MLIS 2022

The 4th International Conference on Machine Learning and Intelligent Systems

November 8th-11th, 2022

Online via MS TEAMS

Conference Program

Supporter KEIMYUNG UNIVERSITY

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MLIS 2022
CONFERENCE PROGRAM

November 8th-11th, 2022

Korea Standard Time (UTC/GMT+9:00)

ONLINE-Microsoft Teams Meeting

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Part II Plenary Session

Opening and Welcome Speech from Conference General Chair

MLIS 2022 Conference General Chair
Prof. Jong-Ha Le

Keimyung University, South Korea

Plenary Speech 1: New Artificial Intelligence Technologies in Healthcare

Prof. Huiyu Zhou

School of Computing and Mathematical Sciences, University of Leicester, UK

Biography: Dr. Huiyu Zhou received a Bachelor of Engineering degree in Radio Technology from Huazhong University of Science and Technology of China, and a Master of Science degree in Biomedical Engineering from University of Dundee of United Kingdom, respectively. He was awarded a Doctor of Philosophy degree in Computer Vision from Heriot-Watt University, Edinburgh, United Kingdom. Dr. Zhou currently is a full Professor at School of Computing and Mathematical Sciences, University of Leicester, United Kingdom. He has published over 380 peer-reviewed papers in the field. He was the recipient of "CVIU 2012 Most Cited Paper Award", "MIUA 2020 Best Paper Award", "ICPRAM 2016 Best Paper Award" and was nominated for "ICPRAM 2017 Best Student Paper Award" and "MBEC 2006 Nightingale Prize". His research work has been or is being supported by UK EPSRC, ESRC, AHRC, MRC, EU, Royal Society, Leverhulme Trust, Invest NI, Puffin Trust, Alzheimer's Research UK, Invest NI and industry.
Homepage: https://www2.le.ac.uk/departments/informatics/people/huiyu-zhou.

Abstract: Artificial intelligence has significantly influenced the health sector for years by delivering novel assistive technologies from robotic surgery to versatile biosensors that enable remote diagnosis and efficient treatment. While the COVID-19 pandemic is devastating, the uses of AI in the healthcare sector are dramatically increasing and it is a critical time to look at its impact in different aspects. In this talk, I will introduce the application of new deep learning models in medical image understanding. Then, I will discuss Parkinson's disease (PD) whilst investigating the behaviour analysis of PD mice. I also present the use of machine learning technologies in sentiment analysis, followed by the discussion on several challenges.

Plenary Speech 2: Efficient and Robust Direct Sampling-Type Methods for General Ill-Posed Inverse Problems

Prof. Jun Zou

Department of Mathematics, The Chinese University of Hong Kong, Hong Kong SAR, China

Biography: Jun Zou is currently Choh-Ming Li Chair Professor of Mathematics of The Chinese University of Hong Kong, and Head of Department of Mathematics. Before taking up his position at The Chinese University of Hong Kong in 1995, he had worked two years (93-95) in University of California at Los Angeles as a post-doctoral fellow and a CAM Assistant Professor, worked two and a half years (91-93) in Technical University of Munich as a Visiting Assistant Professor and an Alexander von Humboldt Research Fellow (Germany), and worked two years (89-91) in Chinese Academy of Sciences (Beijing) as an Assistant Professor. Jun Zou's research interests include numerical methods and analyses of direct and inverse problems of partial differential equations. He is currently vice president of Hong Kong Mathematical Society and president of East Asia Section of Inverse Problems International Association. He serves currently as the associate editor of 12 international mathematics journals, including SIAM Journal on Numerical Analysis, SIAM Journal on Scientific Computing and ESAIM: Mathematical Modelling and Numerical Analysis. Jun Zou was elected a SIAM Fellow in 2019 and an AMS Fellow in 2022.

Abstract: In this talk we present a survey of recent developments of direct sampling type methods (DSMs) for solving general linear and nonlinear inverse problems of partial differential equations. The sampling type methods were proposed earlier for solving inverse acoustic scattering problems with far-field or near-field data [1-2], then developed for inverse electromagnetic scattering problems [3], and further extended for several representative non-wave type inverse problems, including electric impedance tomography [4], diffusive optical tomography [5], inversion of Radon transform [6], as well as recovering moving inhomogeneous inclusions [7]. DSMs have also been demonstrated recently to be applicable to the simultaneous reconstruction of inhomogeneous inclusions of different physical nature [8]. The DSMs are computationally cheap, highly parallel, and robust against noise, particularly applicable to the cases when very limited data is available. Motivations, principles and justifications of DSMs are addressed in this survey talk. Numerical experiments are demonstrated for various inverse problems. There are intensive studies of this type of numerical methods, and some of the references for those most representative inverse problems are listed below.

