

March 10-12, 2023 | Stockholm, Sweden

ICMLT 2023

2023 8TH INTERNATIONAL CONFERENCE ON
MACHINE LEARNING TECHNOLOGIES

CCCE 2023

2023 3RD INTERNATIONAL CONFERENCE ON
COMPUTER AND COMMUNICATION ENGINEERING



Technical Supporter



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GENERAL INFORMATION

◆ Sweden Conference Venue

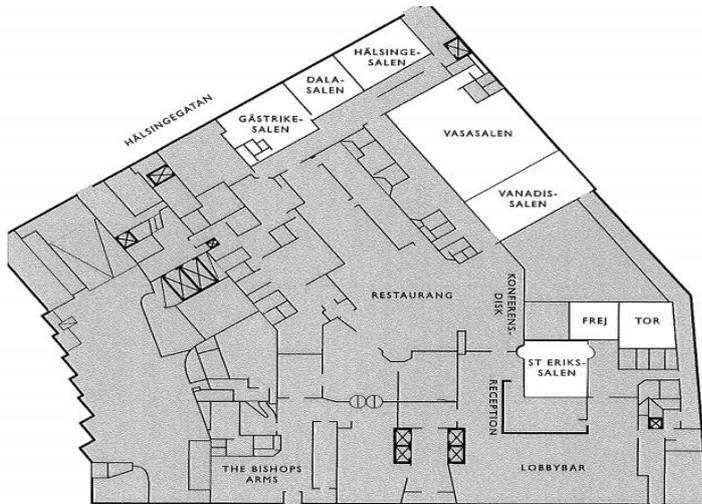


Elite Palace Hotel

Add.: Sankt Eriksgatan 115, 113 43 Stockholm

Official Website: Click [here](#)
 Email: info.palace@elite.se
 Tel.: +46 8-566 217 00

Floor Plan



◆ Onsite Registration

Go to the registration desk → Inform the staff of your paper ID → Sign-in → Claim your conference kit.

◆ Devices Provided by the Organizer

Laptops (with MS-Office & Adobe Reader) / Projectors & Screen / Laser Sticks

◆ Materials Provided by the Presenter

Oral Session: Slides (pptx or pdf version). Format 16:9 is preferred.

Official language: English.

◆ Duration of Each Presentation

Onsite/Online Oral Session: 12min for presentation, 3min for Q&A.

◆ NOTICE

※ Please wear your delegate badge (name tag) for all the conference activities. Lending your participant card to others is not allowed.

※ Please take good care of your valuables at any time during the conference. The conference organizer does not assume any responsibility for the loss of personal belongings of the participants during conference day.

◆ Zoom Meeting ID

	Room	Meeting ID	Meeting Link	✧ Zoom Download: here ✧ Guide for new users: here ✧ Conference Banner: here ✧ Zoom Background: here
	A	835 2704 0734	https://us02web.zoom.us/j/83527040734	
	B	849 2832 2994	https://us02web.zoom.us/j/84928322994	

Note:

We recommend that you install the Zoom platform on your computer before the conference starts. New users can participate in the Zoom meeting without registration.

WELCOME MESSAGE

We are pleased to welcome you to attend the 2023 8th International Conference on Machine Learning Technologies (ICMLT 2023), along with 2023 3rd International Conference on Computer and Communication Engineering (CCCE 2023), which will be held in Stockholm, Sweden during March 10-12, 2023.

This event will provide a unique opportunity for international scholars, researchers and practitioners working in a wide variety of scientific areas with a common interest in Machine Learning Technologies & Computer and Communication Engineering.

This year's conference will be composed of 3 onsite sessions and 4 online sessions, which cover a wide range of interesting topics include AI Technology and Application in Modern Information System, Model and Performance Analysis in Communication and Information Network, Machine Learning Model and Algorithm Optimization, Machine Learning Algorithm and Model Construction, Software and Information Security, Digital Image Imaging and Processing Technology & Wireless Communication and Signal Detection. In addition, 3 keynote speeches will be delivered by Prof. Nikola Kasabov (Auckland University of Technology, New Zealand), Prof. Angrisani Leopoldo (Università degli Studi di Napoli Federico II, Italy), Prof. Arumugam Nallanathan (Queen Mary University of London, UK).

On behalf of the organizing committee, we would like to deeply express our heartfelt appreciation to all our delegates, keynote speakers, session chairs, as well as all the committee members involved in the technical evaluation of conference papers and in the conference organization for your time, effort, and great contributions. Apart from that, we'd like to extend our thanks to all the authors and external reviewers for your contribution. It is your high competence, enthusiasm, valuable time and expertise that have enabled us to prepare the final program with high quality and make the conference a great success.

Finally, I wish to thank all attendees for participating in the conference and hope you have a fruitful and memorable experience at ICMLT 2023 & CCCE 2023!

Last but not least, take care and stay healthy!

With Warmest Regards,

Conference Organizing Committee

ICMLT & CCCE 2023

Contact

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CONFERENCE COMMITTEE 2023

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Emanuela Marasco, George Mason University, USA
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Yagya Raj Pandeya, Jeonbuk National University, South Korea
Rayan Abri, Mavinci Informatics Inc., Turkey
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Haya Abdullah Alhakbani, Imam Mohammad Ibn Saud Islamic University, Saudi Arabia
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Petr Hajek, Academy of Sciences of the Czech Republic, Czech Republic
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N S Rahgava, Delhi Technological University, India
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Shashi Mehrotra, KL University, India
Mayukha Pal, University of Hyderabad Campus, India
Nitikarn Nimsuk, Thammasat University, Thailand
Manoj Gupta, JECRC University, India
Yew Kee Wong, BASIS International School Guangzhou, China
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Mayukha Pal, University of Hyderabad Campus, India
Parameshachari B D, GSSS Institute of Engineering and Technology for Women, India

AGENDA OVERVIEW

Onsite: Venue in Sweden: Elite Palace Hotel
Online: Zoom Meeting ID: Room A: 835 2704 0734 Link: https://us02web.zoom.us/j/83527040734
Room B: 849 2832 2994 Link: https://us02web.zoom.us/j/84928322994

March 10 Friday (UTC+1)									
Online Pre-test Session in Zoom					Zoom Room A: 835 2704 0734				
Zoom Test Timetable									
09:00-09:30		09:30-10:00		10:00-10:30		10:30-11:00		11:00-11:30	
ML029	ML0004	ML005	ML002	ML0006	ML0024	ML0026	ML003-A	Alternative time for participants who are unavailable at allocated time. Other online participants, includes but not limited to keynote speaker, session chair, committee member, listener.	
ML0018	ML027	ML022	ML032	ML041	ML0017	ML012	ML046-A		
ML060	ML019	ML035	ML056	ML042	ML050	ML1003	ML0022		
ML0029	ML1010	ML1008	ML034	ML013	ML025	ML10002	ML030		
ML1001		ML037		ML057		ML039			

- ✧ Participants who are going to do an online presentation are required to join the rehearsal in Zoom on Friday, March 10, 2023. Duration: 3min apiece. Feel free to leave after you finish the test.
- ✧ We will test control panel including screen sharing, audio, video and "Raise Hand" feature, etc. Please get your presentation slides and computer equipment prepared beforehand.

March 11 Saturday (UTC+1)		
08:00-09:00	Onsite Registration & Conference Kits Collection	Gästrike, Entrance Floor & Room A: 835 2704 0734
Keynote & Invited Speech (Onsite & Online)		
Chairman: Prof. Jianhua Zhang, Oslo Metropolitan University, Norway		
09:00-09:10	Opening Remarks: Prof. Ning Xiong, Mälardalen University, Sweden	
09:10-09:50	Keynote Speech I: Brain-inspired Machine learning Technologies Prof. Nikola Kasabov (Life Fellow of IEEE), <i>Auckland University of Technology, New Zealand</i>	
09:50-10:30	Keynote Speech II: Measurement Sustainability: A Sound Enabler for Green AI? Prof. Angrisani Leopoldo (Life Fellow of IEEE), <i>Università degli Studi di Napoli Federico II, Italy</i>	
10:30-11:00	Group Photo & Coffee Break < Restaurang, Entrance Floor >	
11:00-11:40	Keynote Speech III: Machine Learning in Massive Ultra-Reliable Low Latency Connectivity (mURLLC) in 6G Prof. Arumugam Nallanathan (Life Fellow of IEEE), <i>Queen Mary University of London, UK</i>	
11:40-12:10	Invited Speech: <i>TBA</i>	
12:10-13:30	Lunch Time < Restaurang, Entrance Floor >	
Onsite Session in Sweden		
13:30-15:30	< Gästrike, Entrance Floor >	< Hälsinge, Entrance Floor >
	Onsite Session 1: AI Technology and Application in Modern Information System Chairperson: ML009 ML011 ML014 ML015 ML026 ML045 ML049 ML016	Onsite Session 2: Model and Performance Analysis in Communication and Information Network Chairperson: ML0011 ML1007 ML0014 ML058-A ML0015 ML024 ML0010
15:30-16:00	Coffee Break < Restaurang, Entrance Floor >	

<p>16:00-19:00</p>	<p>Onsite Session 3: Machine Learning Model and Algorithm Optimization Chairperson: ML0008 ML006 ML008 ML010 ML033 ML043 ML1004-A ML1012 ML0028 ML007 ML048</p>	 
<p>18:35-20:00</p>	<p>Dinner Time < BISHOP ARMS, BAR 115, Entrance Floor ></p>	
<p>March 11 Saturday (UTC+1)</p>		
<p>Online Session in ZOOM</p>		
<p>13:30-15:45</p>	<p>Zoom Room A: 835 2704 0734 Online Session 1: Software and Information Security Chairperson: ML029 ML0004 ML0018 ML027 ML060 ML019 ML0029</p>	<p>Zoom Room B: 849 2832 2994 Online Session 2: Wireless Communication and Signal Detection Chairperson: ML005 ML002 ML022 ML032 ML035 ML056 ML1008 ML034 ML037</p>
<p>15:45-16:00</p>	<p>Break Time</p>	
<p>16:00-18:30</p>	<p>Online Session 3: Machine Learning Algorithm and Model Construction Chairperson: ML0006 ML0024 ML041 ML0017 ML042 ML050 ML013 ML025 ML057 ML1001</p>	<p>Online Session 4: Digital Image Imaging and Processing Technology Chairperson: ML0026 ML003-A ML012 ML046-A ML1003 ML0022 ML10002 ML030 ML039 ML1010</p>

Note

- *Zoom Meeting online conference room will be open 30 mins before scheduled time. Please enter your room 10-15 minutes early.
- *All online attendees are required to join the pre-test on Friday, March 10. Start from 9:00.
- *A paper not presented or presented by a non-author without prior written approval by the Conference TPC will be removed from the final conference proceedings.

INTRODUCTION OF SPEAKERS

09:10-09:50 Mar. 11 (Sat.) | Sweden Time (UTC+1)
Meeting Room: Gästrike, Entrance Floor
Zoom Room A: 835 2704 0734



Prof. Nikola Kasabov

Life Fellow of IEEE

Auckland University of Technology, New Zealand

Nikola Kasabov is Life Fellow of IEEE, Fellow of the Royal Society of New Zealand, Fellow of the INNS College of Fellows, DVF of the Royal Academy of Engineering UK. He is the Founding Director of the Knowledge Engineering and Discovery Research Institute (KEDRI), Auckland and Professor at the School of Engineering, Computing and Mathematical Sciences at Auckland University of Technology, New Zealand. He is also George Moore Chair Professor of Data Analytics at the University of Ulster UK, Honorary Professor at the Teesside University UK and the University of Auckland NZ, Visiting Professor at the IIKT Bulgarian Academy of Sciences. Kasabov is Past President of the Asia Pacific Neural Network Society (APNNS) and the International Neural Network Society (INNS). He has been a chair and a member of several technical committees of IEEE Computational Intelligence Society and Distinguished Lecturer of IEEE (2012-2014). He is Editor of Springer Handbook of Bio-Neuroinformatics, EIC of Springer Series of Bio-and Neuro-systems and co-EIC of the Springer journal Evolving Systems. He is Associate Editor of several journals, including Neural Networks, IEEE TrNN, Tr CDS, Information Sciences, Applied Soft Computing. Kasabov holds MSc and PhD from TU Sofia, Bulgaria. His main research interests are in the areas of neural networks, intelligent information systems, soft computing, bioinformatics, neuroinformatics. He has published more than 680 publications, highly cited internationally. He has extensive academic experience at various academic and research organisations in Europe and Asia, including: TU Sofia Bulgaria; University of Essex UK; University of Otago, NZ; Advisory Professor at Shanghai Jiao Tong University and CASIA China, Visiting Professor at ETH/University of Zurich and Robert Gordon University UK, Visiting Scholar University of Dalian, China. Kasabov has received a number of awards, among them: Doctor Honoris Causa from Obuda University, Budapest; INNS Ada Lovelace Meritorious Service Award; NN Best Paper Award for 2016; APNNA 'Outstanding Achievements Award'; INNS Gabor Award for 'Outstanding contributions to engineering applications of neural networks'; EU Marie Curie Fellowship; Bayer Science Innovation Award; APNNA Excellent Service Award; RSNZ Science and Technology Medal; 2015 AUT Medal; Honorable Member of the Bulgarian, the Greek and the Scottish Societies for Computer Science. More information of Prof. Kasabov can be found from: <https://academics.aut.ac.nz/nkasabov>.

