



# The 8th International Conference on Fuzzy Systems and Data Mining (FSDM 2022)

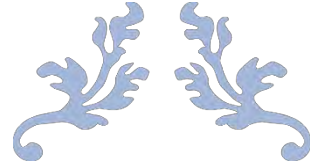
November 4-7, 2022 (GMT+8, Beijing Time)  
Online Conference (Microsoft Teams)

## Conference Guide

Organizer



華僑大學  
HUAQIAO UNIVERSITY



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# INVITATION LETTER

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**The 9th International Conference on Fuzzy Systems and Data Mining**



## **FSDM2023**

**November 10-13, 2023**

**Chongqing, China + Online via MS Teams**

**Supported by**

**Chongqing University of Posts and Telecommunications**



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# **FSDM 2022**

# **CONFERENCE PROGRAM**

November 4<sup>th</sup>-7<sup>th</sup>, 2022 (GMT+8, Beijing Time)

ONLINE-Microsoft Teams Meeting

For FSDM2022 Academic Exchange Only



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# Part I Conference Schedule Summary

**November 4, 2022 (Friday) (GMT+8, Beijing Time)**

MS Teams: <http://www.academicconf.com/teamslink?confname=fsdm2022>

10:00-12:00 MS Teams Online Conference Testing and Ice Breaking

15:00-17:00 MS Teams Online Conference Testing and Ice Breaking Continued

**November 5, 2022 (Saturday) (GMT+8, Beijing Time)**

MS Teams: <http://www.academicconf.com/teamslink?confname=fsdm2022>

Chaired by Prof. Xin Liu, Huaqiao University, China

09:00-09:10 **Opening & Welcoming Remarks**  
*Prof. Jin Gou, Dean, College of Computer Science and Technology, Huaqiao University, China*

09:10-09:50 **Keynote Speech 1: Intelligent Transportation: Learning in Real-Time from Distributed Data**  
*Prof. Nikolaos M. Freris, University of Science and Technology of China (USTC), China*

09:50-10:30 **Keynote Speech 2: Trustworthy Artificial Intelligence of Things**  
*Prof. Gyu Myoung Lee, Liverpool John Moores University, UK*

10:30-10:45 **BREAK**

10:45-11:25 **Keynote Speech 3: The Effectiveness of Bidding Support in Negotiation**  
*Prof. Catholijn M. Jonker, Delft University of Technology, Netherlands*

11:25-12:05 **Keynote Speech 4: Progress and Open Questions of Convolutional Neural Networks**  
*Prof. Milan Tuba, Singidunum University, Serbia*

12:05-14:00 **BREAK**

14:00-16:25 **Oral Session 1: Fuzzy Theory, Algorithm and System**

16:30-17:00 **Poster Session**

**November 6, 2022 (Sunday) (GMT+8, Beijing Time)**

MS Teams: <http://www.academicconf.com/teamslink?confname=fsdm2022>

9:00-11:20 **Oral Session 2: Fuzzy Application**

11:30-14:00 **BREAK**

14:00-16:50 **Oral Session 3: Data Mining, Machine Learning Related to AI**

**November 7, 2022 (Monday) (GMT+8, Beijing Time)**

MS Teams: <http://www.academicconf.com/teamslink?confname=fsdm2022>

9:00-11:25 **Oral Session 4: Interdisciplinary Field of Fuzzy Logic and Data Mining**

## Part II Opening & Welcoming Remarks

### Opening & Welcoming Remarks from Conference General Chair



*FSDM2022 General Chair*

*Prof. Jin Gou,  
Dean, College of Computer Science and  
Technology, Huaqiao University, China*

## Part III Keynote Speeches

### Keynote Speech 1: Intelligent Transportation: Learning in Real-Time from Distributed Data



**Prof. Nikolaos M. Freris,**  
**Vice Dean of the International College; School of Computer Science, University of Science and Technology of China (USTC), China**

**Biography:** Dr. Freris is Professor in the School of Computer Science at USTC, and Vice Dean of the International College. He received the Diploma in Electrical and Computer Engineering from the National Technical University of Athens (NTUA), Greece, in 2005, and the M.S. degree in Electrical and Computer Engineering, the M.S. degree in Mathematics, and the Ph.D. degree in Electrical and Computer Engineering all from the University of Illinois at Urbana-Champaign (UIUC) in 2007, 2008, and 2010, respectively. His research lies in AIoT/CPS/IoT: machine learning, distributed optimization, data mining, wireless networks, control, and signal processing, with applications in power systems, sensor networks, transportation, cyber security, and robotics. Dr. Freris has published several papers in high-profile conferences and journals held by IEEE, ACM, and SIAM and holds three patents. His research has been sponsored by the Ministry of Science and Technology of China, Anhui Dept. of Science and Technology, Tencent,

and NSF, and was recognized with the National High-level Talent award, the USTC Alumni Foundation Innovation Scholar award, and the IBM High Value Patent award. Previously, he was with the faculty of NYU and, before that, he held senior researcher and postdoctoral researcher positions at EPFL and IBM Research, respectively.

Dr. Freris is a Senior Member of ACM and IEEE, and a member of CCF and SIAM.

**Abstract:** Intelligent Transportation is the primordial example of a Cyber-physical System (CPS), that encapsulates a very large network of “smart” devices (possessing sensing, communication, and computation capabilities) controlling physical entities. Besides, the ever-emerging paradigm of AIoT targets solutions that capitalize the computational power of Internet-of-Things (IoT) devices to enable Artificial Intelligence (AI) in system operations.

This keynote will discuss the CPS/AIoT perspective to Intelligent Transportation, which considers real-time learning in a network of agents with distributed data collection. In specific, I will discuss two problems:

- a) Real-time learning of travel time densities via online Sparse Kernel Density Estimation
- b) Real-time 3D Multi-Object Detection & Tracking from LiDAR point clouds

## Keynote Speech 2: Trustworthy Artificial Intelligence of Things



*Prof. Gyu Myoung Lee,*

**Computer Science and Mathematics, Liverpool John Moores University, UK; Korea Advanced Institute of Science and Technology, South Korea**

**Biography:** Gyu Myoung Lee joined the Liverpool John Moores University (LJMU), UK in 2014, as a Senior Lecture in the department of Computer Science and was promoted to a Reader in 2017 and a Professor in 2020. He is also with KAIST Institute for IT convergence, Daejeon, Rep. of Korea, as an Adjunct Professor from 2012.

Before joining the LJMU, he worked with the Institut Mines-Telecom, Telecom SudParis from 2008. Until 2012, he was invited to work with the Electronics and Telecommunications Research Institute (ETRI), Rep. of Korea. He worked as a research professor in KAIST, Rep. of Korea and as a guest researcher in National Institute of Standards and Technology (NIST), USA, in 2007. He worked as a visiting researcher in the University of Melbourne, Australia, in 2002. Furthermore, he also has work experience in industries in Rep. of Korea.

His research interests include Internet of Things, Web of Things, computational trust, knowledge centric networking and services considering all vertical services, Smart Grid, energy saving networks, cloud-based big data analytics platform and multimedia networking and services.