These research projects were supported by Hong Kong RGC General Research Fund (Projects 14306921 and 14306719).

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Plenary Speech 3: Leveraging AI for Smart Transportation

Prof. Sanjay Ranka

Department of Computer Information Science and Engineering, University of Florida, USA

Biography: Sanjay Ranka is a Distinguished Professor in the Department of Computer Information Science and Engineering at University of Florida. From 1999-2002, as the Chief Technology Officer at Paramark (Sunnyvale, CA), he developed a real-time optimization service called PILOT for marketing campaigns. PILOT served more than 10 million optimized decisions a day in 2002 with a 99.99% uptime. Paramark was recognized by VentureWire/Technologic Partners as a Top 100 Internet technology company in 2001 and 2002 and was acquired in 2002. Sanjay has also held positions as a tenured faculty member at Syracuse University, academic visitor at IBM and summer researcher at Hitachi America Limited.

Research in high performance computing and bigdata science is an important avenue for novel discoveries in large-scale applications. The focus of his current research is the development of efficient computational methods and data analysis techniques to model scientific phenomenon, and practical applications of focus are improvements to the quality of healthcare and the reduction of traffic accidents. A core aspiration of his research is to develop novel algorithms and software that make an impact on the application domain, exploiting the interdependence between theory and practice of computer science.

He has coauthored one book, four monographs, 300+ journal and refereed conference articles. His recent coauthored work has received a best student paper runner-up award at IGARSS 2015, best paper award at BICOB 2014, best student paper award at ACM-BCB 2010, best paper runner-up award at KDD-2009, a nomination for the Robbins Prize for the best paper in the Journal of Physics in Medicine and Biology in 2008, and a best paper award at ICN 2007. His work has received 14,000+ citations with an h-index of 58 (based on Google Scholar). He has consulted for several startups and Fortune 500 companies.

He is a fellow of the IEEE, AAAS and AAIA (Asia-Pacific Artificial Intelligence Association) and a past member of IFIP Committee on System Modeling and Optimization. He won the 2020 Research Impact Award from IEEE Technical Committee on Cloud Computing. He is an associate editor-in-chief of the Journal of Parallel and Distributed Computing and an associate editor for ACM Computing Surveys, IEEE/ACM Transactions on Computational Biology and Bioinformatics, Sustainable Computing: Systems and Informatics, Knowledge and Information Systems, and International Journal of Computing. Additionally, he is a book series editor for CRC Press for Bigdata. In the past, he has been an associate editor for IEEE Transactions on Parallel and Distributed Systems and IEEE Transactions on Computers. He was a general co-chair for ICDM in 2009, International Green Computing Conference in 2010 and International Green Computing Conference in 2011, a general chair for ACM Conference on Bioinformatics and Computational Biology in 2012, and a program chair for 2013 International Parallel and Distributed Processing Symposium and 2015 High Performance

Computing Conference. He was a co-general chair for DataCom 2017 and co-program chair for ICMLDS 2017 and 2018.

Abstract: Mitigating traffic congestion and improving safety are the cornerstones of transportation within smart cities. Current practices collect and analyze data from sensors and video processing and then process it offline. Hence, they are limited in proactively reducing traffic fatalities and preventable delays at intersections. We are developing real-time artificial intelligence algorithms and software to analyze video feeds from cameras and fuse them with ground sensor data to develop deep learning based digital twins that mimic traffic behavior both at an intersection and at the city level. We are also using the resultant output to develop technologies that will quantitatively measure and rank intersections by safety, to transmit information about unsafe behavior to connected vehicles and pedestrians in real-time to prevent accidents, and to optimize signal timing to reduce congestion.

Each of these advances are presently being field tested at intersections in the City of Gainesville and in Seminole County. The overall effort is geared toward developing transportation solutions for leading edge 21st century smart cities.