Speech Title: Brain-inspired Machine Learning Technologies

Abstract: The talk discusses briefly current challenges in machine learning (ML), including: efficient learning of data (interactive, adaptive, life-long; transfer); interpretability and explainability; personalised predictive modelling and profiling; multiple modality of data (e.g. genetic, clinical, behaviour, cognitive, static, temporal, longitudinal); computational complexity; energy consumption; human-machine interaction. Opportunities to address these challenges are presented through advancement in Neuroinformatics, Neural networks and Neurocomputers (the 3N). Neuroinformatics offer a tremendous amount of data and knowledge about how the human brain and the nervous system learn. Many brain information processing principles can be now implemented in novel Neural network computational models. The latter ones have inspired the development of neuromorphic hardware chips and Neurocomputers, characterised by much low power consumption, massive parallelism and fast processing. The talk presents also the main principles of evolving connections systems (ECOS) [1,2] and spiking neural networks (SNN) [3,4] along with a brain-inspired ML architecture based on SNN, NeuCube to address the above ML challenges. NeuCube is first used for brain data modelling and then

developed as a generic spatiotemporal ML machine and an open source development environment for a wide scope of applications. Some experimental results include: modelling EEG, fMRI and other multimodal brain data; predicting AD; predicting response to treatment; early diagnosis of psychosis; personalised prediction of stroke; brain-computer interfaces; on-line learning of multisensory data for pollution and earthquake prediction; integrating financial time series and on-line news; and other. In future, a fast development of novel Neural network ML models for the now available massively parallel and low power consuming Neurocomputers is expected, along with successful applications in Neuroinformatics, and in all areas of ML to overcome the current challenges in in ML. And this is the future trend in ML after the current deep neural network technologies.

[1] N.Kasabov, *Evolving Connectionist Systems*, Springer, 2007

[2] NeuCom: <https://theneucom.com>

[3] N.Kasabov, *Time-Space, Spiking Neural Networks and Brain-Inspired Artificial Intelligence*, Springer, 2019, <https://www.springer.com/gp/book/9783662577134>.

[4] NeuCube: <https://kedri.aut.ac.nz/neucube>

09:50-10:30 Mar. 11 (Sat.) | Sweden Time (UTC+1)
Meeting Room: Gästrike, Entrance Floor
Zoom Room A: 835 2704 0734



Prof. Angrisani Leopoldo

Life Fellow of IEEE

Università degli Studi di Napoli Federico II, Italy

Angrisani Leopoldo is full professor of Electrical and Electronic Measurements with the Department of Information Technology and Electrical Engineering of the University of Naples Federico II, Italy. He is also General Manager/Director of CeSMA – Center of Advanced Measurement and Technology Services and member of the Board of the Ph.D. Program on Information Technology and Electrical Engineering of University of Naples Federico II. His research activity is currently focused on communication systems and networks test and measurement; measurements for Internet of Things applications; compressive sampling based measurements; measurements for Industry 4.0; measurement uncertainty. He was and is currently involved in many industrial research projects, in cooperation with small, medium and great enterprises, for which he played and is currently playing the role of scientific coordinator. He is currently playing a relevant role in designing and developing the strategic pillars on which the national Competence Center on Industry 4.0, MedITech, led by Federico II University and geographically located in the South of Italy, is going to be based. He is Fellow Member of the IEEE Instrumentation and Measurement and Communications Societies, Chair of the IEEE Instrumentation & Measurement Society Italy Chapter, Honorary Chairman of the first edition (M&N 2019) of the IEEE International Symposium on Measurements & Networking 2019, General Chairman of the second edition (MetroInd4.0&IoT 2019) of the IEEE International Workshop on Metrology for Industry 4.0 and IoT 2019. He was one of the promoters of the TC-37 "Measurements and Networking" technical committee of the IEEE Instrumentation & Measurement Society and General Chairman of the first (M&N2011), second (M&N2013), third (M&N2015) and fourth edition (M&N2017) of the IEEE International Workshop on Measurements & Networking. He is Representative of Italy in the IEC Validation Team-VT 60050 for maintenance and management of the International Electrotechnical Vocabulary and member of the Italian Association "GMEE-Electrical and Electronic Measurements Group", of CNIT, National Inter-university Consortium for Telecommunications, of the Technical Committee CT 1/25 "Terminology, Quantities and Units" of CEI (Italian Electrotechnical Committee). He is corresponding member of the Accademia Pontaniana in Naples, the oldest Italian academy, with almost 600 years of history, which has always brought together renowned Neapolitan scholars. In 2009, he was awarded the IET Communications Premium for the paper entitled "Performance measurement of IEEE 802.11b-based networks affected by narrowband interference through cross-layer measurements" (published in IET Communications, vol. 2, No. 1, January 2008). The IEEE Instrumentation & Measurement Society Italy Chapter, which he has been chairing since 2015, was awarded in 2016 the prestigious recognition "I&M Society Best Chapter Award" by the IEEE Instrumentation & Measurement Society, in 2017 the prestigious recognition "Most Improved Membership Chapter for 2016" by the IEEE Italy Section, in 2018 the prestigious recognition "Most Innovative Chapter 2018" by the IEEE Italy Section, and in 2021 the prestigious recognition "Chapter of the Year 2021" by the IEEE Region 8 (Europe, Middle Est, Africa). In 2021, he was awarded the prestigious recognition "2021 IEEE Instrumentation and Measurement Society Technical Award" with the following citation "For contributions in the advancement of innovative methods and techniques for communication systems test and measurement".

Speech Title: Measurement Sustainability: A Sound Enabler for Green AI?

Abstract: Nowadays, the concept of Sustainability is gaining significant relevance in every human activity. Hence, it should come as no surprise the growing attention dedicated to this matter by information and communication technologies (ICTs). ICTs have a two-fold effect on sustainability. They are fundamental tools for developing and implementing more sustainable processes and products; nevertheless, the very use of ICTs has its own environmental impact. Measurement systems are relevant manifestations of ICTs. Hence, it is extremely important to address the sustainability of measurements and their impact on the environment. In turn, it is also necessary to develop new measurement models that can contribute to a robust assessment of sustainability. Starting from these considerations, in the talk, an innovative methodological approach aimed at modeling and evaluating the sustainability of ICT manifestations will be presented, with special regard to electronic measurement systems and their evolution towards Cyber-physical Measurement Systems (CPMSs), which holistically integrate measurement solutions with Artificial Intelligence (AI) ones. Assessing the sustainability of CPMS makes it unavoidable to evaluate the environmental impact of AI-based solutions,

due, for example, to the effort required to build large data sets, software libraries, and to train AI models. However, in the literature, there is a lack of systematic studies estimating how much these “actions” can be considered green. To start bridging this gap, the final part of the presentation will open the discussion on whether the methodology proposed for evaluating the sustainability of measurement systems can also be applied to AI, paving the way for raising two main questions: is it possible to measure how green AI is? Is it possible to make AI greener?

11:00-11:40 Mar. 11 (Sat.) | Sweden Time (UTC+1)
Meeting Room: Gästrike, Entrance Floor
Zoom Room A: 835 2704 0734



Prof. Arumugam Nallanathan

Fellow of the IEEE

Queen Mary University of London, UK

Arumugam Nallanathan is professor of Wireless Communications and the founding head of the Communication Systems Research (CSR) group in the School of Electronic Engineering and Computer Science at Queen Mary University of London since September 2017. He was with the Department of Informatics at King's College London from December 2007 to August 2017, where he was Professor of Wireless Communications from April 2013 to August 2017. He was an Assistant Professor in the Department of Electrical and Computer Engineering, National University of Singapore from August 2000 to December 2007. His research interests include 6G Wireless Networks and Internet of Things (IoT). He published nearly 600 technical papers in scientific journals and international conferences. He is a co-recipient of the Best Paper Awards presented at the IEEE International Conference on Communications 2016 (ICC'2016), IEEE Global Communications Conference 2017 (GLOBECOM'2017) and IEEE Vehicular Technology Conference 2017 (VTC'2017). He is a co-recipient of IEEE Communications Society Leonard G. Abraham Prize, 2022. He is an Editor-at-Large for IEEE Transactions on Communications and a senior editor for IEEE Wireless Communications Letters. He was an Editor for IEEE Transactions on Wireless Communications (2006- 2011), IEEE Transactions on Vehicular Technology (2006-2017), IEEE Signal Processing Letters and a Guest Editor for IEEE Journal on Selected Areas in Communications (JSAC). He served as the Chair for the Signal Processing and Computing for Communications (SPCC-TC) of IEEE Communications Society and Technical Program Chair and member of Technical Program Committees in numerous IEEE conferences. He received the IEEE Communications Society SPCE outstanding service award 2012 and IEEE Communications Society RCC outstanding service award 2014. He has been selected as a Web of Science (ISI) Highly Cited Researcher in 2016 and 2022. He is an IEEE Fellow and IEEE Distinguished Lecturer.

Speech Title: Machine Learning in Massive Ultra-Reliable Low Latency Connectivity (mURLLC) in 6G

Abstract: Massive Ultra-Reliable and Low-Latency Communications (mURLLC), which integrates URLLC with massive access, is emerging as a new and important service class in the next generation (6G) for time-sensitive traffics and has recently received tremendous research attention. However, realizing efficient, delay-bounded, and reliable communications for a massive number of user equipments (UEs) in mURLLC, is extremely challenging as it needs to simultaneously take into account the latency, reliability, and massive access requirements. To support these requirements, the third generation partnership project (3GPP) has introduced enhanced grant-free (GF) transmission in the uplink (UL), with multiple active configured-grants (CGs) for URLLC UEs. With multiple CGs (MCG) for UL, UE can choose any of these grants as soon as the data arrives, while with single CG (SCG), UE need to wait for the CG period to transmit the packet. In addition, non-orthogonal multiple access (NOMA) has been proposed to synergize with GF transmission to mitigate the serious transmission delay and network congestion problems. However, in the GF-NOMA scheme, the data is transmitted along with the pilot randomly, which is unknown at the BS and can lead to new research problems. In this talk, Machine Learning (ML) approaches in mURLLC systems will be presented. Promising research directions and possible ML solutions will also be discussed.

