. Recently, the attention is commonly used to build VQA models. It gives a weight to each feature that leads to better interpretation for the images and questions representations. However, VQA faces some issues where it requires multi-attention layers for reasoning. In addition to that, the current works focus on the visual features and ignore the effect of question features. Also, they used the stacked layer approach which increases the models' parameters. In this work, we propose a dynamic attention mechanism based on capsules concept. It can be generalized to work as a self-attention and a co-attention based on the inputs. Furthermore, we make the self-attention improves the co-attention results, by feeding its output to the proposed co-attention instead of using the ordinary embedding vectors as a reference. Motivated by capsule networks, our model computes the attention scores by an iterative process. We evaluated the proposed VQA using the evaluation matrices such as accuracy and WUPS on the benchmark DQAUAR dataset. The results show an improvement in the VQA compared to the baseline models.
MS010 **16:25-16:40**	**Title:** Concept and development of a multi-agent digital twin of plant focused on broccoli **Authors:** P.O. Skobelev, E.V. Simonova, A.S. Tabachinskiy, E.V. Kudryakov, A.O. Strizhakov, O.I. Goryanin, V.V. Ermakov, Y.K. Chan, Y. Sung, T.R. Lee **Presenter:** Aleksey Tabachinskiy, Samara State Technical University, Russia **Abstract:** The paper discusses the principles of developing a multi-agent digital twin of plants using broccoli as an example of plants. The developed model of the digital twin of plants must meet the following requirements: real-time environmental data acquisition, user feedback collection, continuous adaptation of the plant development plan for each event, individual instance for field or field part. The digital twin of plant is designed as an intelligent cyber-physical system that has a user-defined knowledge bas and a multi-agent system for planning and modeling of plant growth and development, as well as for forecasting crop parameters. For this purpose, a new method for estimate stage duration and yield is proposed, which defines a "tube" – a corridor to each of the factors corresponding plant development. The key factors have been determined during consultations with practicing agronomists but can be adjusted by users experience. This concept was originally introduced for wheat digital twin, but now is scaled and modified to simulate broccoli growth process.

MS016 **16:40-16:55**	**Title:** Improved Solution Search Performance of Constrained MOEA/D Hybridizing Directional Mating and Local Mating **Authors:** Masahiro Kanazaki, Takeharu Toyoda **Presenter:** Masahiro Kanazaki, Tokyo Metropolitan University, Japan **Abstract:** In this study, we propose an improvement to the direct mating method, a constraint handling approach for multi-objective evolutionary algorithms, by hybridizing it with local mating. Local mating selects another parent from the feasible solution space around the initially selected parent. The direct mating method selects the other parent along the optimal direction in the objective space after the first parent is selected, even if it is infeasible. It shows better exploration performance for constraint optimization problems with coupling NSGA-II, but requires several individuals along the optimal direction. Due to the lack of better solutions dominated by the optimal direction from the first parent, direct mating becomes difficult as the generation proceeds. To address this issue, we propose a hybrid method that uses local mating to select another parent from the neighborhood of the first selected parent, maintaining diversity around good solutions and helping the direct mating process. We evaluate the proposed method on three mathematical problems with unique Pareto fronts and two real-world applications. We use the generation histories of the averages and standard deviations of the hypervolumes as the performance evaluation criteria. Our investigation results show that the proposed method can solve constraint multi-objective problems better than existing methods while maintaining high diversity.
MS030 **16:55-17:10**	**Title:** Efficient Adaptive Convolutional Model Based on Label Embedding for Text Classification Using Low Resource Languages **Authors:** Victor Kwaku Agbesi, Chen Wenyu, Abush S. Ameneshewa, Emmanuel Odame, Koffi Dumor, and Judith Ayekai Browne **Presenter:** Victor Kwaku Agbesi, University of Electronic Science and Technology of China (UESTC), China **Abstract:** Text classification technology has been efficiently deployed in numerous organizational applications, including subject tagging, in- tent, event detection, spam filtering, and email routing. This also helps organizations streamline processes, enhance data-driven operations, and evaluate and analyze textual resources quickly and economically. This progress results from numerous studies on high- resource languages such as Chinese and English-based text class- sification tasks. However, research in low-resource languages, including Ewe, Arabic, Filipino, and Kazakh, lags behind other high- resource languages like English. Also, the most difficult aspect of text classification using low-resource languages is identifying the optimal set of filters for its feature extraction. This is due to their complex morphology, linguistic diversity, multilingualism, and syntax.