Dr. Lee has been actively participating in standardization meetings including ITU-T SG 13 (Future Networks and cloud) and SG20 (IoT and smart cities and communities), IETF and oneM2M, etc., and currently serves as a Rapporteur of Q16/13 (Knowledge centric trustworthy networking and

services) and Q4/20 (e/Smart services, applications and supporting platforms) in ITU-T. He is also the chair of ITU-T Focus Group on Data Processing and Management (FG-DPM) to support IoT and smart cities & communities. He has contributed more than 300 proposals for standards and published more than 100 papers in academic journals and conferences. He received several Best Paper Awards in international and domestic conferences and served as a reviewer of IEEE journals/conference papers and an organizer/member of committee of international conferences. He is a Senior Member of IEEE.

**Abstract:** Artificial Intelligence (AI) and Internet of Things (IoT) are very important technologies for the future and there are a lot of research activities to combine AI and IoT, called AIoT (Artificial Intelligence of Things). Furthermore, data is becoming essential to support AI based solutions with human interactions. In this regard, this talk introduces key concepts, features and characteristics of human centric AIoT in data driven networking point of view. From AIoT research, many researchers have identified that there are security, privacy and trust concerns to realize human-centric AIoT. To cope with negative effects of AIoT, it's necessary to address trustworthy AIoT. Therefore, this talk introduces data ecosystem and its features. Then, it presents key challenges for realizing trustworthy AIoT and discuss next steps for future research.

### Keynote Speech 3: The Effectiveness of Bidding Support in Negotiation



*Prof. Catholijn M. Jonker,*

**Interactive Intelligence group, Faculty of Electrical Engineering, Mathematics and Computer Science of the Delft University of Technology, Netherlands**

**Biography:** Catholijn Jonker (1967) is full professor of Interactive Intelligence at the Faculty of Electrical Engineering, Mathematics and Computer Science of the Delft University of Technology. Jonker studied computer science, and did her PhD studies at Utrecht University. After a post-doc position in Bern, Switzerland, she became assistant (later associate) professor at the Department of Artificial Intelligence of the Vrije Universiteit Amsterdam. From September 2004 until September 2006 she was a full professor of Artificial Intelligence / Cognitive Science at the Nijmegen Institute of Cognition and Information of the Radboud University Nijmegen. She chaired De Jonge Akademie (Young Academy) of the KNAW (The Royal Netherlands Society of Arts and Sciences) in 2005 and 2006, and she was a member of the same organization from 2005 to 2010. She is a member of the Koninklijke Hollandsche Maarschappij der Wetenschappen and of the Academia Europaea. She was the president of the National Network Female Professors (LNVH) in The Netherlands from September 2013 till January 2016. She served TU Delft for one year as interim head of department for the Design Engineering Department (2014/2015). Catholijn is EurAI Fellow since 2015, and EurAI board member since 2016, EurAI is the European Association for Artificial Intelligence.



Her publications address cognitive processes and concepts such as negotiation, teamwork and the dynamics of individual agents and organizations. In all her research lines Catholijn has adopted a value-sensitive approach. In particular, she works towards intelligent agents that can interact with their users in value-conflicting situations when also meta-values no longer solve the situation. In Delft she works with an interdisciplinary team to create synergy between humans and technology by understanding, shaping and using fundamentals of intelligence and interaction. End 2007 her NWO-STW 1.5 M€ VICI project “Pocket Negotiator” has been awarded. In this project she develops intelligent decision support systems for negotiation. An experimental version of the Pocket Negotiator can be found at:[http://ii.tudelft.nl/negotiation/index.php/Pocket\\_Negotiator](http://ii.tudelft.nl/negotiation/index.php/Pocket_Negotiator).

**Abstract:** We present a dependency analysis and a categorization of future and existing economic decision support mechanisms for negotiation. Our survey suggests that active mechanisms would be more effective than passive ones, and that implicit mechanisms can shield the user from mathematical complexities. We discuss results of empirical studies of the effectiveness of the bidding support mechanisms of the Pocket Negotiator, an economic decision support system. Furthermore, we discuss the open challenges, and report about the community efforts as can be seen from the Annual Negotiating Agents Competition.

## Keynote Speech 4: Progress and Open Questions of Convolutional Neural Networks



*Prof. Milan Tuba,*

**Vice Rector for International Relations, Singidunum University, Serbia**

**Biography:** Milan Tuba is the Vice Rector for International Relations, Singidunum University, Belgrade, Serbia and was the Head of the Department for Mathematical Sciences at State University of Novi Pazar and the Dean of the Graduate School of Computer Science at John Naisbitt University. He is listed in the World's Top 2% Scientists by Stanford University in 2020 and 2021. Prof. Tuba is the author or co-author of more than 250 scientific papers (cited more than 5000 times, h-index 42) and editor, co-editor or member of the editorial board or scientific committee of number of scientific journals and conferences. He was invited and delivered around 60 keynote lectures at international conferences.

He received B. S. in Mathematics, M. S. in Mathematics, M. S. in Computer Science, M. Ph. in Computer Science, Ph. D. in Computer Science from University of Belgrade and New York University. From 1983 to 1994 he was in the U.S.A. first at Vanderbilt University in Nashville and Courant Institute of Mathematical Sciences, New York University and later as Assistant Professor of Electrical Engineering at Cooper Union School of Engineering, New York. During that time he was the founder and director of Microprocessor Lab and VLSI Lab, leader of the NSF scientific projects

and theses supervisor. From 1994 he was Assistant Professor of Computer Science and Director of Computer Center at University of Belgrade, from 2001 Associate Professor, Faculty of Mathematics, University of Belgrade, from 2004 also a Professor of Computer Science and Dean of the College of Computer Science, Megatrend University Belgrade. Prof. Tuba was the principal creator of the new curricula and programs at the Faculty of Mathematics and Computer Science at the University of Belgrade and later at John Naisbitt University where he was the founder and practically alone established a complete new school with bachelor, master and PhD program. He was teaching more than 20 graduate and undergraduate courses, from VLSI Design and Computer Architecture to Computer Networks, Operating Systems, Artificial Intelligence, Image Processing, Calculus and Queuing Theory.

His research interest includes nature-inspired optimizations applied to image processing, computer networks, and neural networks. Member of the ACM, IEEE, AMS, SIAM, IFNA, IASEI.

**Abstract:** Artificial intelligence and machine learning algorithms have become a core of numerous applications used in medicine, security, agriculture, astronomy, and many more. In general, these applications require a classification method, usually for the classification of digital images. In decades of intensive study of the classification problem, various classification methods were proposed and used. However, in recent years, the convolutional neural networks have proven to be a far better method for certain classification problems and have brought some revolutionary changes in certain areas. Convolutional neural networks (CNNs) are the type of deep artificial neural networks that manage to significantly improve classification accuracy, especially of digital images. Using, creating and training CNN is a relatively simple task due to the various available software tools, but the problem with CNNs is finding the optimal configuration and architecture. Designing and tuning CNN represents a very challenging problem that should be dealt with in order to achieve the best possible results. The optimal CNN's configuration depends on the considered problem and one CNN that is good for one problem is not necessarily good for others. Finding the optimal configuration is not a simple task since there are numerous hyperparameters such as the number, type and order of layers, number of neurons in each layer, kernel size, optimization algorithm, padding, stride, and many others, that should be fine-tuned for each classification problem. There is no unique efficient method for finding optimal values of CNNs' hyperparameters. A commonly used method for setting the CNN's configuration is to guess good starting values and estimate better values for the hyper-parameters (guestimating). This method is simple but not the most efficient. Since this is an optimization problem, some recent studies tested different optimization metaheuristics such as swarm intelligence algorithms. Usage of swarm intelligence algorithms for finding CNNs' configuration can be time consuming but the improvement of the classification accuracy is significant. In this talk, the advantages and challenges of finding the optimal CNN configuration will be presented.