PARALLEL SESSION

Mar. 11 (Sat.) 13:30-15:30

< Gästrike, Entrance Floor | Elite Palace Hotel >

Onsite Session 1: AI Technology and Application in Modern Information System

Session Chair:

Time & Paper ID	Speech Title & Presenter
13:30-13:45 ML009	<p>Remaining Cycle Time Prediction with Graph Neural Networks for Predictive Process Monitoring</p> <p>Le Toan Duong, LAAS-CNRS, Université de Toulouse, France</p> <p>Abstract—Predictive process monitoring is at the intersection of machine learning and process mining. This subfield of process mining leverages historical data generated from process executions to make predictions about the ongoing process. One of the predictive process monitoring tasks with high interest is predicting the remaining cycle time of process instances. Recently, deep neural networks, particularly long short-term memory, have attracted much attention due to their ability to learn relevant features automatically and predict with high accuracy. While these models require data defined in the Euclidean space, graph neural networks have the advantage of handling data that can be represented as graphs. This paper proposes the use of graph neural network models to predict the remaining cycle time, which has not yet been studied in the literature. The proposed models are evaluated on real-life event logs and compared to a state-of-the-art long short-term memory model. The results show that graph neural network models can improve prediction accuracy, particularly for complex processes.</p>
13:45-14:00 ML011	<p>Deep Learning-Based Cone Angle Estimation Using Spray Sequence Images</p> <p>Fran Huzjan, University of Zagreb, Croatia</p> <p>Abstract—Engine efficiency, combustion process, and gas emissions are greatly affected by spray strategies. Spray strategies are utilized in engines with internal combustion. Spray strategies are determined by parameters such as nozzle diameter, injection pressure, chamber pressure, cylinder type, and others. These parameters determine spray shape. Spray shape is established by three main spray macroscopic parameters which are cone angle, penetration length, and spray area. Spray cone angle, with other spray macroscopic parameters, is often used to describe the parameters of numerical simulations. In this paper, we propose two new methods for the estimation of spray cone angle which affects the air engulfing and mixing process. Spray images gathered during a single spray injection are highly correlated. To use this fact to our advantage we proposed two deep learning-based methods that use image sequence as input. StackNet is a regression neural network that stacks images and uses them as input. It also uses a feature extractor and a fully connected layer. CNN-LSTM is another regression neural network with a feature extractor, but it utilizes Long Short-Term Memory (LSTM) cells before a fully connected layer. Both of the methods were trained, validated, and tested on preprocessed sequence images. To achieve better generalization and more data diversity, data augmentation was used. Three state-of-the-art feature extractors were tested, VGG16, MobileNetV3, and EfficientNetB0. The proposed methods were compared with the baseline approach which uses a single image as an input. Experimental validation showed that StackNet with VGG as a feature extractor achieved the best result. The proposed method estimated cone angle with a mean absolute error of 0.505 degrees, which is more than two times more accurate than the best baseline approach.</p>
14:00-14:15 ML014	<p>The Role of Artificial Intelligence for The Architectural Plan Design: Automation in Decision-making</p> <p>Tuğçe Çelik, Ostim Technical University, Ankara, Turkey</p> <p>Abstract—Increasingly more pervasive of using of artificial intelligence within the complexity of the world around us continues to fuel the scientific, art and design debate. Although still in an embryonic phase, even within the architecture sector, it is possible to observe the first concrete results of the application of new digital processes</p>

	<p>which are more and more autonomous and support the design, definition, and validation of the project. The new frontiers of expansion of artificial intelligence systems, encouraged by the digital transition, require a careful reflection on the impact of new technologies in redefining the designer's role in the decision-making process. Even if a full design action cannot be mentioned yet, it is predicted that artificial intelligence can develop into an algorithm that can learn the design action with new algorithms and new hardware in the future. In parallel with the development of artificial intelligence and technologies, the discipline of architecture will constantly transform and develop.</p>
<p>14:15-14:30 ML015</p>	<p>Performance Comparison of Novel Object Detection Models on Traffic Data Goran Oreski & Lucia Varesko, University of Juraj Dobrila Pula, Croatia</p> <p>Abstract—This research evaluated the performance of 14 novel object detection models on a traffic dataset to reveal significant differences between the selected models. The goal was to generate recommendations for best-performing models for researchers coming into the domain. The performance is evaluated with respect to the size of objects, inference time, and the number of learnable parameters. The results show that even though several models have similar performance on the entire dataset, their performance on small and large objects can significantly differ. Also, the difference in inference time is significant and could influence the choice of a suitable model. The paper's conclusion emphasizes the best-performing models based on their performance strengths.</p>
<p>14:30-14:45 ML026</p>	<p>The Effect of Target Variable Rescaling on Energy Consumption Prediction in a Vehicle Powertrain using Multi-Target Regression Trees Mueller, Julian, Mercedes-Benz AG, Germany</p> <p>Abstract—Data preprocessing is a crucial step in every data science project. In many real-world use cases, it is practical for efficiency reasons to combine multiple numeric target variables into one model whenever the input features are the same. However, the characteristics of the target variables can be different and can influence the overall model performance negatively which is why scaling is a common method used to reduce such variability. In this work, we first prove that target variable scaling has an effect on the splitting behavior of regression trees. We apply the findings to a real-world data science project from the automotive industry aiming at predicting energy consumption in networked electronic components of passenger cars. We do result assessment with the help of key performance indicators (KPIs). The results show that in practice multi-target regression problems can reduce training cost and time as well as model size with a negligible loss in model accuracy. The selection of the right scaling method in multi-target regression trees has also the potential to improve overall weighed project-relevant KPIs.</p>
<p>14:45-15:00 ML045</p>	<p>Automatic Analogue Gauge Reading Using Smartphones for Industrial Scenarios Maria Vasconcelos, Fraunhofer Portugal AICOS, Portugal</p> <p>Abstract—Several maintenance tasks in industrial sectors involve dealing with analogue devices, often performed manually by a worker, leaving no evidence of the task being done and prone to human error. A typical device found in this environment is the analogue gauge. This work proposes a methodology to read analogue gauges automatically in real-time for industrial scenario applications. It first uses traditional computer vision techniques to detect the circular gauge followed by a keypoint detector approach to extract the gauge value. Three datasets, one public and two private, were used to develop and test the algorithms. Gauge detection achieved 89.13% F1-score and gauge reading achieved a return rate of 64.55%, mean error angle of 4.11 degrees and mean relative error of 0.0131 in test images, with the results being comparable with state of the art.</p>
<p>15:00-15:15 ML049</p>	<p>Reinforcement Learning to Improve Color Adjustments in the Ceramic Industry Ana C. Morgado, Fraunhofer Portugal AICOS, Portugal</p> <p>Abstract—The ceramic industry is a highly competitive millenary sector with a substantial economic impact in several countries translated into a high global volume business, especially in exports. Reliability in the color development process is critical, ensuring that the produced pieces achieve the defined requirements. Nevertheless, current strategies for color formulation or adjustment are quite manual and subjective,</p>

	<p>essentially based on a trial-error process. These conventional procedures lead to the development of unnecessary pieces until the target color is achieved, which translates into a waste of raw materials and working time. In this paper, we present an automated approach based on Reinforcement Learning (RL) to improve color adjustments in the ceramic industry. By using the spectral data of the available components (pigments and glazes), the proposed algorithm provides the best formula to achieve the target color, i.e. the list of components for the mixture and corresponding quantities. Two datasets were used: the NTU Watercolor Pigments Spectral Measurement dataset; and the Matcerâmica Ceramics Spectral Measurement dataset. Three RL algorithms were trained and compared for benchmarking purposes: Deep Q-learning. (DQN), Advantage Actor-Critic (A2C) and Continual RL Without Conflict (OWL). The A2C and OWL models obtained similar performances for the NTU dataset with a mean ΔE^*_{ab} of 0.668 and 0.733, respectively. For the Matcerâmica dataset, OWL yielded better results with a mean ΔE^*_{ab} of 3.258. These results demonstrate the potential of the proposed approach to be integrated into an AI-powered software solution that optimizes the iterative process of color(re)creation in ceramic glazes.</p>
<p>15:15-15:30 ML016</p>	<p>Integration of Vision IoT, AI-based OCR and Blockchain Ledger for Immutable Tracking of Vehicle's Departure and Arrival Times</p> <p>Marumbo Sichinga, University of Rwanda (UR), Rwanda</p> <p>Abstract—Vehicle based logistics are hinged on their ability to timely deliver goods, services, and people. The classical expression of “time is money” comes alive in the logistics industry yielding potentially huge financial and health consequences in case of missing deadlines. This is especially the case for time sensitive pharmaceuticals, delivery of perishable goods, delivery of people travelling, delivery of services in fault fixing/recovery sector. All these use cases motivate the need for an immutable, secure, and immortalized process of tracking time. To solve this challenge, this paper presents prototype-based research that integrates the 4th industrial revolution technologies of vision Internet of Things (IoT), Artificial Intelligence (AI)-based Optical Character Recognition (OCR) and blockchain. The developed prototype features a Raspberry-PI board embedding a camera, an Artificial Intelligence (AI) model to recognize plate letters from the image and a crypto wallet to sign the logging of plate number and time events on the NEAR blockchain, an emerging sharded, proof-of-stake, layer-one blockchain that is simple to use, secure and scalable. The effective operation of the developed prototype has been validated inside a campus parking and shows an accuracy of 80%. The benefits of transparency, security, and immutability of the blockchain combined with the intelligence, data capture, and processing of IoT will enable to develop accountability solutions trusted by all different logistic stakeholders.</p>

Mar. 11 (Sat.) 13:30-15:30

< Hålsinge, Entrance Floor | Elite Palace Hotel >

Onsite Session 2: Model and Performance Analysis in Communication and Information Network

Session Chair:

Time & Paper ID	Speech Title & Presenter
13:30-13:45 ML0011	<p>Obstacle Aware Link Selection for Stable Multicast D2D Communications</p> <p>Rathindra Nath Dutta, <i>Indian Statistical Institute, India</i></p> <p>Abstract—The rapid growth of multimedia applications requiring high bandwidth has paved the way for millimeter-wave (mmWave) device-to-device (D2D) communications. In many modern applications, such as video streaming, same data packets need to be delivered to a group of users. Multicasting these packets has a clear advantage over repeated unicast. Establishing a stable multicast route for mmWave D2D communications is a challenging task as presence of obstacles can easily break a link. In this work we devise a mechanism for constructing a stable route for D2D multicast communications in presence of static as well as dynamic obstacles. This requires some knowledge about the blockage probabilities due to the obstacles. We then present a way of learning these blockage probabilities using the Dempster-Shafer evidential theory framework. We show the effectiveness of our proposed scheme over an existing approach through extensive simulations.</p>
13:45-14:00 ML1007	<p>HE-MAN – Homomorphically Encrypted MACHine Learning with ONNX Models</p> <p>Martin Nocker, <i>MCI Management Center Innsbruck, Innsbruck, Austria</i></p> <p>Abstract—Machine learning (ML) algorithms are increasingly important for the success of products and services, especially considering the growing amount and availability of data. This also holds for areas handling sensitive data, e.g. applications processing medical data or facial images. However, people are reluctant to pass their personal sensitive data to a ML service provider. At the same time, service providers have a strong interest in protecting their intellectual property and therefore refrain from publicly sharing their ML model. Fully homomorphic encryption (FHE) is a promising technique to enable individuals using ML services without giving up privacy and protecting the ML model of service providers at the same time. Despite steady improvements, FHE is still hardly integrated in today's ML applications. Reasons for that are, among others, that existing implementations either require the user to possess expertise in FHE, do not feature an easy ML framework integration, or have to approximate non-polynomial activations. We introduce HE-MAN, an open-source two-party machine learning toolset for privacy preserving inference with ONNX models and homomorphically encrypted data. Both the model and the input data do not have to be disclosed. HE-MAN abstracts cryptographic details away from the users, thus expertise in FHE is not required for either party. HE-MAN's security relies on its underlying FHE schemes. For now, we integrate two different homomorphic encryption schemes, namely Concrete and TenSEAL. Compared to prior work, HE-MAN supports a broad range of ML models in ONNX format out of the box without sacrificing accuracy. We evaluate the performance of our implementation on different network architectures classifying handwritten digits and performing face recognition and report accuracy and latency of the homomorphically encrypted inference. Cryptographic parameters are automatically derived by the tools. We show that the accuracy of HE-MAN is on par with models using plaintext input while inference latency is several orders of magnitude higher compared to the plaintext case.</p>
14:00-14:15 EA029	<p>BIM Game: A Testing Ground for Specifying, Modeling, Evaluating and Visualising Information in IFC Formats</p> <p>Gregor Grunwald, <i>Jade University of Applied Sciences, Germany</i></p> <p>Abstract—The Jade University of Applied Sciences organises digital simulation games to teach students in the Department of Architecture the networked and digital planning methodology Building Information Modelling (BIM). BIM is to be the planning standard for construction projects and thus an integral part of university education. The</p>