MS030 **16:55-17:10**	In addition, machine and deep learning models need to improve the efficiency of label information. As a result, the label information for these languages needs to be adequately utilized to enhance classification results. To solve this problem, this study proposes an efficient adaptive convolutional model based on label embedding (EAdaCLE) to efficiently represent label information and utilize the learned label representations for various text classification tasks. EAdaCLE has adaptively engineered convolutional filters trained on inputs based on label embeddings generated in the same network as the text vectors. EAdaCLE ensures the adaptability of adaptive convolution and completely obtains label data as a supporting function to enhance the classification results. Extensive experiments indicate that our technique is more reliable than other methods on four low-resource public datasets.
MS040 **17:10-17:25**	**Title:** Habitat Prediction and Knowledge Extraction for Marine Bivalves using Machine Learning Techniques **Authors:** Alme B. Maravillas, LARMIE S. FELISCUZO, JAMES ARNOLD E. NOGRA **Presenter:** Alme B. Maravillas, Cebu Institute of Technology University, Philippines **Abstract:** Species distribution models (SDMs) are powerful tools for analyzing the relationships between species and the environment. SDM results can provide insights into a species' response to a given habitat condition, making it crucial to compare SDMs based on their predictive performance and habitat information. The marine bivalves' habitat has been highly threatened due to anthropogenic activities and natural disturbances and continues to lose their rich biodiversity resources. Protection for these species requires detailed spatial distribution of these habitats such as habitat suitability maps. Three machine learning methods (Maximum Entropy, Random Forest, and Support Vector Machine) and Artificial Neural Network (ANN) models were used to predict the habitat suitability for marine bivalves, comparing their predictive performance and ecological relevance. A spatial modeling approach was used, incorporating 1200 occurrence data points and ten environmental factors. The study used five performance metrics to estimate the accuracy of the habitat suitability models. All of the four SDMs methods showed significant relationship between the marine bivalves distribution and environmental factors. Results indicate that Random Forest (RF) model is the best predictor of potential bivalve habitat, with an area under curve (AUC) value of 0.98 compared to SVM (0.87), MaxEnt (0.97) and ANN (0.87) models. The most important environmental factors that affect the bivalve's distribution in the area were pH, diffuse, and calcite. Finally, a potential area for cultivating the marine bivalves with high and very suitability was suggested based on the RF model.

MS033
17:25-17:40

Title: Framework for Healthy/Hemorrhagic Brain Condition Detection using CT Scan Images

Authors: S. Kadry, A. Gandomi
Presenter: Amir H Gandomi, University of Technology Sydney, Sydney, NSW, Australia

Abstract: In human physiology, the brain plays a significant role as the control center of all regulatory processes. Any abnormality in the brain could lead to various physiological and psychological problems and, thus, demands early detection and treatment. Accurate identification of a brain condition is vital during treatment planning. Hence, medical imaging combined with Artificial Intelligence (AI) schemes is widely employed in hospitals to achieve better detection accuracy. Specifically, a brain hemorrhage is a medical emergency that needs immediate treatment to reduce its impact. Therefore, this research aimed to develop and implement a Lightweight Deep Learning (LDL) procedure to classify brain Computed Tomography (CT) slices into healthy/hemorrhagic classes. The various stages of this scheme involve: (i) image collection, resizing, and preprocessing; (ii) LDL feature extraction; and (iii) binary classification with 3-fold cross-validation. In this work, the CT slices were initially preprocessed with a threshold filter and then considered to verify the performance of the proposed scheme with based on individual and dual features. The experimental outcome of this study con-firms that the dual features help to achieve a detection accuracy of >96% with the Support Vector Machine (SVM) classifier.

Session Chair

Dr.-Ing. Ahmed Rabee Sadik,
Honda Research Institute Europe, Germany

Session

3

April 24, 2023
17:50 pm — 19:50 pm (GMT+8)

Topic: Artificial Intelligence and Smart Computing

- Please join the conference room 15 minutes in advance before the session starts.
- 1 Best Presentation Award will be selected and announced at the end of this session.
- Presentation certificates will be sent by emails after the conference.