# Part IV Poster Presentation

## Poster Presentation Preparation

- ✚ There is no size constraint for the e-poster, if you have difficulty to decide one, then A1 size (594mm×841mm) is recommended.
- ✚ Please send the poster at **.PDF** format. The Poster would be updated on the conference website after pre-review and confirmation.
- ✚ The Poster could design as you like with requirements as below:
  - ✧ The conference logo should be clearly shown in the header;
  - ✧ Title, presenter, and affiliation information should be well indicated;
- ✚ Signed and stamped electronic presentation certificate would be issued via e-mail after the conference.

## List of Posters

Please Click <http://www.academicconf.com/poster?confname=fsdm2022> to Access the Poster Presentations.

If you have any questions to ask the presenters, you can leave your questions at the webpage of related poster listed via the same link mentioned above. The presenters will answer your questions as soon as possible via the same webpages.

16:30-17:00, November 5, 2022 (Saturday) (GMT+8, Beijing Time)

<b>FSDM3892</b>	<a href="#">Improved Object Detection Method Based on Attention Mechanism</a> <i>Assoc. Prof. Jing Zhou, Jiangnan University, China</i>
<b>FSDM3980</b>	<a href="#">Construction and Validation of a CNV-Driven Ferroptosis-Related Gene Signature for Predicting the Prognosis of Lung Adenocarcinoma</a> <i>Dr. Yanqing Wang, Central Hospital of Guangdong Provincial Nongken, China</i>
<b>FSDM4015</b>	<a href="#">A Limit Theorem for Weighted Sums of Random Sets in Fuzzy Metric Space</a> <i>Assoc. Prof. Li Guan, Beijing University of Technology, China</i>
<b>FSDM4016</b>	<a href="#">Emotion-enhanced Multi-modal Persuasive Techniques Detection Using Split Features</a> <i>Mr. Taosong Fang, Dalian University of Technology, China</i>
<b>FSDM4023</b>	<a href="#">Reduced-order Observer Design for Singularly Perturbed Linear Systems</a> <i>Dr. Heonjong Yoo, Chonnam National University, South Korea</i>
<b>FSDM4024</b>	<a href="#">Precipitation Change Pattern Analysis in the US with Image Sequence and Decision Tree Methods</a> <i>Mr. Patrick Li, Basis Independent Silicon Valley, USA</i>
<b>FSDM4040</b>	<a href="#">Implicative Quasi-semi-lattices</a> <i>Ms. Xiaolei Zhu, University of Jinan, China</i>
<b>FSDM4052</b>	<a href="#">Efficiency and Precision Trade-offs in UAV Tracking with Filter Pruning and Dynamic Channel Weighting</a> <i>Prof. Shuiwang Li, Guilin University of Technology, China</i>
<b>FSDM4060</b>	<a href="#">On Convergence Theorems for Strong Fuzzy Variational Henstock Integrals</a> <i>Mr. Yang Li, Chongqing University of Posts and Telecommunications, China</i>
<b>FSDM4061</b>	<a href="#">Fuzzy Henstock-<math>\Delta</math>-Integral on Time Scales and Its Application</a>

	<i>Mr. Yubing Li, Chongqing University of Posts and Telecommunications, China</i>
<b>FSDM4062</b>	<a href="#">A Preliminary Study on Education and Teaching Based on the Concept of Metaverse—Take “Information Technology” as an Example</a> <i>Dr. Xiaoli Liu, Jinan University, China</i>
<b>FSDM4065</b>	<a href="#">Fast Attribute Reduction for Big Datasets Based on Neighborhood Rough Set</a> <i>Mr. Cheng Wang, Chongqing University of Posts and Telecommunications, China</i>

## Abstracts of Posters

**FSDM3892, FSDM4015, FSDM4016, FSDM4024, FSDM4040, FSDM4052, FSDM4060, FSDM4061, FSDM4062 and FSDM4065** To avoid repeatability issue, the abstracts will be available after the full papers are published in the conference proceedings.

### **FSDM3980 Construction and Validation of a CNV-Driven Ferroptosis-Related Gene Signature for Predicting the Prognosis of Lung Adenocarcinoma**

Yanqing Wang<sup>a</sup>, Yi Zhao<sup>b</sup>, Yong Li<sup>a</sup>, Zemin Luo<sup>a</sup> and Hongzhu Chen<sup>a</sup>

<sup>a</sup>*Integrated Chinese and Western Treatment of Oncology Department, Central Hospital of Guangdong Provincial Nongken, China*

<sup>b</sup>*Guangdong Ocean University, China*

**Abstract.** *Background.* Previous studies have shown that ferroptosis plays an integral role in the development of cancer and copy number variations (CNVs) have been reported to associated with the ferroptosis. However, the role of CNVs-driven ferroptosis-related genes (FRGs) in lung adenocarcinoma (LUAD) continues to be poorly understood. Therefore, we aimed to establish a novel gene signature in LUAD based on CNVs-driven ferroptosis-related genes. *Methods.* The transcriptome data and clinical features of LUAD patients were downloaded from the Gene Expression Omnibus (GEO) database and The Cancer Genome Atlas (TCGA) database. Differential analysis was carried out to recognize differentially expressed CNV-driven FRGs. Univariate Cox and least absolute shrinkage and selection operator (LASSO) regression analyses were utilized to identify prognosis-associated genes. Kaplan-Meier (K-M) analysis was a builder to estimate the worth of model. In addition, the nomogram was created to estimate survival probability of each patient. Ultimately, the immune microenvironment landscape between high and low risk groups was evaluated. *Results.* A total of 22 differentially expressed CNV-driven FRGs were acquired in LUAD. These genes were significantly associated with serine family amino acid metabolism, iron regulation, reactive oxygen species metabolism, and cellular response to oxidative stress, and were involved in amino acid metabolism, malaria, amino acid biosynthesis, and HIF-1 signaling pathways. Moreover, on the strength of 6 genes (TFAP2A, SLC2A1, AURKA, CDO1, SLC7A11, and ALOX5), the prognostic model was created, and the LUAD samples were significantly fall into the high- and low-risk groups, with the high-risk group had a poorer prognosis. Furthermore, risk score was an independent prognostic element. The nomogram with excellent predictive performance was developed for calculating the final result of LUAD patients at 1, 2, and 3 years. Finally, 19 immune cells had different infiltration differences among groups. *Conclusion.* A novel CNV-driven ferroptosis-related prognosis was established and could be used as a predictive indicator in LUAD. However, further clinical and in vivo in vitro experiments are necessary.