	<p>innovative and motivating teaching format "BIM Game" was developed for this purpose. This article describes in detail how the BIM Game is used as a testing ground for the building information process in a BIM workflow. It specifies the project requirements in Employer Information requirements (EIRs) and checks compliance with the specifications automatically through model checks. In addition, the results of the design competition are read out of the model, visualised and compared as a result evaluation of this architectural design competition. Furthermore, the basic structure of the BIM game is explained with special attention to the BIM Nuggets. The creation of the BIM Nuggets and their implementation in a new educational structure is funded by Stiftung Innovation in der Hochschullehre.</p>
<p>14:15-14:30 ML0014</p>	<p>Mobility Aware Path Selection for Millimeterwave 5G Networks in the Presence of Obstacles Subhojit Sarkar, <i>Indian Statistical Institute, India</i></p> <p>Abstract—An often overlooked metric in millimeterwave communication is the so-called stability of assigned links. Links can fail due to obstacles (both static and dynamic), and user mobility. Handling static obstacles is easy; the challenge comes in tracking dynamic obstacles which may impede transmission in the near future. Most works in literature track dynamic obstacles by using additionally deployed hardware like radars and cameras, which add to deployment cost. Our approach requires no such additional hardware. We handle multiple static obstacles, and a single dynamic obstacle, to allocate stable transmission paths which are unlikely to break in the near future. We then adopt a holistic approach to the problem of transmission path allocation, by assigning paths that are estimated to be active for the longest possible time, albeit at the cost of some individual throughput. In other words, we do not always select the best link based on instantaneous system parameters; rather, we can counter-intuitively choose slower, but more stable links. To achieve this, we consider user mobility, and obstacles which may cause links to fail prematurely. We demonstrate the accuracy with which dynamic obstacle trajectories can be captured by our proposed approach. By further simulation studies, we show that our approach leads to the assignment of more stable links as compared to the traditional received signal strength based greedy approach.</p>
<p>14:30-14:45 ML058-A</p>	<p>Future Trends in Artificial Intelligence for SatCom Tomas Navarro, <i>European Space Agency, UK</i></p> <p>Abstract—The coming years will see a heightened focus on furthering the development of Artificial Intelligence for satellite communications. Not only because improved communication and data transmission will be vital for the implementation of the future higher-efficiency satcom networks, but because new satcom systems will need to be designed, operated and maintained in a complete different way to cope with the demands of future seamless, ubiquitous and integrated satellite-terrestrial communications. Additionally, as AI technology advances, the future satcom systems are bound to inevitably evolve into more autonomous, reliable, and more efficient systems.</p> <p>This presentation will discuss specific trends in Artificial Intelligence that are to be explored in the upcoming years for enhancing or enabling new SatCom applications. More specifically the presentation will focus on bio-inspired Machine Learning algorithms, Deep learning-assisted Generative Design, advanced Reinforcement Learning algorithms and on-board Continual Learning. The presentation will finally give a broader view on the potential benefits of using these emerging AI technologies for a selected number of SatCom applications.</p>
<p>14:45-15:00 ML0015</p>	<p>A Probabilistic Analysis of the Delay in RIS Assisted SISO D2D Communication Using Chernoff's Bounds Sasthi C. Ghosh, <i>Indian Statistical Institute, India</i></p> <p>Abstract—Reflecting intelligent surface (RIS) assisted millimeter wave (mmWave) device to device (D2D) communication in single input single output (SISO) mode is considered. RIS can bypass the blocked D2D pairs since mmWaves are highly susceptible to blockages. However, the RIS is composed of passive elements which cannot accurately measure the state of the given channel and may suffer outages from moving obstacles (blockages) or due to moving devices (communication out of range) causing uncertainty in link quality. Each data packet will have some probability</p>

	<p>to be successfully transmitted towards the destination device via a RIS in each time unit. When a packet is lost it has to be re-transmitted which will induce extra delay. In this paper, the impact of link success probability on delay is studied. A lower bound on delay such that all packets are received successfully for the given link success probability has been derived. Later, we have derived a new term called apparent success probability which captures the trade-off between delay and link success probability. Simulations are performed which conforms with the derived theoretical results.</p>
<p>15:00-15:15 ML024</p>	<p>Open-NAS: A Customizable Search Space for Neural Architecture Search Léo Pouy, ESTACA, France</p> <p>Abstract—As we advance in the fast-growing era of Machine Learning, various new and more complex neural architectures are arising to tackle problem more efficiently. On the one hand, efficiently deploy them requires advanced knowledge and expertise, which is most of the time difficult to find on the labor market. On the other hand, searching for an optimized neural architecture is a time-consuming task when it is performed manually using a trial-and-error approach. Hence, a method and a tool support are needed to assist users of neural architectures, leading to an eagerness in the field of Automatic Machine Learning (AutoML). When it comes to Deep Learning, an important part of AutoML is the Neural Architecture Search (NAS). In this paper, we propose a formalization for a cell-based search space. The objectives of the proposed approach are to optimize the search-time and to be general enough to handle most of state-of-the-art Convolutional Neural Networks (CNN) architectures, as well as being customizable.</p>
<p>15:15-15:30 ML0010</p>	<p>A Geometry-based Strategic Placement of RISs in Millimeter Wave Device to Device Communication Sasthi Charan Ghosh, Indian Statistical Institute, India</p> <p>Abstract—Recently, reconfigurable intelligent surfaces (RISs) have been introduced in millimeter wave (mmWave) device to device (D2D) communication scenarios to provide seamless connection and high data rate to a pair of proximity users. However, such high data rate can be achieved, only if the concerned device pair resides in close proximity and a direct line of sight (LoS) link exists between them. The proximity and the LoS link is necessary because of the high propagation and penetration losses of the mmWaves. The direct LoS link between a pair of devices may be blocked easily by static obstacles like buildings and trees. If there is no such direct LoS link between a pair of devices, we can use RIS to form an indirect LoS link between them. However, in that case, proper placement of RISs is necessary to provide such indirect LoS link. In this work, we develop a RIS placement strategy to serve those device pairs who do not have any direct LoS links. In order to provide an indirect LoS link for a requesting device pair, we first use some basic ideas from computational geometry to find out the candidate zones for placing RISs. Next we find the candidate zones for all such requesting device pairs considering the fact that two or more candidate zones may overlap and create a new candidate zone. We construct a graph where each candidate zone represents a vertex and there exist an edge between two overlapping candidate zones. We convert the RIS placement problem to a clique partitioning problem of the graph and use a greedy algorithm to get a near optimal solution. From simulation results, we can see that the strategically placed RISs give better performance in comparison to an existing deployment strategy, which places RISs only on the walls of the building.</p>

Mar. 11 (Sat.) 15:45-18:35

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Onsite Session 3: Machine Learning Model and Algorithm Optimization

Session Chair:

Time & Paper ID	Speech Title & Presenter
15:45-16:00 ML0008	<p>An Analysis of the Performance Changes of the Model by Reducing the Input Feature Dimension in Stock Price Forecasting</p> <p>Woo Jin Cho, <i>Semyung University, Korea</i></p> <p>Abstract—In general, it can suffer from the curse of dimensionality in developing machine learning models using high-dimensional data. To solve this problem, various dimensionality reduction algorithms have been developed, and PCA is the most widely used dimensionality reduction algorithm. In this paper, the PCA algorithm is applied to deep learning-based stock price prediction models developed in previous studies and their performance changes are analyzed. The models used data expected to affect stock price fluctuations as input features, and the data consist of 715 and 250 high-dimensional features, respectively. As a result, they not only took a lot of time in the model training and testing but also had the disadvantage of generating noises. Therefore, in this paper, the number of input features used in previous studies was reduced by using the dimension reduction method, and the performance change was analyzed. As a result of the experiment, it was confirmed that the models to which the PCA is applied have improved training speed and performance compared to the model without the PCA.</p>
16:00-16:15 ML006	<p>Forecasting Arctic Sea Ice Concentration Using Long Short-term Memory Networks</p> <p>Thunchanok Phutthaphaiboon, <i>King Mongkut's University of Technology Thonburi, Bangkok, Thailand</i></p> <p>Abstract—Due to global warming, Arctic sea ice is now declining, and this loss is a self-accelerating process that speeds up sea ice melting and the severity of climate change. Accurate and timely sea ice information is critically important for better monitoring of global climate. Publicly available multi-source, multi-scale, and high-dimensional sea ice data from satellites is a game changer that allows researchers to better understand the Arctic through more sophisticated methods. This study proposes two Long short-term memory (LSTM) networks for sea ice concentration (SIC) forecasting in the arctic area over 1-, 3-, 6-, and 9-month forecast horizons. The first network forecasts the SIC of each grid in a single output with the grid coordinate must be supplied as an additional input, while the second network forecasts the SIC of all grids at once in a single output. The models with and without atmospheric and oceanic variables as external predictors were trained by using 43 years of data and tuned by using random search strategies. The model performance was evaluated and compared based on the root mean square errors and weighted absolute percentage errors to determine the impact of using climate variables in the prediction and arrive at the best-performing forecast model.</p>
16:15-16:30 ML008	<p>Learning the Structure of Commands by Detecting Random Tokens Using Markov Model</p> <p>Zafar Hussain, <i>University of Helsinki, Finland</i></p> <p>Abstract—Learning the syntax and structure of command-line commands is of utmost importance in the field of cyber security to identify valid and malicious sets of commands. It is hard to learn the syntax and structure of every command because of various reasons, such as the continuous evolution of commands, precise syntax requirement, huge volume of available commands, and no room for errors, etc. In this research work, we studied two approaches to learning the structure of the commands by detecting the random tokens in them, such as temp files, temp directories, numerical values, etc. In the first approach, we write hard-coded regular expressions to identify random tokens in a command whereas in the second approach we trained a second-order Markov model which detects the random tokens based on their</p>

	<p>probabilities. To validate the efficiency of these approaches, we clustered the commands using their word embeddings and sentence embeddings. For clustering, we explored KMeans, and DBScan with word embeddings and sentence clustering based on sentence embeddings. We evaluated the performance of clustering algorithms against three metrics, the Silhouette Coefficient, the Calinski-Harabasz Index, and the Davies-Bouldin Index. The results show that regular expression and the Markov model achieve the same scores for KMeans and DBScan based on word embeddings against three metrics, whereas when clustered using sentence embeddings, the Markov model performs better than regular expression. These results validate our idea of using the Markov model instead of regular expressions, to get similar scores or even better performance with less resource utilization, such as human effort, time to write regular expressions, and maintaining & storage of those regular expressions.</p>
16:30-16:45 ML010	<p>Energy-aware Tiny Machine Learning for Sensor-based Hand-washing Recognition Lorenzo Calisti, <i>University of Urbino, Italy</i></p> <p>Abstract—Tiny wearable devices are nowadays one of the most popular and used devices in everyday life. At the same time, machine learning techniques have reached a level of maturity such that they can be used in the most varied fields. The union of these two technologies represents a valuable opportunity for the development of pervasive computing applications. On the other hand, pushing the machine learning inference on a wearable device can lead to nontrivial issues. In fact, devices with small size and low-energy availability, like those dedicated to wearable platforms, pose strict computational, memory, and power requirements which result in challenging issues to be addressed by designers. The main purpose of this study is to empirically explore the trade-off between energy consumption and classification accuracy of a machine learning based hand-washing recognition task deployed on a real wearable device. Through extensive experimental results, obtained on a public human activity recognition dataset, we demonstrated that given an identical level of classification performance, a classic SVM classifier can save about 40% of energy with respect to a more complex LSTM network. Moreover, reducing the LSTM complexity, by lowering the number of its internal unit, can make the LSTM network energy cost-effective (with a savings of about 30%) at the cost of a reduction in accuracy of only 2%.</p>
16:45-17:00 ML033	<p>Improving Color Mixture Predictions in Ceramics using Data-centric Deep Learning Tomás Pereira, <i>Fraunhofer Portugal AICOS, Portugal</i></p> <p>Abstract—Ceramics is a millenary industrial sector with relevant financial impact for several countries. Efficiency in color mixing is crucial in the ceramic industry, both in terms of staff time and consumables costs. Traditional color mixing methods usually consist of manual processes based on in-depth domain knowledge of basic color theory or color models like Kubelka-Munk. Thus, the efficiency of these procedures is highly dependent on the technician's expertise, being challenging for novices to acquire these skills and be proficient. This work explores the usage of Deep Learning to generate color mixture predictions in ceramic glazes. The proposed solution is based on spectral data of ceramic components (pigments and glazes) and, based on their respective quantities, simulates the color mixing result in a wholly digital way. Given the lack of freely available datasets, we started by exploring our approach in the NTU Watercolor Pigments Spectral Measurement dataset. We then translated the collected knowledge to the Matcerâmica Ceramics Spectral Measurement dataset, which was specifically created in the ambit of this work. By using data-centric optimization techniques to improve our model interactively, the best performance was achieved by fully connected neural network model, with mean ΔE^*_{ab} of 1.57 and 2.35 for the NTU and Matcerâmica datasets, respectively. These results demonstrate the potential of the proposed approach to be integrated into an AI-powered software solution that improves color mixing procedures in the ceramic industry.</p>
17:00-17:15 ML043	<p>"When Can I Trust It?" Contextualising Explainability Methods for Classifiers Lars Holmberg, <i>University of Malmö, Sweden</i></p> <p>Abstract—The need for artificial intelligence systems to expose reasons for promoted decisions grows with the prevalence of these systems in society. In this work, we study, for carefully selected images, how an end user's trust is affected by visual explanations. Additionally, we complement our work by probing the pretrained neural network's consistency for the selected images. Our research approach exposes the</p>