Plenary Speech 4: How Interacting Agents Use Different Types of Learning to Interact Adaptively

Prof. Jan Treur & Dr. Sophie C.F. Hendrikse

Vrije Universiteit Amsterdam, Netherlands

Biography: Jan Treur has been a full professor of AI since 1990 and is a well-recognized expert in the area of multidisciplinary human-like AI modeling. He has published over 700 well-cited papers about cognitive, affective, and social modeling and AI systems making use of such models. He has also supervised more than 40 Ph.D. students in these areas and from 2016 on written and edited three books on (adaptive) network-oriented AI modeling and its application in various other disciplines. Current research addresses the modeling of higher-order adaptive processes by self-modeling network models with a specific focus on mental processes based on internal mental models and their use by internal simulation, their learning or formation (including organizational learning), and the control over them. An application focus is on the development and use of shared mental models supporting the road toward a just safety culture in organizations such as hospitals. A joint Springer Nature book about computational modeling of multilevel organizational learning is in preparation and will come out by the end of 2022 or the beginning of 2023.

Sophie Hendrikse holds a position as researcher at the Clinical Psychology department at Vrije Universiteit Amsterdam and as a guest researcher at the Methodology and Statistics unit within the Psychology institute at Leiden University. She was educated through a research master in Social and Behavioral Sciences and a master in Computer Science with a specialization in Artificial Intelligence and Data Science. Her research focuses on multimodal social interaction of humans and/or artificial agents. She has developed multi-adaptive agent models to capture intrapersonal synchrony, interpersonal synchrony and adaptive social behaviors based on human-human interactions research. These agent models can be used both in agent-agent interactions and human-agent interactions. In a Springer Nature book that will come out in 2023 this will be discussed in detail. She has also been involved in the development of a brain-computer interface and studies algorithms to analyze interpersonal synchrony.

Abstract: When humans interact, multiple types of adaptivity occur, concerning their behaviour toward each other. For example, these types of behavioural adaptivity include short-term effects such as affiliation but also long-term effects such as bonding. Moreover, some forms of behavioural adaptivity apply to specific persons, whereas other forms apply in a generic manner to any person. The latter is addressed in theories such as attachment theory, describing how behavioural adaptations acquired in one relationship also have their effects in other relationships. All these forms of adaptivity or learning can be considered first-order adaptivity. However, their occurrence and strength depend on contextual circumstances. This dependence functions as a form of context-sensitive control of adaptivity and can be conceptualised as second-order adaptivity. Within neuroscience, it has been found that central mechanisms in the causal pathways leading to such forms of adaptivity or plasticity

can be based on synaptic plasticity (adaptive connections, for example based on Hebbian learning) or nonsynaptic plasticity (adaptive intrinsic properties of neurons such as excitability thresholds). Moreover, it also has been found within neuroscience that metaplasticity occurs to control plasticity in a context-sensitive manner. In this plenary speech, it is discussed which learning or adaptation principles can apply to describe the different types of pathways to behavioural adaptivity mentioned above and how they relate to the learning or adaptation mechanisms identified within neuroscience. The work discussed here is based on a series of computational analyses that have been conducted last year and this year using a self-modeling network modeling approach. A Springer Nature book about this work will come out in 2023.

Part III E-Poster Presentations

Online Poster Guidelines

- All E-Posters will be demonstrated on the official conference website.
- Participants could view and share their comments on the website. If you have any questions on E-posters, kindly contact conference secretary for assistance.
- Signed and stamped electronic presentation certificate would be issued via e-mail after the presentation is delivered.

List of Posters

Please get access of the e-posters via http://www.academicconf.com/poster?confname=mlis2022

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ML1469	A study of regression models for estimation of greenhouse gas "methan" in paddy field *Mr. Ryota Kishaba, Meiji University, Japan*
ML1470	Time series forecast of environment factors to support Prediction of Methane (CH4) *Mr. Keigo Chiba, Meiji University, Japan*
ML1473	An intelligent data labelling tool that supports machine learning for frost forecast *Mr. Tokio Tanaka, Meiji University, Japan*
ML1523	Metaheuristics taxonomy *Dr. Dunia Sattar Tahir, University of Basrah, Iraq*
ML1509	Quaternion modeling of a delta planar robot and training of an enhanced multilayer neural network to solve the inverse kinematic problem *Dr. Eusebio Jiménez-López, Universidad Tecnológica del Sur de Sonora-ULSA Noroeste, México*

Abstracts of Poster Presentations

ML1453: Luminosity determination for a synchrotron accelerator and for a collider with scintillators detectors systems