**Keywords:** cancer and copy number variations (CNVs), ferroptosis-related genes (FRGs), lung adenocarcinoma (LUAD)

### **FSDM4023 Reduced-order Observer Design for Singularly Perturbed Linear Systems**

Tean Chen<sup>a</sup>, Kyeonghwan Lee<sup>a,b,c</sup>, Heonjong Yoo<sup>b</sup>

<sup>a</sup> *Department of Convergence Biosystems Engineering, Chonnam National University, South Korea*

<sup>b</sup> *Agricultural Automation Research Center, Chonnam National University, South Korea*

<sup>c</sup> *BK21 Interdisciplinary Program in IT-Bio Convergence System, Chonnam National University, South Korea*

**Abstract.** We have designed slow and fast full-order observers and observer-based controllers by placing eigenvalues using the two-stage feedback design for slow and fast subproblems. The numerically ill-conditioning problem is avoided using the two-stage design method for singularly perturbed linear systems so that independent feedback controllers can be applied to each sub-system. We have demonstrated that the singularly perturbed system can be successfully controlled via the eigenvalue placement technique with the state feedback controllers and the full-order observers designed at the subsystem levels. The two-stage method is successfully implemented for both the full-order observer and corresponding controller designs. In this chapter, we will consider the problem studied in Chapter 3, but using the reduced-order observers. The reduced-order observer for singularly perturbed systems have been studied only in a few papers, all of them producing accuracy of  $O(\epsilon)$ . The approach presented in this chapter will produce  $O(\epsilon^k)$ ,  $k = 2, 3, \dots$  accuracy, which for large  $k$  practically mean the exact accuracy.

**Keywords:** singularly perturbed linear systems, reduced-order observer design, numerically ill-conditioning problem

# Part V Oral Presentation

## Oral Presentation Guidelines

- ✚ The oral presentations include the forms of pre-recorded video presentation and oral presentation on live via **Microsoft Teams (MS Teams) meeting**.
- ✚ For oral presentation on live, please refer to the official instructions on [how to share content via MS Teams](#) before the conference.
- ✚ The pre-recorded video should be uploaded to FSDM2022 online submission system **before October 15, 2022** in the format of **.mp4** and time duration should be 15-20 mins.
- ✚ Visit [Here](#) to know How to record a video with PowerPoint.
- ✚ The PPT either for pre-recorded video presentation or oral presentation on live could design as you like with requirements as below:
  - ✓ The conference logo should be added to each PPT slide
  - ✓ Title, presenter and affiliation information should be indicated in the first slide
  - ✓ Each slide should be concise, uncluttered and readable from a distance
  - ✓ Include only key words and phrases for visual reinforcement
- ✚ Signed and stamped electronic oral presentation certificate would be issued via e-mail after the conference.

## Best Oral Presentations Selection

Four best oral presentations will be selected by session chairs and conference committee.

### Selection Criteria

A best presentation will be selected based on the following items:

- ✓ Research Quality
- ✓ Presentation Performance
- ✓ Presentation Language
- ✓ PowerPoint Design

### Selection Procedure

- Each session will select one Best Oral Presentation, please ensure your Paper ID (FSDM\*\*\*\*) is shown correctly on the first or last page at your presentation data.
- The best presenter of each session will be awarded with free registration for the next FSDM conference.

## Best Oral Presentations Award

This award consists of a certificate and the privilege of free registration fee to attend FSDM2023.

## Oral Session 1: Fuzzy Theory, Algorithm and System

November 5, 2022 (Saturday) (GMT+8, Beijing Time)

Session Chair: Prof. Lanyong Zhang, Harbin Engineering University, China

Please Click <http://www.academicconf.com/teamslink?confname=fsdm2022> to enter the conference meeting room.

Please Click <http://www.academicconf.com/video?confname=fsdm2022> to Access the Video Presentations.

14:00-14:20	<b>FSDM4102</b> (invited) (live)	Bipolar Complex Fuzzy Sets and Their Applications in Cluster Analysis <i>Prof. Tahir Mahmood, International Islamic University Islamabad, Pakistan</i>
14:20-14:35	<b>FSDM4028</b> (live)	Optimization of Fuzzy System Inference Model on Mini Batch Gradient Descent <i>Assoc. Prof. Sugiyarto Surono, Universitas Ahmad Dahlan, Indonesia</i>
14:35-14:50	<b>FSDM3868</b> (live)	Solving Interval Investment Problem in Vague Environment Using Dynamic Programming Approach <i>Dr. Pavan Kumar, VIT Bhopal University, India</i>
14:50-15:05	<b>FSDM4067</b> (live)	Neuro-Fuzzy Employee Ranking System in the Public Sector <i>Mr. Christos Karras, University of Patras, Greece</i>
15:05-15:20		<b>BREAK</b>
15:20-15:35	<b>FSDM4003</b> (live)	On Separation Principle in Dynamic Output Controller Design for One Class of Takagi-Sugeno Fuzzy Systems <i>Prof. Dusan Krokavec, Technical University of Kosice, Slovakia</i>
15:35-15:50	<b>FSDM3961</b> (live)	A Study on Fuzzy Rule Hunting Strategy of Multiple Unmanned Vehicles Based on Improved Artificial Potential Field Method <i>Prof. Lanyong Zhang, Harbin Engineering University, China</i>
15:50-16:05	<b>FSDM4104</b> (video)	Theory and Applications of Smooth Fuzzy Systems <i>Dr. Ebrahim Navid Sadjadi, Universidad Carlos III de Madrid, Spain</i>
16:05-16:25	<b>FSDM4099</b> (invited) (live)	On Direct Product of Intuitionistic Fuzzy Normal Subrings <i>Prof. Ali Farajzadeh, Razi University, Iran</i>

## Abstracts of Oral Session 1

**FSDM3868, FSDM4003, FSDM4028 and FSDM4067** To avoid repeatability issue, the abstracts will be available after the full papers are published in the conference proceedings.

### **FSDM4102 Bipolar Complex Fuzzy Sets and Their Applications in Cluster Analysis**

Tahir Mahmood

*International Islamic University Islamabad, Pakistan*

**Abstract.** The notion of bipolar complex fuzzy sets has already been defined, but the predefined notion of bipolar complex fuzzy sets has some serious issues. In this talk after discussing the motivation and need of fuzzy sets and their generalizations, we will discuss the drawbacks of predefined notion of bipolar complex fuzzy sets and will initiate a novel approach towards bipolar complex fuzzy sets. We will also define some basic operational laws and some similarity measures for bipolar complex fuzzy sets. In the end we will discuss some cluster analysis problem by using the discussed methods in the environment of bipolar complex fuzzy sets.