	<p>brittleness in these systems pointing toward a need to develop benchmarking methods connecting visual explanations to training data distribution and, additionally, move away from a flat output hierarchy toward including a concept ontology that matches the tar_x0002_get domain. Additional material and code to reproduce experiments can be found at https://github.com/k3larra/IKR.</p>
<p>17:15-17:30 ML1004-A</p>	<p>Extreme Event Prediction of High Payments in Defaulted Financial Portfolios Using an Advanced Machine Learning Framework Abel Sancarlos, B2Holding, Spain</p> <p>Abstract—The European debt purchase market as measured by the total book value of purchased debt approached €25bn in 2020 and it was growing at double-digit rates [1]. This is an example of how big the debt collection and debt purchase industry has grown and the important impact it has in the financial sector. However, in order to ensure an adequate return during the debt collection process, a good portfolio valuation for the purchase of debt is important. In several European markets, current valuation tools have problems to detect the amount and occurrence of high payments during the debt collection process. This leads to a wrong valuation of the portfolio, significantly affecting the fair price that should be offered for it and therefore affecting profitability. The present work offers a solution of the above problem. Specifically, a new machine learning modelling framework is presented showing how significantly outperforms current strategies employed in the sector. The solution contains a pre-processing pipeline, where we deal with quality problems with vendor data, a probability estimator, and an amount estimator. Performance is validated employing real Polish portfolios.</p>
<p>17:30-17:45 ML1012</p>	<p>On the Effect of Adversarial Training Against Invariance-based Adversarial Examples Martin Nocker, MCI Management Center Innsbruck, Innsbruck, Austria</p> <p>Abstract—Adversarial examples are carefully crafted attack points that are supposed to fool machine learning classifiers. In the last years, the field of adversarial machine learning, especially the study of perturbation-based adversarial examples, in which a perturbation that is not perceptible for humans is added to the images, has been studied extensively. Adversarial training can be used to achieve robustness against such inputs. Another type of adversarial examples are invariance-based adversarial examples, where the images are semantically modified such that the predicted class of the model does not change, but the class that is determined by humans does. How to ensure robustness against this type of adversarial examples has not been explored yet. This work addresses the impact of adversarial training with invariance-based adversarial examples on a convolutional neural network (CNN). We show that when adversarial training with invariance-based and perturbation-based adversarial examples is applied, it should be conducted simultaneously and not consecutively. This procedure can achieve relatively high robustness against both types of adversarial examples. Additionally, we find that the algorithm used for generating invariance-based adversarial examples in prior work does not correctly determine the labels and therefore we use human-determined labels.</p>
<p>17:45-18:00 ML0028</p>	<p>An Interpretable Hybrid Recommender Based on Graph Convolution to Address Serendipity Ananya Uppal, PES University, India</p> <p>Abstract—This paper proposes a hybridized recommender system built to overcome the disadvantages of its individual components by combining them in a way that balances contrasting metrics. The individual components are a content-based and collaborative filtering-based model, a neural network model, and a graph convolutional network model. The individual models used in today's scientific landscape focus entirely on a single metric to be tuned and optimized. Through this paper, we introduce a way to balance all metrics, while retaining excellent precision and recall and improving on less focused metrics such as coverage and serendipity. We also explore a novel hybridization technique that represents the recommendation scenario as a graph and infers edges from the dataset to map relevant relationships. Interpretability is the comprehension of a model's fundamental decision-making. This helps improve users' trust in the model and is an attempt at understanding the features and their relevance. The results of the hybrid recommender are explained using post hoc interpretability techniques. Additionally, serendipity is used to capture user satisfaction</p>

	<p>and the factor of “pleasant surprise” with the recommendations. To overcome the subjective nature of evaluating serendipity, we also propose a new distance-based method to calculate it. The results provide a comparison of contrasting and competing metrics of the individual and hybrid models, and also show the balance of metrics achieved by the hybrid models.</p>
<p>18:00-18:15 ML007</p>	<p>Self-Supervised PPG Representation Learning Shows High Inter-Subject Variability Ramin Ghorbani, <i>TU Delft, Netherlands</i></p> <p>Abstract—With the progress of sensor technology in wearables, the collection and analysis of PPG signals are gaining more interest. Using Machine Learning, the cardiac rhythm corresponding to PPG signals can be used to predict different tasks such as activity recognition, sleep stage detection, or more general health status. However, supervised learning is often limited by the amount of available labeled data, which is typically expensive to obtain. To address this problem, we propose a Self-Supervised Learning (SSL) method with a pretext task of signal reconstruction to learn an informative generalized PPG representation. The performance of the proposed SSL framework is compared with two fully supervised baselines. The results show that in a very limited label data setting (10 samples per class or less), using SSL is beneficial, and a simple classifier trained on SSL-learned representations outperforms fully supervised deep neural networks. However, the results reveal that the SSL-learned representations are too focused on encoding the subjects. Unfortunately, there is high inter-subject variability in the SSL-learned representations, which makes working with this data more challenging when labeled data is scarce. The high inter-subject variability suggests that there is still room for improvements in learning representations. In general, the results suggest that SSL may pave the way for the broader use of machine learning models on PPG data in label-scarce regimes.</p>
<p>18:15-18:30 ML048</p>	<p>Are Attention Blocks Better than BiLSTM for Text Recognition? Belhakimi Amine Mohamed, <i>IDNOW gmbh, France</i></p> <p>Abstract—This paper studies the impact of using Sequential Attention blocks versus Bidirectional Long-Short-Term Memory (BiLSTM) layers for Optical Character Recognition (OCR). The main target is to improve the inference time – specifically on CPU – of state-of-the-art OCRs, with also the additional constraint of being trainable with only a restricted amount of data. While OCR research often focuses on improving recognition accuracy, there has been little emphasis on optimizing processing speed and model weights. In this context, experimental results presented in this paper show the superiority of Attention blocks compared to BiLSTM layers. Attention blocks appear to be up to 5x faster on CPU, while achieving better and similar decoding rates on a typical industrial dataset of identity document text fields and publicly available Scene Text Recognition (STR) datasets, respectively. Also, in addition to being faster and accurate, which was the primary goal, it appears that Attention blocks lead to lighter models.</p>

Mar. 11 (Sat.) 13:30-15:15

< ZOOM Room A: 835 2704 0734 >

Online Session 1: Software and Information Security

Session Chair:

Time & Paper ID	Speech Title & Presenter
13:30-13:45 ML029	<p>An End-to-End Trainable Power Line Communication System</p> <p>Min-sung Koh, <i>Eastern Washington University, USA</i></p> <p>Abstract—This paper introduces an end-to-end trainable power line communication (PLC) system based on a deep neural network (DNN). PLC channels are challenging to be modeled and estimated because of uncertain loads in utility / power grids, heterogeneous network topologies, and many equipment such as switching gears, relays, transformers, etc., which are usually not considered in traditional communication systems. With a trainable transmitter and receiver, this paper designs a PLC system not requiring any power line channel information. The designed PLC system can achieve similar bit error rate (BER) performances to the cases harnessing perfect power line channel information. Since the proposed design can be end-to-end trained without any PLC channel information in diverse power line environments, it will be a promising PLC communication design even for internet of things (IoT) applications targeting for smart grids, smart homes / factories etc.</p>
13:45-14:00 ML0004	<p>Improved Crime Linked Location Predictions with Dynamic Features for Societal Security</p> <p>Omobayo Ayokunle Esan, <i>University of South Africa, South Africa</i></p> <p>Abstract—Crime has negatively impacted the individual's life and the nation's economic growth. Currently, manual human assessments are used by security operatives to analyze the relationship between crime location and crime types from huge crime datasets, which are tedious and overwhelming. Hence, subject the criminal prediction results to errors. While many researchers make use of static crime dataset features for prediction which affects the prediction results, fewer approaches have focused on using crime specialized features to address this lacuna. This research develops a machine learning-ensemble model inclined on specialized crime features to address the issue of inaccuracy affecting crime prediction systems. Experiments were conducted on an Africa-based crime dataset. Based on the experimental results, the proposed model outperforms the state of art models in terms of average precision, recall, F1-score, and accuracy with 0.97, 0.95, 0.97, and 97.03% respectively. The deployment of this proposed model in a complex environment can help security personnel to solve crime accurately and have a better response towards criminal activities.</p>
14:00-14:15 ML0018	<p>Enhancing IoT Security through Deep Learning-based Intrusion Detection</p> <p>Jyotsna A., Christ (<i>Deemed to be university</i>), <i>Bengaluru, India</i></p> <p>Abstract—The Internet of Things (IoT) has revolutionized the way we interact with technology by connecting everyday devices to the internet. However, this increased connectivity also poses new security challenges, as IoT devices are often vulnerable to intrusion and malicious attacks. In this paper, we propose a deep learning-based intrusion detection system for enhancing IoT security. The proposed work has been experimented on IoT-23 dataset taken from Zenodo. The proposed work has been tested with 10 machine learning classifiers and two deep learning models without feature selection and with feature selection. From the results it can be inferred that the proposed work performs well with feature selection and in deep learning model named as Gated Recurrent Units (GRU) and the GRU is tested with various optimizers namely Follow-the-Regularized-Leader (Ftrl), Adaptive Delta (Adadelta), Adaptive Gradient Algorithm (Adagrad), Root Mean Squared Propagation (RmsProp), Stochastic</p>