Madalina Cruceru[1, *], Anatoly Litvinenko[2] and Serghey Afanasiev[2]

[1]*Department of Applied Nuclear Physics/ Horia Hulubei National Institute of Physics and Nuclear Engineering, Magurele, Romania*

[2]*Veksler and Baldin Laboratory of High-Energy Physics/Joint Institute for Nuclear Research, Dubna, Russia*

*Corresponding author: madalinacruceru48@gmail.com

Abstract. Two detectors systems with scintillators were proposed for luminosity determination. First detector was designed and assembled in Horia Hulubei NIPNE for the Internal Target Station at the Nuclotron superconductive synchrotron accelerator in JINR Dubna. This detector is a ΔE-E semiconductor detector combined with a CsI(Tl) inorganic scintillator crystal. The scintillator crystal has 10x10x30 mm3 and is produced by Hangzhou Yong Hee Photonics Co., Ltd. China. The impurity in crystal is Thallium with 1500ppm concentration. The CsI(Tl) crystal is positioned between two Si PIN photodiodes. The first photodiode (ΔE part of detector) is a thin silicon(20μm) photodiode from CiS Germany. The second photodiode (E part detector) has a thickness of 300μm type S 7478 made by Hamamatsu, Japan. Luminosity was calculated with this ΔE-E detector in the case of dA reactions on thin targets (Ag and Cu) for secondary protons. It was obtained the value (0.49±0.01) $x10^{30}$ $cm^{-2}s^{-1}$. For NICA (Nuclotron-based Ion Collider Acility) collider from JINR Dubna a plastic scintillation detector system is designed in VBLHEP department. The system has two symmetric detectors (left and right) located on both sides of the interaction point at equal distances L=300cm along the collision axis. Each detector has three planes of four concentric rings centered at the collision axis. The luminosity obtained with this detector is $1x10^{27}cm^{-2}s^{-1}$ for Au-Au reactions with protons spectators. Because in a collider experiment where the detector is symmetric, the event rate is lower than in a fixed target experiment where the event rate is high, this explains the experimentally values for luminosity obtained with our scintillators detectors.

Keywords: Luminosity, Scintillator, Inorganic

ML1469: A study of regression models for estimation of greenhouse gas "Methan" in paddy field

Ryota Kishaba[1*], Yuto Morishita[1], Keigo Chiba[1], Ding Liya[1], Kosuke Noborio[2] and Sunchai Phumgern[2]

[1] *School of Science and Technology, Meiji University 1-1-1 Higashimita, Tama-ku, Kawasaki, 214-8571, Japan*

[2] *School of Science and Technology, Meiji University, 1-1-1 Higashimita, Tama-ku, Kawasaki, 214-8571, Japan*

Corresponding author: ce211019@meiji.ac.jp; emosaku7@gmail.com

Abstract. Methane (CH4), a greenhouse gas produced by rice paddies, is responsible for about 23% of the global warming effect of all greenhouse gases. Therefore, an accurate estimation of CH4 occurrence is meaningful to help human action in reducing CH4 emissions so that mitigating global warming.

The factors related to CH4 generation include air temperature (AT), soil temperature (ST), and soil water content (SWC). Using these factors as input, a trained regression model can be applied to estimate CH4 at the same time.

Three kinds of models: neural networks, support vector regression, and polynomial regression, have been constructed and evaluated for RMSE using 5-folds cross-validation with different combinations

of input variables. As a preliminary result, an average RMSE of 10 for CH4 reading (range 0~100, after removal of negative cases done in data cleaning) is achieved, with the data measured in a rice paddy at Tokyo University of Agriculture and Technology, Japan, during May to September 2021.We have also observed that (a) polynomial regression shows the best performance; (b) any model with three input variables is better than the same model with two variables, while the combination of AT and SWC is better than other combinations with two input variables.
Considering that SWC does not behave as time-series data and is subject to change due to anthropogenic influences such as water supply and drainage, further efforts are needed to improve the accuracy of regression models as well as that of the time series models for AT and ST.