MS012 **17:50-18:05**	**Title:** Analyzing the Computing Time to Solve Single Row Facility Layout Problems by Simulated Annealing in a Python Framework **Authors:** Alexandre Miccoli, Thomas Hanne and Rolf Dornberger **Presenter:** Thomas Hanne, University of Applied Sciences and Arts Northwestern Switzerland **Abstract:** The goal of this paper is to assess the Python computing time to solve a single row facility layout problem (SRFLP) by Simulated Annealing. The optimization problem is introduced, systematically modelled and then optimized numerically using a particular Python framework. The computing time and the results of experiments with various problem sizes and parameters are analyzed and discussed.
MS013 **18:05-18:20**	**Title:** Deepfake Detection Analyzing Hybrid Dataset Utilizing CNN and SVM **Authors:** Jacob Mallet, Laura Pryor, Rushit Dave and Mounika Vanamala **Presenter:** Mounika Vanamala, University of Wisconsin-Eau Claire, USA **Abstract:** Social media is currently being used by many individuals online as a major source of information. However, not all information shared online is true, even photos and videos can be doctored. Deepfakes have recently risen with the rise of technological advancement and have allowed nefarious online users to replace one's face with a computer-generated face of anyone they would like, including important political and cultural figures. Deepfakes are now a tool to be able to spread mass misinformation. There is now an immense need to create models that are able to detect deepfakes and keep them from being spread as seemingly real images or videos. In this paper, we propose a new deepfake detection schema using two popular machine learning algorithms; support vector machine and convolutional neural network, along with a publicly available dataset named the 140k Real and Fake Faces to accurately detect deepfakes in images with accuracy rates reaching as high as 88.33%.

MS018 **18:20-18:35**	**Title:** Set-Based Particle Swarm Optimization for Data Clustering: Comparison and Analysis of Control Parameters **Authors:** Rijk Marius de Wet, Andries Engelbrecht **Presenter:** Rijk Marius de Wet, Department of Industrial Engineering, Stellenbosch University, South Africa **Abstract:** Data clustering is a highly studied field of data science and computational intelligence. Population-based algorithms such as particle swarm optimization (PSO) have shown to be effective at data clustering. Set-based particle swarm optimization (SBPSO) is a generic set-based PSO variant that has shown promise in clustering stationary and non-stationary data. In this paper, SBPSO is used to cluster fifteen datasets with diverse characteristics. The clustering ability of SBPSO is compared in depth to the performance of six other tuned clustering algorithms. A sensitivity analysis of the SBPSO control parameters is performed to determine the effect that variation in these control parameters have on swarm diversity and other measures. SBPSO ranked third from among the algorithms evaluated and proved a viable clustering algorithm. A trade-off between swarm diversity and clustering ability was discovered, and the control parameters that control this trade-off were determined.
MS019-A **18:35-18:50**	**Title:** Visualizing Process of Image Reconstruction from Brain Activities by Using Non-parametric Generative Model **Authors:** Kensuke Inaba, Toshiaki Omori **Presenter:** Kensuke Inaba, Department of Electrical and Electronic Engineering, Graduate School of Engineering, Kobe University, Japan **Abstract:** Reconstructing perceptual images from functional magnetic resonance imaging (fMRI) recordings is one of the most important subjects in neuroscience and medical sciences, since it is regarded as a promising technique for reading the brain. However, reconstructing perceptual images from the fMRI is challenging because the visual encoding in the brain is very complex and has not been fully elucidated. There are conventional methods employing black-box type learning and inference processes. However, it is difficult to analyze decoding processes related to perceptual information. Furthermore, it is another important issue to improve the accuracy of decoding. **(continued on next page)**

MS019-A **18:35-18:50**	In this study, we propose a method for visualizing the process of image reconstruction from fMRI. More concretely, we reconstruct perceptual images from fMRI signals using a framework based on a flow-based image generation model. To realize white-box type decoding algorithms, we employ a free-form continuous dynamics (FFJORD), which is a neural network model that extends with neural ordinary differential equations (neural ODE) as a flow-type image generator. By introducing the FFJORD into a system for reconstructing perceptual images, the proposed method realizes mapping points from a simple distribution to a complex distribution through the neural ODE. By applying the neural ODE as a non-parametric layer, we can flexibly learn and inference the medical data with irregular time intervals without restrictions. In addition, by applying a flow-type neural network, it is possible to derive estimated images without dimensionality compression and expansion during the learning phase. This allows us to visually decode how the shape features of the image are successively captured in the learning and inference process of image reconstruction. Experimental results show that the reconstructed images using the proposed method successfully estimates the perceived images. Moreover, quantitative analysis based on structural similarity index shows that the proposed method is more accurate than the conventional black-box type methods. Furthermore, the proposed method has shown visually the images of successive intermediate representations in the reconstruction process. In conclusion, it is shown that the proposed method improves the accuracy of decoding perceptual images and clarifies the structure of information processing in the learning process.
MS021 **18:50-19:05**	**Title:** Three-dimensional Super-resolution of X-ray CT Data of Rock Samples by Sparse Representation Learning **Authors:** Shoi Suzuki, Atsushi Okamoto, Katsuyoshi Michibayashi and Toshiaki Omori **Presenter:** Shoi Suzuki, Department of Electrical and Electronic Engineering, Graduate School of Engineering, Kobe University, Japan **Abstract:** In recent years, computed tomography (CT) has been widely used during scientific drilling, providing continuous data of various rock structures such as rock layers, sedimentary layers, fractures and pores. Low-resolution CT used in drilling is insufficient to reveal the fine structures of rocks. On the other hand, X-ray CT, such as that used in the laboratory, has high resolution but is limited by the size of the sample. If the different scale-resolutions between high-resolution and low-resolution CT data can be linked, important information for multiscale analysis can be extracted. We therefore propose three-dimensional sparse super-resolution for CT data of rock samples. We show that the proposed method can reconstruct particles, veins, and texture microstructures from low-resolution three-dimensional data with super-resolution. Using multiple evaluation indices, we also demonstrate the effectiveness of the proposed method by comparing the proposed method with conventional interpolation methods.