	<p>Gradient Descent (SGD), Nesterov-Accelerated Adaptive Moment Estimation (Nadam), Adaptive Moment Estimation (Adam). Each evaluation is done with the consideration of highest performance metric with low running time.</p>
<p>14:15-14:30 ML027</p>	<p>Chatbot Recommender Systems in Tourism: A Systematic Review and A Benefit-cost Analysis</p> <p>Mark Anthony Camilleri, <i>University of Malta, Malta</i></p> <p>Abstract—This research is focused on the utilization of artificially intelligent (AI), customer service chatbots in travel, tourism and hospitality. Rigorous criteria were used to search, screen, extract and synthesize articles on conversational, automated systems. The results shed light on the most-cited articles on the use of “chatbots” and “tourism” or “hospitality”. The researchers scrutinize the extracted articles, synthesize the findings and outline the pros and cons of using these interactive technologies. This contribution implies that there is scope for tourism businesses to continue improving their online customer services in terms of their efficiency and responsiveness to consumers and prospects. For the time being, AI chatbots are still not in a position to replace human agents in all service interactions as they cannot resolve complex queries and complaints. However, works are in progress to improve their verbal, vocal and anthropomorphic capabilities to deliver a better consumer experience.</p>
<p>14:30-14:45 ML060</p>	<p>Deep Learning Model Regression Based Object Detection for Adaptive Driving Beam Headlights</p> <p>Swathi Ganesan, <i>York St John University, UK</i></p> <p>Abstract—As the world move toward automated driving (AD) continues, the future of adaptive driving beam headlights (ADB), is quickly coming into focus. Engineers, developers and designers are researching hard to identify the most effective combination of components to meet driver requirements for safety and visibility. ADB is a technology used in automotive headlight systems that automatically adjusts the beam pattern of the headlights to provide the best visibility for the driver while also reducing glare for oncoming drivers. The system uses cameras, sensors, and algorithms to detect the presence of other vehicles on the road and adjust the headlight beams accordingly. This allows the driver to have the highest level of visibility while minimizing the risk of dazzling other drivers. ADB is available on many vehicles including Europe, Asia & Middle East. Adaptive capabilities help reveal critical objects such as lane markings, pedestrians, and oncoming cars while avoiding using full high beams that might temporarily blind an oncoming vehicle driver. However, designing and developing a solution for the real road conditions is time-intensive, expensive, and complex. Hence, there is a requirement for adaptive driving beam headlights to detect the oncoming vehicles to reduce the glare for oncoming vehicle drivers. The detection solution needs to be fast, accurate and easy to integrate with automotive vehicular system. This paper reviews various detection techniques that can be used in implementing adaptive headlamps and application of the Machine Learning technique to predict fast and accurate object detection.</p>
<p>14:45-15:00 ML019</p>	<p>Developing an IoT-based Conversational AI Recommender Assistant for Vital Sign Predicted Anomalies</p> <p>Akram Ali Omar, <i>University of Rwanda (UR), Rwanda</i></p> <p>Abstract—In most real-time scenarios such as emergency first response or a patient self-monitoring using a wearable device, likely, accessing a healthcare physician for assessing potential vital sign anomalies and providing a recommendation will be impossible; thus potentially putting the patient at risk. Leveraging the latest advances in Natural Language Processing (NLP), this paper presents a research-driven design and development of a cloud-based conversational AI platform trained to predict vital signs anomalies and provides recommendations from a dataset created by physicians. To reinforce the learning of the virtual assistant, the Conversation Driven Development (CDD) methodology has been adopted to involve end users in the testing process in the early phase. The proposed platform will help to manage the consequences of low physician-patient ratios, especially in developing countries.</p>
<p>15:00-15:15 ML0029</p>	<p>Development of Home-Bot with Accident-Sensory System Using IOT and Android Application for Control</p> <p>Stephen Paul Lumbay Alagao, <i>University of Mindanao, Philippines</i></p>

Abstract—The Internet-of-Things (IoT) and robotics, individually, has been widely used in promoting better home security and quality of life to its users. This study aims to design and develop a home-bot's accident-sensory system to monitor flame, smoke, and earthquake detection through the use of IoT; and develop an android application to monitor the transmitted data from the device (hubs) and even control the home-bot using Bluetooth. The real-time readings from all the hubs will be sent to the cloud Backend-as-a-Service real-time database. This data will then be reflected in real-time in the android application and when either of the hubs detected any warning from any of the parameters, it will trigger an alarm to the hub itself and the android application for its user to react immediately. The system uses a nested loop algorithm to make sure that a detection is true in a span of time, together with a voting algorithm to avoid false alarms. The data gathered from the functionality tests was statistically analyzed using the confusion matrix method and resulted a 95.5% sensor accuracy for flame detection, 90.0% sensor accuracy for both the smoke and earthquake detection, and a successful transmission of data to the database to the android application in all the tests. The results showed significance accuracy and the system performed with accordance to its objectives and purpose.

Mar. 11 (Sat.) 13:30-15:45

< ZOOM Room B: 849 2832 2994 >

Online Session 2: Wireless Communication and Signal Detection

Session Chair:

Time & Paper ID	Speech Title & Presenter
13:30-13:45 ML005	<p>On the Use of VGGish as Feature Extractor for COVID-19 Cough Classification</p> <p>Christian, Salamea-Palacios, <i>Universidad Politécnica Salesiana, Ecuador</i></p> <p>Abstract—The COVID-19 pandemic has changed the daily lives of all people worldwide, affecting not only society but also various sectors such as finance, tourism, etc. To counteract the pandemic, measures are required to detect contagions and take the necessary actions to prevent the virus spread. In this work, a Transfer Learning approach has been used to model COVID-19 coughs as a previous step to the diagnosis of the illness. The data set of the University of Cambridge, ComParE 2021 COVID-19 Cough Sub-Challenge, has been used, which consists of 725 samples of cough sounds from 397 people of which 119 have been diagnosed with positive COVID-19, besides, a data augmentation technique has been used to balance the data set. This work evaluates the performance of the pre-trained VGGish model for the classification of the audio cough signals as COVID or Not COVID cough. For this purpose, the VGGish model is used as a feature extractor and a convolutional neural network provides the final classification of the cough recordings to determine whether they are COVID-19 positive or negative. Despite the difficulty of the task, optimum results have been founded to detect negative cases obtaining up to 81% of precision. Considering the Unweighted Average Recall (UAR) as metric, the methodology proposed in this work has obtained an improvement up to 3% comparing to OpenSmile technique when the same database has been used.</p>
13:45-14:00 ML002	<p>Self-Monitoring of External Magnetic Interference in Magnetostrictive Position Sensors Using Machine Learning</p> <p>Aimal Khan, <i>Pforzheim University, Germany</i></p> <p>Abstract—The increasingly rich and diverse applications of sensors in industry as well as in commercial products require flexible, accurate, and long-term dependable integrated electronics realizations. To achieve this goal, the future sensors in Industry 4.0 should be envisaged to have self-x capabilities. Generally, sensors should be able not only to monitor itself for anomalies and defects but also to calibrate and heal itself. Sensors should be made capable of detecting anomalies in the sensing environment or within its own sensing components and react appropriately to mitigate the effects. Magnetostrictive Position Sensors (MPS) are used for the purpose of high accuracy distance and velocity measurement. These sensors work on the basis of Time-of-Flight (ToF) calculation for a structure-borne sound wave generated through magnetic fields within the sensor systems. The accuracy of the measurement is very sensitive to any External Magnetic Interference (EMI) interacting with the generated structure borne sound wave. This work suggests a novel approach of self-monitoring which applies machine learning to classify the intensity of the EMI. Thus, it is of significance for measurement in industrial environment where multiple sources of external electromagnetic interference can be present.</p>
14:00-14:15 ML022	<p>SCALA: Scaling Algorithm for Multi-class Imbalanced Classification</p> <p>Ala Othman Barzinji, <i>University of Greenwich, UK</i></p> <p>Abstract—Most of the existing techniques for solving data imbalance problems are geared towards binary classification problems, hence a novel strategy capable of</p>

	<p>natively handling multi-class classification problems is required. Existing implementations mainly employ a one-versus-rest approach to support multi-class problems and this generalisation hinders its effectiveness in datasets with multiple minority classes. On the contrary, a one-versus-one approach avoids such generalisation and provides finer control over the balancing strategy. In this paper, we propose a novel SCALA algorithm capable of handling imbalanced data with multiple minority class labels with a multi-class output. We introduce a user-defined set of scaling factors which are then integrated with a one-versus-one balancing strategy. Our results show that SCALA demonstrated a significant improvement compared to ADASYN and SMOTE in model performance metrics used to validate balancing techniques. SCALA can balance these datasets without allowing minority classes to overshadow other minority classes. This preserves the information needed by the training algorithm to distinguish between the classes to a high precision.</p>
<p>14:15-14:30 ML032</p>	<p>Support Vector Machine Process Against Probabilistic Byzantine Attack for Cooperative Spectrum Sensing in CRNs</p> <p>Zhixuan Zhang, Hangzhou Dianzi University, China</p> <p>Abstract—In view of the spectrum shortage problem of wireless devices and applications, cognitive radio (CR) allows secondary users (SUs) with a signal detection function to opportunistically access spectrum resources being authorized to primary users (PUs) by means of cooperative spectrum sensing (CSS). However, the inherent openness of CR technology provides an opportunity for malicious SUs (MSUs) to launch Byzantine attack, therefore undermining the premise of CR. For this reason, motivated by advantages of machine learning, we make use of support vector machine (SVM) to identify MSUs by providing a maximum margin hyperplane in this paper, in which the generated spectrum sensing data features benefit from the PU status in the training process. This paper makes an in-depth analysis on the SUs' sensing results in the presence of a large-scale probabilistic Byzantine attack by the SVM process and provides a method linking with a reputation structure to identify those potential MSUs and mitigate the negative impact of Byzantine attack on CSS. Finally, a series of numerical simulation result shows that the security of the CSS process can be guaranteed by selecting those reliable sensing results identified by means of SVM, especially in a large-scale attack.</p>
<p>14:30-14:45 ML035</p>	<p>Attention Based Deep Hybrid Networks for Traffic Flow Prediction Using Google Maps Data</p> <p>Md. Moshir Rahman, Christ (Deemed to be university), Bengaluru, India</p> <p>Abstract—Accurate traffic flow prediction is a keystone for building intelligent traffic management systems which have gained attention from researchers because of the availability of the massive volume of traffic data and advances in deep learning technologies. However, there are many cities in the world, that suffer from terrible traffic congestion but there are no infrastructure facilities to collect traffic data. To address this problem we develop a tool that collects traffic data from Google Maps without using its paid API. After that, we proposed an Attention-based Deep Hybrid network (ADHN) for traffic flow prediction using Google map data. The proposed ADHN combines two Convolutional Long Short-Term Memory (ConvLSTM) to capture dynamic spatial temporal dependencies of the traffic flow and applies attention mechanism on traffic features. The experiment result shows that our proposed ADHN can provide higher prediction accuracy compared with the other state-of-the-art approaches.</p>
<p>14:45-15:00 ML056</p>	<p>An Approach to Detecting Extremely Small or Large Objects based on an Improvement to Scale Variation in yolov3</p> <p>Yunusa Haruna, Beihang University, China</p> <p>Abstract—YOLOv3 is a state-of-the-art object detection algorithm mainly used to solve real-time tasks. However, this design struggles with scale variation, especially for extremely small or large objects. To improve scale variation, we re-design the Feature Pyramid Network by replacing the stride-2 operation pooling layer with a dilated convolution and bilateral filter. Thus, reducing the network complexity. This helps to improve the network's ability to detect smaller and bigger scale objects. Lastly, the network performance is improved with respect to speed and accuracy.</p>
<p>15:00-15:15</p>	<p>Few-shot 3D Point Cloud Semantic Segmentation with Prototype Alignment</p>

ML1008	<p>Maolin Wei, <i>East China Normal University, China</i></p> <p>Abstract—Semantic Segmentation for 3D point clouds has made great progress in recent years. Most existing approaches for 3D point cloud segmentation are fully supervised, and they require a large number of well-annotated data for training. The training data is cost and quite difficult to obtain. Moreover, these fully supervised approaches cannot segment new classes well that are unseen in the training process. Thus, Few-shot segmentation has been developed to mitigate these limitations by learning to perform segment from a few labeled examples. In this paper, we propose a method to more adequately utilize information of query set and support set to promote performance of semantic segmentation for 3D point clouds. Specifically, we first extract support and query features and generate multiple prototypes to map the distribution of point clouds. Then we apply a transductive label propagation method to exploit the relations between labeled multi-prototypes and unlabeled points, and between pairs of unlabeled points. Finally, we utilize query points and predicted query masks to perform segmentation for support points. Our proposed method shows improvements for specific classes on S3DIS dataset compared to baselines in 2/3-way 1-shot point cloud semantic segmentation.</p>
15:15-15:30 ML034	<p>A Noise Suppression of LSTM Algorithm Combined with Kalman Filter for Agriculture Automation</p> <p>ABDOULAYE BARRY, <i>University of the District of Columbia, USA</i></p> <p>Abstract—Enormous amounts of data are generated each day by sensor devices. In agriculture, these devices continuously monitor numerous environmental properties in the fields of aquaponics, hydroponics, and soil-based food production. Data stream mining is the process of extracting data from continuous, rapidly sampled data sources. The data accuracy that can be achieved in data stream mining is highly dependent on the algorithm chosen to suppress noise. For threshold-based automation, an actuator can be activated when the value of sensor data is above a permissible threshold. Noise from sensors may activate the actuator. Several statistical and machine learning-based noise-suppression algorithms have been proposed in the literature. They have been evaluated based on the mean squared error metric (MSE). The Long Short-Term Memory – LSTM filter (MSE: 0.000999943) performs better noise suppression than other traditional filters – Kalman (MSE: 0.0015982). We propose a new noise suppression filter -- LSTM combined with Kalman (LSTM-KF). In LSTM-KF, the Kalman filter acts as an encoder and the LSTM becomes the decoder, resulting in a significantly lower MSE -- 0.000080789592. The LSTM-KF is installed in our threshold-based aquaponics automation to maximize sustainable food production at minimum cost.</p>
15:30-15:45 ML037	<p>QLDT+: Efficient Construction of a Quantum Logic Decision Tree</p> <p>Ingo Schmitt, <i>Brandenburgische Technische Universität Cottbus-Senftenberg, Germany</i></p> <p>Abstract—The quantum-logic inspired decision tree (QLDT) is based on quantum logic concepts and input values from the unit interval whereas the traditional decision tree is based on Boolean values. The logic behind the QLDT obeys the rules of a Boolean algebra. The QLDT is appropriate for classification problems where for a class decision several input values interact gradually with each other. The QLDT construction for a classification problem with n input attributes requires the computation of 2^n minterms. The QLDT+ method, however, uses a heuristic for obtaining a QLDT with much smaller computational complexity. As result, the QLDT+ method can be applied to classification problems with a higher number of input attributes.</p>