**Keywords:** bipolar complex fuzzy sets, cluster analysis

### **FSDM3961 A Study on Fuzzy Rule Hunting Strategy of Multiple Unmanned Vehicles Based on Improved Artificial Potential Field Method**

Lanyong Zhang, Kun He and Yuru Tian

*College of Intelligent Systems Science and Engineering, Harbin Engineering University, China*

**Abstract.** A multiple unmanned vehicle hunting strategy based on the improved artificial potential field method is designed to solve the multiple unmanned vehicle cooperative hunting problem in complex environments. First, the decision layer is designed based on the fuzzy inference system to achieve the stage division and selection of corresponding strategies. Subsequently, the improved repulsive field function for variable safety distance is designed according to the relative velocity and angle between the unmanned vehicle and the obstacle, to achieve efficient obstacle avoidance of the unmanned vehicle during hunting. Then, a hunting strategy comprising consistent state, obstacle avoidance, and control costs is designed to obtain the time-optimal path of the unmanned vehicle and achieve fast target hunting by minimizing this cost function. Finally, the effectiveness of the designed hunting strategy is verified via simulations and experiments, and then compared with other hunting strategies. Accordingly, it is inferred that the hunting strategy designed in this study improves the efficiency of hunting by 16.3%, in addition to ensuring the obstacle avoidance effect.

**Keywords:** unmanned vehicle, fuzzy inference system, hunting strategy, artificial potential field, variable safety distance, efficient obstacle avoidance

### **FSDM4104 Theory and Applications of Smooth Fuzzy Systems**

Ebrahim Navid Sadjadi

*The Centre for Automation and Robotics (CAR) CSIC-UPM; Universidad Carlos III de Madrid, Spain*

**Abstract.** The main focus of the current work is on comprehensive study of the new achievements on the structural properties of fuzzy models with the smooth compositions and their applications. Although fuzzy models have been employed for a long time so far, however, the recent research in the fuzzy systems demonstrates that some kinds of fuzzy compositions can enlarge the design space into higher dimensions through the Fourier expansion of the membership functions. In particular, we would like to study the transient response of the smooth fuzzy systems as well as the steady state



performance and complement the time domain analysis with the analysis in the frequency domain. Besides, the robustness and the stability of the smooth fuzzy models will be discussed. We conclude the paper by presenting some applications and then challenges.

**Keywords:** fuzzy models, fuzzy systems

#### **FSDM4099 On Direct Product of Intuitionistic Fuzzy Normal Subrings**

Ali Farajzadeh

*Department of Mathematics, Razi University, Kermanshah, Iran*

**Abstract.** In this paper, the concept of intuitionistic fuzzy normal subrings over a non-associative ring is extended. It is shown that if  $X = A \times B$  and  $Y = C \times D$  be two LA-subrings of an LA-ring

$R_1 \times R_2$ , then  $X \cap Y$  is an LA-subring of an LA-ring  $R_1 \times R_2$  if and

only if the intuitionistic characteristic function  $\chi_Z = \langle \mu\chi_Z, \gamma\chi_Z \rangle$  of  $Z = X \cap Y$  is an intuitionistic fuzzy normal LA-subring of an LA-ring  $R_1 \times R_2$ . It is also proved that Let  $A_1, A_2, \dots, A_n$  be

LA-subrings of LA-rings  $R_1, R_2, \dots, R_n$ , respectively. Then  $A_1 \times A_2 \times \dots \times A_n$  is an LA-subring of an LA-ring  $R_1 \times R_2 \times \dots \times R_n$  if and only if the intuitionistic characteristic function  $\chi_A = \langle \mu\chi_A, \gamma\chi_A \rangle$  of  $A = A_1 \times A_2 \times \dots \times A_n$  is an intuitionistic fuzzy normal LA-subring of an LA-ring  $R_1 \times R_2 \times \dots \times R_n$ .

Finally, it will be proved the following fact:

Let  $A = A_1 \times A_2 \times \dots \times A_n$  and  $B = B_1 \times B_2 \times \dots \times B_n$  be intuitionistic fuzzy sets of LA-rings  $R = R_1 \times R_2 \times \dots \times R_n$  and  $R' = R'_1 \times R'_2 \times \dots \times R'_n$  with left identities  $e = (e_1, e_2, \dots, e_n)$  and  $e' = (e'_1, e'_2, \dots, e'_n)$ , respectively and  $A \times B$  is an intuitionistic fuzzy normal LA-subring of an LA-ring  $R \times R'$ . Then the following conditions are true.

(i) If  $\mu_A(x) \leq \mu_B(e')$  and  $\gamma_A(x) \geq \gamma_B(e')$ , for all  $x \in R$ , then  $A$  is an intuitionistic fuzzy normal LA-subring of  $R$ .

(ii) If  $\mu_B(x') \leq \mu_A(e)$  and  $\gamma_B(x') \geq \gamma_A(e)$ , for all  $x' \in R'$ , then  $B$  is an intuitionistic fuzzy normal LA-subring of  $R'$ .

**Keywords:** direct product of intuitionistic, fuzzy LA-subrings, direct product of intuitionistic, fuzzy normal LA-subrings

## Oral Session 2: Fuzzy Application

November 6, 2022 (Sunday) (GMT+8, Beijing Time)

Session Chair: Assoc. Prof. Abbas Khosravi, Deakin University, Australia

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09:00-09:20	<b>FSDM3861</b> (Invited) (live)	Uncertainty Quantification for Artificial Intelligence (UQ4AI): Why and How <i>Assoc. Prof. Abbas Khosravi, Deakin University, Australia</i>
09:20-09:35	<b>FSDM3953</b> (live)	Community Division Metric Based on Persistent Homology <i>Ms. Hui Zhong, Kunming University of Science and Technology, China</i>
09:35-09:50	<b>FSDM3897</b> (live)	Comparison and Combination of Leaky ReLU Activation Functions and Three Optimizers on Deep CNN for COVID-19 Detection <i>Mr. Almuzhidul Mujhid, University of Ahmad Dahlan, Indonesia</i>
09:50-10:05	<b>FSDM3974</b> (video)	Fractional Gradient Descent Learning of Backpropagation Artificial Neural Networks with Conformable Fractional Calculus <i>Dr. Basem Ajarmah, Al-Istiqlal University, Palestine</i>
10:05-10:20		<b>BREAK</b>
10:20-10:35	<b>FSDM4021</b> (video)	Accelerate the Convergence Speed of Perceptron Learning Algorithm with Weight <i>Dr. Liuyang Zhao, Bohai University, China</i>
10:35-10:50	<b>FSDM3898</b> (live)	Deep Visual Transformer Neural Network with Imbalanced Algorithms for Identifying Weeds in Tea Gardens Using Long-Tailed Image Datasets <i>Dr. Qijuan Gao, Anhui Agriculture University, China</i>
10:50-11:05	<b>FSDM4079</b> (live)	A Better Alternative to the Generalized Bilal Distribution: a New Model And Applications <i>Dr. Ayman Mohamed Abd-Elrahman, Assiut University, Egypt</i>
11:05-11:20	<b>FSDM3900</b> (live)	Two Stream Fused Fuzzy Deep Neural Network for Multi-agent Learning <i>Mr. Caiming Zheng, Hefei University of Technology, China</i>

## Abstracts of Oral Session 2

### **FSDM3861 Uncertainty Quantification for Artificial Intelligence (UQ4AI): Why and How**

Abbas Khosravi

*Institute for Intelligent Systems Research and Innovation, Deakin University, Waurn Ponds Campus, Australia*

**Abstract.** As artificial intelligence (AI) technologies translate into real-world decision tools, many experts are questioning how much subject matter experts could trust decisions and predictions generated by these systems. Trust is the key mechanism that shapes how experts use and adopt AI. Currently, the lack of trust in AI systems is a significant drawback in the adoption of this technology in safety-critical and health-related applications. Confidence of an AI model, in particular deep learning models, about its output has been always a critical point to its performance and reliability. How can one develop, for example, a neural network that knows when it does not know? Answering this type of questions is a prerequisite for widespread deployment of neural networks in safety critical applications. The field of AI-based uncertainty quantification has gained an overwhelming attention among researchers in recent years resulting in an arsenal of different methods. Several methods and frameworks have been proposed in literature to generate predictive uncertainty estimates using neural networks.