MS025 **19:05-19:20**	**Title:** Leveraging Deep Learning Approaches for Deepfake Detection: A Review **Authors:** Aniruddha Tiwari, Dr. Rushit Dave, Dr. Mounika Vanamala **Presenter:** Aniruddha Tiwari, Minnesota State University, Mankato, USA **Abstract:** Conspicuous progression in the field of machine learning (ML) and deep learning (DL) have led the jump of highly realistic fake media, these media oftentimes referred as deepfakes. Deepfakes are fabricated media which are generated by sophisticated AI that are at times very difficult to set apart from the real media. So far, this media can be uploaded to the various social media platforms, hence advertising it to the world got easy, calling for an efficacious countermeasure. Thus, one of the optimistic counter steps against deepfake would be deepfake detection. To undertake this threat, researchers in the past have created models to detect deepfakes based on ML/DL techniques like Convolutional Neural Networks (CNN). This paper aims to explore different methodologies with an intention to achieve a cost-effective model with a higher accuracy with different types of the datasets, which is to address the generalizability of the dataset.
MS029 **19:20-19:35**	**Title:** Predicting Open Parking Space using Deep Learning and Support Vector Regression **Authors:** WEI JUN, W.J., LEE, MOHAMMAD DALVI, M.D., ESFAHANI, KWAN LEE, K.L., TSEU **Presenter:** Lee Wei Jun, Universiti Tunku Abdul Rahman (UTAR), Kampar Campus, Malaysia **Abstract:** Vehicle parking issues have been one of the biggest problems faced in urban areas, as the supply and demand for vehicles and parking spaces are getting unbalanced year by year. The traditional approach of adding more parking spaces is no longer an effective solution. A practical and intelligent solution is to predict open parking spots using machine learning (ML), which would increase the utilization of available parking spaces and alleviate traffic congestion and decrease emissions from idling vehicles. This study aims to propose a parking prediction model using support vector regression (SVR) to predict available parking spaces. The data used in training the ML model is collected using a custom object detector, which is developed using the YOLOv4 (You Only Look Once) algorithm. The result shows that the custom YOLOv4 model is able to detect and identify empty and occupied parking spaces, and the SVR prediction model can predict the number of empty parking spaces. Two additional ML algorithms, which are linear regression (LR) and decision tree regressor were applied in this project to compare the performance of the SVR prediction model.

MS042 **19:35-19:50**	**Title:** Machine Learning for Socially Responsible Portfolio Optimisation **Authors:** Taeisha Nundlall and Terence Van Zyl **Presenter:** Taeisha Nundlall, University of Witwatersand, South Africa **Abstract:** Socially responsible investors build investment portfolios intending to incite social and environmental advancement alongside a financial return. Although Mean-Variance (MV) models successfully generate the highest possible return based on an investor's risk tolerance, MV models do not make provisions for additional constraints relevant to socially responsible (SR) investors. In response to this problem, the MV model must consider Environmental, Social, and Governance (ESG) scores in optimisation. Based on the prominent MV model, this study implements portfolio optimisation for socially responsible investors. The amended MV model allows SR investors to enter markets with competitive SR portfolios despite facing a trade-off between their investment Sharpe Ratio and the average ESG score of the portfolio.

Thanks for Your Participation!