Mar. 11 (Sat.) 16:00-18:15

< ZOOM Room A: 835 2704 0734 >

Online Session 3: Machine Learning Algorithm and Model Construction

Session Chair:

Time & Paper ID	Speech Title & Presenter
16:00-16:15 ML0006	<p>An Empirical Analysis on Lossless Compression Techniques</p> <p>Mohammad Badrul Hossain, <i>BRAC University, Bangladesh</i></p> <p>Abstract—A method of presenting source data into its compact form is known as data compression. In this process, data size is minimized, redundancy is eliminated, and excess information is gotten rid of. A reduction in actual data is usually advantageous because it uses less resources overall, including bandwidth, processing, space, time, and many others. There are numerous compression algorithms for reducing the size of data of different formats. Even for compressing a particular data type, many approaches are being used. The proposed research has explored three of the lossless compression techniques which are: Run Length Encoding, Lempel Ziv Welch, and Huffman Encoding algorithms. We found out that based on compression size, compression ratio, and space saving percentage, Lempel Ziv Welch outperformed the other two. In contrast, Huffman Encoding performed better than the other two based on compression time. In the best case, LZW got a compression size of 250992 bytes, a compression ratio of 5.0106, and a space saving percentage of 80.04% while Huffman encoding got a compression time of 32.28 milliseconds.</p>
16:15-16:30 ML0024	<p>Tropical Cyclone Analysis and Accumulated Precipitation Predictive Model Using Regression Machine Learning Algorithm</p> <p>Maribel Salvador Abalos, <i>Isabela State University, Philippines</i></p> <p>Abstract—The Philippines is susceptible to tropical cyclones due to its geographical location which generally produces heavy rains and flooding of a large area that result in heavy casualties to human life and destruction of crops and properties. In the past 4 years, the Cagayan Valley region is hit by almost 20 Tropical Cyclones with different strengths and attributes. It is of utmost importance to have sufficient knowledge of such maritime phenomena for beneficial purposes. This study analyzed the Tropical Cyclones that hit Cagayan Valley using Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) dataset from 2018-2021. Different attributes were considered to create a framework, statistical analysis, and comparison matrix. Also, the dataset is analyzed using four Regression Machine Learning Algorithms namely Multilayer Perceptron, Linear Regression, SMOReg, and Gaussian Processes, and compared their performances where the best-performed algorithm is used to develop a predictive model for rainfall accumulation. Results of the study found that Cagayan Valley accumulated 219.857 millimeters of rainfall and an average Tropical Cyclone Maximum Sustained winds of 123.438 kph. Tropical Cyclone Ulysses reached almost the highest value in all the attributes as evidence of its devastating nature last November 2020. Also, the Linear Regression algorithm revealed a better performance which displayed a higher correlation coefficient and lower error estimates and took less time in developing the model. Lastly, the results can be considered to be a basis of the impact of a Tropical Cyclone based on their attributes and can be implemented into technological platforms for predictive application which helps foresee the prediction rate of rain accumulation to develop techniques and preventive</p>

	measures to target reduction of damage on properties and number of casualties.
16:30-16:45 ML041	<p>Classifying Corn Leaf Diseases Using Ensemble Learning with Dropout and Stochastic Depth Based Convolutional Networks</p> <p>Mohammad Rakibul Hasan Mahin, BRAC University, Bangladesh</p> <p>Abstract—Widespread plant illnesses have a negative influence on crop production, so it is important to diagnose them timely otherwise there is possibility that they can spread speedily and dramatically lower crop output. Corn is the second-most prevalent cereal grain grown for human use, and several societies throughout history have depended on it. Therefore, discovering corn leaf disease too late can result in significant loss. In our work, we looked into how deep learning works and made a convolutional ensemble network to help the model find corn lesion features better. To better recognize plant disease categories, we employed ensemble learning to ensemble three convolutional neural networks (CNN) which has a custom CNN with dropout, a custom CNN with Stochastic Depth, and DenseNet201. The ensemble technique combines the power of three different networks, resulting an optimal performance. On the corn leaf diseases images of Plant Village dataset, the proposed technique averaged 98.36% accuracy. The experimental results validate the suggested approach and show that it outperforms the current state-of-the-art.</p>
16:45-17:00 ML0017	<p>A Hybrid Algorithm by Incorporating Neural Network and Metaheuristic Algorithms for Function Approximation and Demand Prediction Estimation</p> <p>Zhen-Yao Chen, Hungkuo Delin University of Technology, Taiwan</p> <p>Abstract—This study intends to heighten the training expression of radial basis function neural network (RbfN) via artificial neural network (ANN) and metaheuristic (MH) algorithms. Further, the self-organizing map neural network (SOMN), artificial immune system (AIS) and ant colony optimization (ACO)-based algorithms are employed to train RbfN for function approximation and demand prediction estimation. The proposed hybrid of SOMN with AIS-based and ACO-based (HSIA) algorithm incorporates the complementarity of exploitation and exploration potentialities to attain problem settle. The experimental consequences have evidenced that AIS-based and ACO-based algorithms can be integrated cleverly and propose a hybrid algorithm which attempts for receiving the optimal training expression among corresponding algorithms in this study. Additionally, method appraisal consequences for two benchmark nonlinear test functions illustrate that the proposed HSIA algorithm surpasses corresponding algorithms in accuracy of function approximation issue and the industrial computer (IC) demand prediction exercise.</p>
17:00-17:15 ML042	<p>Multi-Supervised LSTM for Bengali Text Sentiment</p> <p>Syed Muaz Ali, BRAC University, Bangladesh</p> <p>Abstract—Bangla text sentiment analysis is one of the chal- lenges of recent years. Various machine learning and deep learning approaches have been made to further improve the classification models' performance to achieve state-of-the art results. Since text sentiment analysis is a sequential task, Long Short-term memory (LSTM) have provided great results in these cases. In this paper, we propose a methodology to tweak an existing LSTM model to gain further improvement in results. As Bengali Text Sentiment analysis is a sequence-to-one task, we discuss how using the features of the entire sequence generated from LSTM along with the last hidden state's output can improve the results. We compare with a single LSTM layer where the last hidden state is used for producing the final result with our methodology where also a single LSTM layer is used but with additional feature engineering and multi-supervision is applied on the generated sequence and final hidden state to produce the results. Our final results show that adding these tweaks to an existing LSTM layer can increase the overall performance of the model.</p>
17:15-17:30 ML050	<p>Forecasting Meteorological Solar Irradiation Using Machine Learning and N-BEATS Architecture</p> <p>Md. Farhadul Islam, BRAC University, Bangladesh</p> <p>Abstract—For developing nations like Bangladesh, the Calamity of Energy, one of the most important warnings experienced in the modern world, is a significant problem. Solar energy is a great solution for the future. When solar panels are used to create electricity, no greenhouse gas emissions are produced. Solar energy is essential to the</p>

	<p>shift to the production of clean energy because the sun generates more electricity than people could possibly need. In this study, for better planning and decision making for solar energy consumption, we propose a forecasting model based on Bangladeshi data. We collected the data from NSRDB(National Solar Radiation Database). Using meteorological data of 4 Regions of Bangladesh - Chittagong(CTG), Khulna(KHU), Sylhet(SYL), Rajshahi(Raj). Firstly, we find the most important feature for radiation prediction and we conduct a regression analysis based on the selected feature, then for time series analysis, we use state-of-the-art N-BEATS architecture, which gives us impressive results with very low computational cost and time. N-BEATS outperformed other popular models like LSTM and SARIMA.</p>
<p>17:30-17:45 ML013</p>	<p>Action Classification in Human Robot Interaction cells in Manufacturing Shakra Mehak, <i>Pilz Ireland, Technological University Dublin, Ireland</i></p> <p>Abstract—Action recognition has become a prerequisite approach to fluent Human-Robot Interaction (HRI) due to a high degree of movement flexibility. With the improvements in machine learning algorithms, robots are gradually transitioning into more human-populated areas. However, HRI systems demand the need for robots to possess enough cognition. The action recognition algorithms require massive training datasets, structural information of objects in the environment, and less expensive models in terms of computational complexity. In addition, many such algorithms are trained on datasets derived from daily activities. The algorithms trained on non-industrial datasets may have an unfavorable impact on implementing models and validating actions in an industrial context. This study proposed a lightweight deep learning model for classifying low-level actions in an assembly setting. The model is based on optical flow feature elicitation and mobilenetV2-SSD action classification and is trained and assessed on an actual industrial activities’ dataset. The experimental outcomes show that the presented method is futuristic and does not require extensive preprocessing; therefore, it can be promising in terms of the feasibility of action recognition for mutual performance monitoring in real-world HRI applications. The test result shows 80% accuracy for low-level RGB action classes. The study's primary objective is to generate experimental results that may be used as a reference for future HRI algorithms based on the InHard dataset.</p>
<p>17:45-18:00 ML025</p>	<p>Impact of Sentiment Analysis for the 2020 U.S. Presidential Election on Social Media Data MIFTAHUL QORIB, <i>University of the District of Columbia, USA</i></p> <p>Abstract—The increased number of social media platforms allows different groups of people around the globe to express their thoughts and sentiments on such media. Such ideas and opinions might implicate the user's social and political perspectives. Those perspectives are subject-specific inputs that have been useful to data science researchers to do community detection and sentiment analysis studies. Research studies utilize the rich information from social media, such as Twitter, to gain a better knowledge of public opinion in societies. In our study, we proposed a machine learning-based algorithm to predict and classify the textual data from Twitter about the 2020 US election campaign. The opinion poll of the presidential elections might be inaccurate or bias, resulting in providing significant negative effects with voters. The dataset was collected during the 2020 presidential election campaign toward the voting day. In addition to the original tweets, we generated fake tweets added to the dataset. Before organizing the comprehensive data and validation, we have done data cleaning and screening to get a reasonable and sensible correlation. For comparison, we used a total of five classification algorithms, such as Linear Support Vector Classification (LSVC), Random Forest (RF), Decision Tree (DT), Logistic Regression, and Naive Bayes. The study found that Trump was more popular than Biden on Twitter. Even though he was more famous than his rival, the study suggested that Joe Biden has a higher average percentage of positive sentiments than Donald Trump nationally. On the other hand, Donald Trump has a higher average percentage of negative sentiments than Joe Biden. In favor of Joe Biden compared to Donald Trump during the 2020 US presidential election, which led to the prediction that Joe Biden would outperform Donald Trump in the 2020 election. Furthermore, adding fake tweets into the dataset has slightly decreased Naive Bayes, Decision Tree, and LinearSVC model performances, but it slightly improved the Logistics Regression model classifier. Retrospectively, the Twitter data could have successfully predicted the US presidential election outcome by factoring in the proportion of positive and negative sentiment for the leading candidates. The study concludes that social media data-based sentiment</p>