In this workshop, we will provide a comprehensive overview on recent advances on deep learning-based uncertainty quantification techniques. This will include ensemble, Bayesian, and direct methods for deep uncertainty quantification. Applications of these algorithms for developing uncertainty-aware decision-making tools will be then reviewed and discussed.

**Keywords:** uncertainty quantification, artificial intelligence, deep learning

### **FSDM3898 Deep Visual Transformer Neural Network with Imbalanced Algorithms for Identifying Weeds in Tea Gardens Using Long-Tailed Image Datasets**

Aibing Liu, Xiu Jin, Midi Wan, Qing Zou, Yi Song, Yeyun Li, Jingxu Zhang, Chongyue Wang, and Qijuan Gao

*Anhui Agriculture University, China*

**Abstract.** Weeding is a necessary step during the tea cultivation process, but there are many species of weeds in tea gardens. At present, the accuracy of weed identification models in tea gardens is generally not high, which is related to the fact that the number of collected weed images conforms to the distribution of long-tailed data, and the imbalanced algorithm is one of the effective ways to solve this problem. Thus, this paper constructs deep learning models with an imbalanced algorithm to classify weeds in several tea gardens. The classification performance of the Vision Transformer (ViT) and other models on 38 weed species was compared. The best classification accuracy of the ViT model was 92.19%. Furthermore, weed image datasets from natural environment collections tend to have long-tailed distributions because of high cost for collecting and screening images. This study evaluated the performance of the best model with three imbalanced algorithms. The trained ViT model with over-sampling achieved an accuracy of 97.31%, which is an increase of 5.12%. The over-sampling methods increase the accuracy of the model for most weed classes in long-tailed data. Specifically, the accuracy increased from about 60% to about 80% for five species of weeds (*Digitaria sanguinalis*, *Cynodon dactylon*, *Hemistepta lyrata*, *Cocculus orbiculatus*, and *Amaranthus retroflexus*). Therefore, this paper provides a solution to the problem of weed classification and identification in the natural tea garden environment and provides a theoretical basis for solving the long-tailed data problem.

**Keywords:** probabilistic model checking, inconsistency-tolerant model checking, hierarchical model checking, clinical reasoning verification

### **FSDM4079 A Better Alternative to the Generalized Bilal Distribution: a New Model And Applications**

Ayman Mohamed Abd-Elrahman

*Department of Mathematics, Faculty of Science, Assiut University, Egypt*

**Abstract.** In (2017) Abd-Elrahman, A. M., introduces a generalization of the Bilal distribution, where a new two-parameter distribution is presented (GBD). He shows that its failure rate function can be upside-down bathtub shaped. The failure rate can also be decreasing or increasing. But due to some mathematical and statistical reasons, which will be given below. In this paper, we introduce a simple and better alternative to the GBD, which will be denoted by (WMD). We show that The WMD is a two-parameter distribution which can fit five different types of data sets with respect to their empirical hazard rate functions. Most properties of The WMD are investigated. Point and interval estimation procedures for the two unknown parameters are presented. The existence and uniqueness of the maximum likelihood estimates are proved. The moment estimates are obtained; and one of these estimates is the minimum variance unbiased estimate (MVUE) for its corresponding parameter. A simulation study is provided; and the paper is motivated by applications to three different real data sets. Finally, some concluding remarks are presented.

**Keywords:** the generalized bilal distribution, fisher's information matrix, maximum likelihood estimators, minimum variance unbiased estimate, real data sets, lambert function, simulation

### **FSDM3900 Two Stream Fused Fuzzy Deep Neural Network for Multi-agent Learning**

Baofu Fang <sup>a,b</sup>, Caiming Zheng <sup>a,b</sup>, Hao Wang <sup>a,b</sup> and Tingting Yu <sup>a,b</sup>

<sup>a</sup> *Key Laboratory of Knowledge Engineering with Big Data, Ministry of Education, Hefei University of Technology, China*

<sup>b</sup> *Department of Computer Science and Technology, Hefei University of Technology, China*

**Abstract.** In multi-agent reinforcement learning, multilayer fully connected neural network (MLP) is used for value function approximation, which solves large-scale or continuous space problems. However, the MLP policy model tends to converge to local optimal policies, and the models are prone to overfitting. In this paper, a two-stream fused fuzzy deep neural network model is proposed for multi-agent learning, and fuzzy logic inference is introduced into deep neural networks for value function approximation. The proposed two-stream fused fuzzy deep neural network model is a parallel representation method that combines fuzzy logic inference and deep neural network. It obtains information from fuzzy logic inference and deep neural representation models, respectively, and fuses the representational knowledge learned by both models for value function approximation. Compared with the policy model with MLP, the proposed method can enhance the fitting generalization ability of the agent policy model, so that the multi-agent model can converge to a better cooperative policy. The generalization ability and effectiveness of the proposed method are verified in a variety of cooperative multi-agent environments, and the experimental results show that the proposed method is superior to the neural network representation method.

**Keywords:** multi-agent systems, value function approximation, fuzzy logic inference, deep reinforcement learning

**FSDM3953, FSDM3897, FSDM3974 and FSDM4021** To avoid repeatability issue, the abstracts will be available after the full papers are published in the conference proceedings.



## Oral Session 3: Data Mining, Machine Learning Related to AI

November 6, 2022 (Sunday) (GMT+8, Beijing Time)

Session Chair: Assoc. Prof. Konstantin Ryabinin, Perm State University, Russia

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14:00-14:15	<b>FSDM3997</b> (live)	Applied Decision Focused Learning: An End-To-End Decision System for Task Allocation <i>Mr. Chia E. Tungom, Onewo Space-Tech Service Co., Ltd.; Shenzhen University, China</i>
14:15-14:30	<b>FSDM4017</b> (live)	Data Visualization and Analysis with Machine Learning for the USA's COVID-19 Prediction <i>Dr. Connie Yuen, Hong Kong Shue Yan University, China</i>
14:30-14:45	<b>FSDM4068</b> (video)	Spatial Feature Evolutionary Relationship Discovery Based on Tree Structure Pattern Mining and Spatial Co-Location Pattern Mining in Spatial Cliques <i>Mr. Kaishuo Lin, Yunnan University, China</i>
14:45-15:00	<b>FSDM3966</b> (live)	Forecasting Tax Risk By Machine Learning: Case of Firms in Ho Chi Minh City <i>Assoc. Prof. Phong Anh Nguyen, University of Economics and Law; Vietnam National University, Vietnam</i>
15:00-15:15		<b>BREAK</b>
15:15-15:35	<b>FSDM4009</b> (Invited) (live)	Sustainable Smart Agriculture: Internet of Things (IoT) and AI-Enabled Technologies--Challenges, Potential Initiatives, and Future Trends <i>Prof. Tanzila Saba, King Abdulaziz University, Saudi Arabia</i>
15:35-15:55	<b>FSDM3851</b> (Invited) (live)	Ontology-Driven Visual Analytics Platform for Semantic Data Mining and Fuzzy Classification <i>Assoc. Prof. Konstantin Ryabinin, Perm State University, Russia</i>
15:55-16:15	<b>FSDM3877</b> (Invited) (live)	Global Optimization in Control Theory and Machine Learning <i>Dr. Dmitri E. Kvasov, University of Calabria, Italy</i>
16:15-16:35	<b>FSDM3856</b> (Invited) (live)	Networking Cognitive Security <i>Prof. Gianni D'Angelo, University of Salerno, Italy</i>
16:35-16:50	<b>FSDM4004</b> (live)	Automated Log Analysis and Anomaly Detection using Machine Learning <i>Mr. Ali Hussain Shah, University of Bradford, UK</i>

## Abstracts of Oral Session 3

**FSDM3851, FSDM3966, FSDM3997, FSDM4004, FSDM4017 and FSDM4068** To avoid repeatability issue, the abstracts will be available after the full papers are published in the conference proceedings.

### **FSDM4009 Sustainable Smart Agriculture: Internet of Things (IoT) and AI-Enabled Technologies--Challenges, Potential Initiatives, and Future Trends**

Tanzila Saba

*Artificial Intelligence & Data Analytics (AIDA) Lab, College of Computer and Information Sciences, Prince Sultan University, Saudi Arabia*

**Abstract.** With the rise of new technologies, such as the Internet of Things, raising the productivity of agricultural and farming activities is critical to improving yields and cost-effectiveness. IoT, in particular, can improve the efficiency of agriculture and farming processes by eliminating human intervention through automation. The fast rise of the Internet of Things (IoT)-based tools have changed nearly all life sectors, including business, agriculture, surveillance, etc. These radical developments are upending traditional agricultural practices and presenting new options in the face of various obstacles. IoT aids in collecting data that is useful in the farming sector, such as changes in climatic conditions, soil fertility, amount of water required for crops, irrigation, insect and pest detection, bug location disruption of creatures to the sphere, and horticulture. Furthermore, IoT enables farmers to effectively use technology to monitor their forms remotely round the clock. Several sensors, including distributed WSNs (wireless sensor networks), are utilized for agricultural inspection and control, which is very important due to their exact output and utilization. In addition, cameras are used to keep an eye on the field from afar. Moreover, the current rise in Artificial Intelligence enables farmers to deploy autonomous agricultural equipment and generate more accurate future forecasts based on present and historical circumstances to reduce crop illnesses and insect infestation. These two enabling technologies have together transformed traditional agricultural operations. The goal of this session is to evaluate smart agriculture using IoT approaches in depth. I will discuss the IoT applications, benefits, current obstacles, and solutions in smart agriculture. Additionally, a comprehensive analysis of the future technology and sociological potential of intelligent agricultural systems will be highlighted for adoption by farmers worldwide.

**Keywords:** Internet of Things (IoT), artificial intelligence, wireless sensor networks

### **FSDM3877 Global Optimization in Control Theory and Machine Learning**

Dmitri E. Kvasov

*University of Calabria, Italy*

**Abstract.** Many problems in the design of systems with parametric uncertainty can be formulated as global optimization problems. Parameters of such systems can be unknown or not uniquely defined, while their functional dependencies can be multiextremal and with no analytical representation (the so-called black-box problems). Due to the high computational cost involved in this decision-making process, the main goal is to develop efficient global optimization algorithms that produce reasonably good and guaranteed solutions with a limited budget of function evaluations. Derivative-free methods can be therefore particularly suitable for addressing these challenging global optimization problems and can be of a deterministic or stochastic (in particular, metaheuristic) nature. Some of the methods of these two groups are briefly surveyed and their application in the fields of control theory and machine learning is discussed.

**Keywords:** expensive global optimization, deterministic methods, metaheuristics, comparison, control theory, machine learning

### **FSDM3856 Networking Cognitive Security**

Gianni D'Angelo

*Department of Computer Sciences, University of Salerno, Italy*

**Abstract.** The talk addresses the changing world of security systems, and the possible approaches to their improvement through the usage of Artificial Intelligence and Machine Learning-based techniques. Although many security aspects are addressed, the talk will be focused on addressing networking security issues. The concept of "Networking Cognitive Security" is mainly explored from three different perspectives and implementation levels, namely:

- a) Network-level, by considering only data flowing in a network in order to perform Traffic Classification and Anomaly Detection;
- b) Application-level, by modeling the behavior of apps in order to detect suspect behaviors.
- c) Social-level, by modeling the behavior of entities involved in social communities in order to detect unfair users of social networks.

For each of these levels, theoretical aspects and implementation details will be shown. In particular, solutions based on Deep Neural Network architectures and ad-hoc intelligent algorithms will be shown.

Particular attention is given to the inner behavior of Deep Neural Networks. In this regard, a formal mathematical exploration of inner processes behind neural network architectures are shown in order to provide a useful understanding of how each neural component affects network performance. This allows improving the skill of a neural network designer to provide improvements in reliability and performance of security systems. These aspects are presented with reference to many security systems developed in our research group making use of Convolutional Neural Networks, Recurrent Neural Networks, Autoencoders, and their combinations as well as specific algorithms also based on evolutionary approaches to solve constrained optimization problems, and more.

**Keywords:** deep neural network, optimization

## Oral Session 4: Interdisciplinary Field of Fuzzy Logic and Data Mining

November 7, 2022 (Monday) (GMT+8, Beijing Time)

Session Chair: Assoc. Prof. Mohd Hanafi Ahmad Hijazi, Universiti Malaysia Sabah, Malaysia

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09:00-09:15	<b>FSDM3987</b> (live)	Lattice Linear Discriminant Analysis for Shape Constrained Classification <i>Dr. Geng Deng, Corporate Model Risk, Wells Fargo, USA</i>
09:15-09:35	<b>FSDM4055</b> (Invited) (live)	Presentation Attack Detection for Automatic Speaker Verification Systems: Trends and Potential Future Work <i>Assoc. Prof. Mohd Hanafi Ahmad Hijazi, Universiti Malaysia Sabah, Malaysia</i>
09:35-09:50	<b>FSDM3893</b> (live)	Credit Risk Assessment by A Comparison Application of Two Boosting Algorithms <i>Mr. Zhichao Si, University of Science and Technology Beijing, China</i>
09:50-10:05	<b>FSDM3999</b> (live)	An Accurate Cardinality Estimation Scheme for Cloned Tags under the Capture Effect <i>Ms. Tiancong Wang, Yangzhou University, China</i>
10:05-10:20		<b>BREAK</b>
10:20-10:35	<b>FSDM3947</b> (live)	A Neural Network Approach to Optimizing Treatments for Depression Using Data from Specialist and Community Psychiatric Services in Australia, New Zealand and Japan <i>Mr. Aidan Cousins, University of New South Wales, Australia</i>
10:35-10:50	<b>FSDM4020</b> (video)	Affective Analysis and Visualization from Posted Text, Replies, and Images for Analysis of Buzz Factors <i>Mr. Reishi Amitani, Tokushima University, Japan</i>
10:50-11:10	<b>FSDM4096</b> (Invited) (live)	Mathematical Modeling and Analysis for the Optimal Immunotherapeutic Treatment Strategy of Chronic Leukemia Cancer <i>Prof. Md. Haider Ali Biswas, Khulna University, Bangladesh</i>
11:10-11:25	<b>FSDM4014</b> (live)	Nowcasting Influenza-like Illness (ILI) via a Stacking-based Ensemble Approach <i>Dr. Yang Zhao, Sun Yat-sen University, China</i>