	analysis provides an accurate prediction model for American presidential elections.
18:00-18:15 ML057	<p>Sleep Quality Prediction from Wearables using Convolution Neural Networks and Ensemble Learning</p> <p>Berrenur Saylam, <i>Boğaziçi University, Turkey</i></p> <p>Abstract—Sleep is among the most important factors affecting one’s daily performance, well-being, and life quality. Nevertheless, it became possible to measure it in daily life in an unobtrusive manner with wearable devices. Rather than camera recordings and extraction of the state from the images, wrist-worn devices can measure directly via accelerometer, heart rate, and heart rate variability sensors. Some measured features can be as follows: time to bed, time out of bed, bedtime duration, minutes to fall asleep, and minutes after wake-up. There are several studies in the literature regarding sleep quality and stage prediction. However, they use only wearable data to predict or focus on the sleep stage. In this study, we use the NetHealth dataset, which is collected from 698 college students’ via wearables, as well as surveys. Recently, there has been an advancement in deep learning algorithms, and they generally perform better than conventional machine learning techniques. Among them, Convolutional Neural Networks (CNN) have high performances. Thus, in this study, we apply different CNN architectures that have already performed well in the human activity recognition domain and compare their results. We also apply Random Forest (RF) since it performs best among the conventional methods. In future studies, we will compare them with other deep learning algorithms.</p>
18:15-18:30 ML1001	<p>A Novel Explainable Machine Learning Framework Using an NLP Interface</p> <p>Dessureault, Jean-Sebastien, <i>Université du Québec à Trois-Rivières, Québec, Canada</i></p> <p>Abstract—This paper proposes a novel machine learning framework that encapsulates recent concerns of the data scientists community: accessibility and explainability. This framework, called AI2, proposes a natural language interface, making the framework accessible even to a non-expert. Traditionally, machine learning frameworks are accessible using a programming language. Python is one of the most common programming language for coding different machine learning methods. The AI2 framework, although made with Python scripts, is made to be accessed in a natural language, namely, English. Hence, the first contribution is about accessibility, allowing a non-data scientist to exploit a machine learning framework without knowing how to code. For decades, the data scientists community has known that one of the drawbacks in the machine learning field is the black-box problem. Data scientists have to create different methods to explain their results. The second contribution of this paper is to encapsulate the principle of explainability in the framework, systematically proposing not only the results but also the explanations of the results for every included machine learning algorithm.</p>

Mar. 11 (Sat.) 16:00-18:30

< ZOOM Room B: 849 2832 2994 >

Online Session 4: Digital Image Imaging and Processing Technology

Session Chair:

Time & Paper ID	Speech Title & Presenter
16:00-16:15 ML0026	<p>Rough Rice Grading in the Philippines Using Infrared Thermography</p> <p>Orfel Ledesma Bejarin, <i>Isabela State University, Philippines</i></p> <p>Abstract—The Rough rice grading is a set of standard methods and processes for evaluating quality that are important to marketing and process controls. IR thermography uses the electromagnetic spectrum's infrared region to detect heat that has been emitted. FLIR ONE thermal camera was used to acquire images of the sample. In order to represent each sample, a thermal index was generated using the average value of the pixels in the thermal image. In this study, the grading of rough rice was evaluated using infrared thermography and image processing techniques. Using infrared thermography, the results of the study indicated that detecting moisture content was 87.30% accurate and detecting foreign matter was 95.04% accurate. The results showed that infrared thermography evaluation using spectral analysis could accurately determine the moisture content of rough rice. Farmers, rice millers, and other related government agencies can greatly benefit from the application of non-contact, non-destructive methods for determining the purity and moisture content of rough rice.</p>
16:15-16:30 ML003-A	<p>Motion-blur Detection in Underwater Images Using Classical-quantum cnn based Method</p> <p>Sreeraj Rajan Warriar, <i>Mahindra University, India</i></p> <p>Abstract—Underwater images often suffer from turbidity, low-contrast, low-light and high noise. Underwater sensing and imaging technologies are of significant interest in many applications such as pipeline and optical fibre monitoring, ocean bed resource explorations, etc [1]. Due to the unique conditions present underwater image enhancement tools play a crucial role in object detection and recognition. In the present work, we propose a quantum-classical CNN based method for identification of motion blur in the images taken by an autonomous underwater vehicle (AUV) built in-house at MU. We first predict the presence of motion_x0002_blur in the images from a standard dataset PASCAL VOC 2010 followed by the real-time images taken from AUV. We further estimate the motion blur kernel function or motion blur field distribution using the method discussed in [2].</p>
16:30-16:45 ML012	<p>Filters & Lumination: Creating Multi-illuminant Images for Computational Color Constancy</p> <p>Ilija Domislović, <i>University of Zagreb, Croatia</i></p> <p>Abstract—White-balancing is a very important process in photography. It is present in every digital camera, and it has a significant influence on how an image will look. It removes the chromatic effect of scene illumination so that the image looks as though it is illuminated by a perfectly white light. This needs to be done so that images look natural. The Human Visual System does this and without white-balancing digital images look odd. Many methods have been developed, and it was shown that the best</p>

	<p>results are obtained using learning-based methods. Learning-based methods rely on large, diverse datasets for proper training and evaluation. While there are many datasets with images affected by a single uniform illuminant, thorough research on images affected by multiple illuminants has only recently started. To help with such research, in this paper we propose a new way to create multi-illuminant color constancy images. With our approach, images of a diverse set of scenes with a variable number of illuminants can be created. Our approach also includes an automatic way to create a per-pixel illumination mask for each image. We used around 100 different scenes to evaluate our dataset creation approach. We also evaluate several methods from the literature on our images.</p>
16:45-17:00 ML046-A	<p>Real-Time Digital Meter Reading on Edge Devices based on Deep Learning</p> <p>Rafaela Carvalho, <i>Fraunhofer Portugal AICOS, Portugal</i></p> <p>Abstract—The introduction of industrial intelligence in maintenance processes is crucial for supporting decision-making systems and allowing proper auditing methods. To automate the current manual and error-prone reading process of digital meters, this work proposes a deep learning-based solution for Sc200 controllers and FT flow meters. As a first step, we employ a screen detection module to extract the digital display area of the equipment, followed by a perspective correction step. Subsequently, the text regions are identified with a fine-tuned EAST text detector and the values for reading are selected, based on the expected graphical structure. Finally, a fine-tuned CRNN model extracts the important text and registers it into the server. The overall results show that 55.47% and 63.70% of the values are correctly recognized in Sc200, while 67.19% of the readings from FT meters are correct. This pipeline performs in real-time and reduces workload as it can seamlessly be incorporated into the operators' existing workflow.</p>
17:00-17:15 ML1003	<p>Explainability and Interpretability in Agent based Modelling to Approximate Market Indexes</p> <p>Filippo Neri, <i>University of Naples, Italy</i></p> <p>Abstract—The study will discuss the notions of explainability and interpretability in a specific domain that is financial market modeling. The study will in fact show the notions of explainability and interpretability when agent based modeling is used to approximate market indexes. In order to conduct the empirical evaluation in this study the L-FABS system will be used. L-FABS learns agent based models whose parameters are determined by simulated annealing. L-FABS aims to explain and predict financial time series like: SP500, DJIA, GLD, SLV, etc. The study will assume the following definitions for interpretability: being able to make sense of system output. And for explainability: understanding how that system's output was generated. The main novelty of the paper stands in the discussion of explainability and interpretability in the context of agent based modelling as implemented in L-FABS. An empirical case study will be presented. Please note that the goal of this paper is not to describe how the L-FABS system works.</p>
17:15-17:30 ML0022	<p>Deep QA: An Open-Domain Dataset of Deep Questions and Comprehensive Answers</p> <p>Harshavardhan Veeranna Navalli, <i>PES University, India</i></p> <p>Abstract—Current available question answering(QA) datasets fall short in two aspects - providing comprehensive answers that span over a few sentences and questions being deep or analytical in nature. Though individually these issues are addressed, a dataset that addresses both these issues is still not available. To address this gap, we introduce Deep QA(DQA), i.e., a dataset consisting of 12816 questions broadly classified into 4 types of questions. The generated dataset has been analyzed and compared with a standard QA dataset to prove that it demands higher cognitive skills. To prove the point further, state of art models trained on remembering type factive QA dataset have been pre-trained on the proposed dataset and are shown to perform poorly on the question types generated. Finally, some preliminary investigation using a graph neural model has been done to probe the possibility of an alternative answer generation technique on such a dataset of deeper questions.</p>
17:30-17:45 ML10002	<p>Enhanced Acoustic Noise Reduction Techniques for Magnetic Resonance Imaging System</p> <p>I. Juvanna, <i>Hindustan Institute of Technology and Science, India</i></p>

	<p>Abstract—Magnetic Resonance Imaging is a diagnostic tool meant for scanning organs and structures inside the body. The undesirable effect of MRI machine is the significant high level of acoustic noise produced at the time of scanning, which creates more negative effects. Therefore there is a necessity to reduce this noise level. Various solutions, including software and hardware upgrades, can be utilized to address this issue. The suggested model includes an active noise control (ANC) system for pre-recorded sound from a MRI scanner. The modified ANC with Filtered Least Mean Square Algorithm (FxLMS) technique aids in reduction of noise level produced in the MRI scanner. Then the performance of the system can be analyzed by three different cases such as insulation of the chamber by glasswool, performance of noise level reduction in the presence of static magnetic field, and analysis of noise level reduction by employing multiple microphones with this modified ANC system. The sound pressure level (SPL) is measured with and without ANC system. From the result analysis, it is found that the ANC system performance is enhanced to significant level of 24 dB noise reduction with glasswool insulation and 25 dB noise reduction with multiple microphones, while the static magnetic field does not affect the system performance.</p>
<p>17:45-18:00 ML030</p>	<p>An Approach to Multi-Party Privacy Conflict Resolution for Co-owned Images on Content Sharing Platforms</p> <p>Farzad Nourmohammadzadeh Motlagh, <i>Hasso-plattner-institute, Germany</i></p> <p>Abstract—The popularity of content-sharing platforms such as Online Social Networks (OSNs) is due primarily to advances in information-sharing technologies. One feature that makes content-sharing platforms particularly attractive for users is the possibility of capturing and sharing images. Image sharing however raises a privacy issue in the case of jointly owned images. Jointly owned images might involve users with varying privacy concerns, ranging from very strict (no disclosure) to very relaxed (share everything). So, sharing such images requires obtaining explicit permission to avoid privacy violations. However, obtaining explicit permission from the stakeholders (users) involved is a time-consuming process that additionally raises multi-party privacy conflicts (MPC). In this paper, we present a privacy inference model that operates by considering user preferences in order to automate the decision-making process involved in resolving Multi-Party Privacy Conflicts and inferring user permissions with respect to sharing co-owned images on content-sharing platforms such as OSNs. Our results demonstrate that our privacy inference model performs with 79.60% accuracy.</p>
<p>18:00-18:15 ML039</p>	<p>English To French Neural Machine Translation Using Transformer</p> <p>Md Humaion Kabir Mehedi, <i>BRAC University, Bangladesh</i></p> <p>Abstract—Neural Machine Translation is a many-to-many problem, like a short sentence in a particular language may become long in another language or vice versa. Sequence-to-sequence models are deep learning models that have excelled in tasks like machine translation, text summarization, and picture captions. A model that outputs another sequence of items from a sequence of input items (words, letters, features of an image, etc.) is known as a sequence-to-sequence model. The Transformer is a model that uses attention to boost the speed with which these models can be trained. In our project, we have used this transformer which is a Seq2Seq model to create an English-to-French language translator. Our project can help to create a more robust and effective translator. It can be used for other languages as well. This model can be used on creating a translator chatbot as well.</p>
<p>18:15-18:30 ML1010</p>	<p>The Impact of Social Media Text Tone on Stock Prices: Evidence from SeekingAlpha.Com</p> <p>Yilin Niu, <i>Minzu University of China, China</i></p> <p>Abstract—This paper investigates whether social media text tone impacts financial markets. I collect data from SeekingAlpha.com. I find that social media text tone is positively correlated with stock return. User-level analyses indicate that the effect on return is more significant if a user is an influencer, which I define as a person who has many followers and has the power to influence many people through social media, and if the user is more senior, which I define as having extended access to social media platforms. Content analyses indicate that the length of articles negatively correlates with market returns. Additionally, investors overreact to information on social media, and a reversal pattern is observed in the long run. Overall, tone and</p>