## Abstracts of Oral Session 4

### **FSDM4055 Presentation Attack Detection for Automatic Speaker Verification Systems: Trends and Potential Future Work**

Mohd Hanafi Ahmad Hijazi and Tan Choon Beng

*Data Technologies & Applications Research Group, Faculty of Computing and Informatics, Universiti Malaysia Sabah, Malaysia*

**Abstract.** The emergence of biometric technology provides greater security than the traditional identification and authentication techniques, which are less efficient and secure. However, the existing biometric systems such as Automatic Speaker Verification systems (ASV) are weak against presentation attack, a spoofing attack launched towards the speaker recognition system to gain access. There were numerous Presentation Attack Detection (PAD) systems reported in the literature, but lack of systematic survey available that describes the current state of research and application. This work presents a systematic analysis of state-of-the-art voice PAD systems to provide researchers with evidence to promote further advancement in this area. The objectives are two folds: (i) to understand the nature of recent work on PAD systems, and (ii) to identify areas that require additional research. As a result, a taxonomy of voice PAD and the trend analysis of recent work on PAD systems were built and presented, whereby the recent and relevant articles, mostly indexed by Scopus, published between 2015 and 2021 were considered. The findings of this survey present the limitation of recent works, which include spoof-type dependent PAD, and the future direction of work on voice PAD for interested researchers is established.

**Keywords:** speaker identification, speaker verification, anti-spoofing voice recognition, voice presentation attack detection

### **FSDM4096 Mathematical Modeling and Analysis for the Optimal Immunotherapeutic Treatment Strategy of Chronic Leukemia Cancer**

Md. Haider Ali Biswas

*Mathematics Discipline, Science Engineering and Technology School, Khulna University, Bangladesh*

**Abstract.** Chronic lymphocytic leukemia (CLL) is a type of slow growing cancer that affects developing B-lymphocytes (also known as B-cells) in the bone marrow. B-lymphocytes are specialized white blood cells in which the bone marrow makes too many lymphocytes and in case of CLL, lymphocytes undergo a malignant (cancerous) change and become leukemic cells. Among the non-communicable diseases, cancer is the most killer diseases and hence is a worldwide public health problem. It is the result of unconstrained growth of immature white blood cells in the blood. In this talk, we discuss a compartmental model of leukemia cancer in terms of a system of coupled nonlinear ordinary differential equations to describe the cell-cell interactions inside the body. We then introduce two control variables; namely,  $u_1$  (representing immune boosting drugs) as well as  $u_2$  (representing engineered T-cell therapy) as immunotherapeutic treatment strategies to apply optimal control technique in obtaining optimal strategies to minimize the number of infected cells in the blood. Initially, a mathematical model of leukemia is formulated and verified for the well posedness of the solution. We also verify the stability of the equilibria (disease-free and endemic equilibrium point) of the model based on the basic reproduction number. After words, in order to minimize the number of infected cells as well as the costs of the controls, we develop an appropriate optimal control model by applying Pontryagin's minimum principle. Finally, numerical simulation of



the proposed model and optimal control model are performed to show that the effectiveness of immune boosting drugs as well as immunotherapy to defend leukemia in the blood.

**Keywords:** compartmental model, CLL, Immunotherapeutic treatment, optimal control, Pontryagin's minimum principle, computational analysis

### **FSDM3947 Recent Advances in Protein Spatial Structure Prediction**

Aidan Cousins

*Faculty of Medicine and Health, Rural Clinical School, University of New South Wales, Australia*

**Abstract.** This study investigated the application of a recurrent neural network for optimising pharmacological treatment for depression. A clinical dataset of 458 participants from specialist and community psychiatric services in Australia, New Zealand and Japan were extracted from an existing custom-built, web-based tool called Psynary. This data, which included baseline and self-completed reviews, was used to train and refine a novel algorithm which was a fully connected network feature extractor and long short-term memory algorithm was firstly trained in isolation and then integrated and annealed using slow learning rates due to the low dimensionality of the data. The accuracy of predicting depression remission before processing patient review data was 49.8%. After processing only 2 reviews, the accuracy was 76.5%. When considering a change in medication, the precision of changing medications was 97.4% and the recall was 71.4%. The medications with predicted best results were antipsychotics (88%) and selective serotonin reuptake inhibitors (87.9%). This is the first study that has created an all-in-one algorithm for optimising treatments for all subtypes of depression. Reducing treatment optimisation time for patients suffering with depression may lead to earlier remission and hence reduce the high levels of disability associated with the condition. Furthermore, in a setting where mental health conditions are increasing strain on mental health services, the utilisation of web-based tools for remote monitoring and machine/deep learning algorithms may assist clinicians in both specialist and primary care in extending specialist mental healthcare to a larger patient community.

**Keywords:** depression, machine learning, deep learning, treatment optimisation, mental health, LSTM

**FSDM3893, FSDM3987, FSDM3999, FSDM4014 and FSDM4020** To avoid repeatability issue, the abstracts will be available after the full papers are published in the conference proceedings.

## **Part VI Acknowledgements**

On behalf of the FSDM2022 Organizing Committee, we would like to take this opportunity to express our sincere gratitude to our participants. Without their support and contributions, we would not be able to hold the conference successfully in this special year. We would also like to express our acknowledgements to the Technical Program Committee members who have given their professional guidance and valuable advice as reviewers.

Special Thanks go to the supports from College of Computer Science and Technology, Huaqiao University, China. In these uncertain times, their continuous support and valuable opinions help us to meet the challenges of organizing the conference in this moment and those yet to come.

Below are the lists of the Technical Program Committee members. For those who contribute to the success of the conference organization without listing the name here, we would love to say thanks as well.

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Prof. Jin Gou, Dean, College of Computer Science and Technology, Huaqiao University, China

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Mr. Hui Ying, Secretary of International Affairs, College of Computer Science and Technology, Huaqiao University, China

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Dr. Valentina E. Balas, Professor, Department of Automatics and Applied Software, Faculty of Engineering, “Aurel Vlaicu” University of Arad, Romania

## **C**

Dr. Chi-Hua Chen, Distinguished Professor, College of Computer and Data Science, Fuzhou University, China

Dr. Cheng Siong Chin, Reader (Associate Professor), Newcastle University, Singapore; Adjunct Full Professor, School of Automotive Engineering, Chongqing University, China

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