Keywords: Neural networks, Support vector regression, Polynomial regression, Cross validation, Regression with time series forecast

ML1470: Time series forecast of environment factors to support Prediction of Methane (CH_4)

Keigo Chiba[1*], Ryota Kishaba[1], Yuto Morishita[1], Ding Liya[1], Kosuke Noborio[2] and Sunchai Phungern[2]
[1] School of Science and Technology, Meiji University 1-1-1 Higashimita, Tama-ku, Kawasaki, 214-8571, Japan
[2] School of Agriculture, Meiji University 1-1-1 Higashimita, Tama-ku, Kawasaki, 214-8571, Japan
**Corresponding author: ce221050@meiji.ac.jp; c.keigo1008@gmail.com*

Abstract. Methane-producing bacteria lurk in the soil of rice paddies and feed on organic matter such as rice straw to produce methane. Rice cultivation produces 45% of the methane emitted by human activities in Japan. In addition, Greenhouse effect of Methane (CH_4) is approximately twenty-four times as big as that of carbon dioxide and leads to "Global Warming". An early alarm of methane occurrence is helpful to guide human action in reducing methane.
CH_4 occurrence is rather irregular and impacted by meteorological and soil factors. Forecast of future CH_4 occurrence is challenging with unknown future readings of those factors. Air temperature (AT) and soil temperature (ST) have been confirmed highly relevant among influence factors to CH_4, and more importantly their future values can be possibly forecasted through time series forecasting. We analyzed the trends of AT and ST observed in rice paddies using Auto-Regressive models to predict their future values. The predicted results will then be fed into regression models to predict future methane.
Experiments were done using datasets collected in a rice paddy at Tokyo University of Agriculture and Technology, Japan, during May to September 2021. As preliminary results, we achieved forecast accuracies with an average error at ± 2.48℃ for AT and ± 0.71℃ for ST for 1-day continuous period, and ± 2.97℃ for AT and ± 0.97℃ for ST for 3-day continuous period.
More investigation in time series models is being carried out for better forecast accuracy. With the support of time series forecasting on meteorological and soil data, and good regression models, forecast of CH_4 can be achieved.

Keywords: Methene (CH_4) prediction, Time series forecast, Auto-regression model, Machine learning

ML1473: An intelligent data labelling tool that supports machine learning for frost forecast

Tokio Tanaka[1,*], Shugo Yoshida[1], Liya Ding[1], Kosuke Noborio[2] and Kazuki Shibuya[2]
[1]*School of Science and Technology, Meiji University, Japan*
[2]*School of Agriculture, Meiji University, Japan*
**Corresponding author: ee191103@meiji.ac.jp*

Abstract. To forecast the occurrence of frost using machine learning, a dataset labelled with the status of frost corresponding to meteorological conditions is required. Currently, we use a manually labelled dataset based on measured meteorological factors model training. However, more labelled data is required for further development and continuous training of forecast models, therefore an efficient labelling method is needed.
In this study, we propose a labelling tool that performs automatic labelling using machine learning for most of the cases but leaves only those with insufficient confidence to manual processing.
Random forests, gradient boosting decision trees, and logistic regression are employed for labelling models with Air Temperature, Wetness Level, and Vapor Pressure Deficit (VPD) as input features. The labelling models are first trained with a small set of manually labelled data, and then applied to unlabelled data to make prediction. The prediction results are used as labels and the probabilities of prediction as confidence. To ensure the quality of labelling, we set two thresholds for positive and negative cases. When confidence is sufficiently high, a newly labelled case is added to training dataset for further model retraining otherwise manual labelling is required. This process is continued iteratively until a satisfactory amount of training data achieved. For those cases requiring manual labelling we offer a convenient view of surrounding environments factors to support the identification. This tool significantly reduces the effort of manual labelling while providing reliable labelled data that can be used for training frost forecast models.

Keywords: Frost forecast, Data labelling, Predictive models, Machine Learning

ML1523: Metaheuristics taxonomy

Dunia Sattar Tahir
Department of Computer Engineering, College of Engineering, University of Basrah, Basrah 61001, Iraq
**Corresponding author: dunia.tahir@uobasrah.edu.iq*

Abstract. Metaheuristics are a powerful tool for solving complex optimization problems in a variety of scientific and engineering disciplines due to their generality, stochasticity, flexibility, and gradient-free nature. Metaheuristics can be classified based on various inspiration fields to seven categories: biology, physics, chemistry, athematical, social, music, and sport and games.

ML1509: Quaternion modeling of a delta planar robot and training of an enhanced multilayer neural network to solve the inverse kinematic problem

Eusebio Jiménez-López[1], Renée Nicole Espinoza-Miranda[2], Aldo López-Martínez[3], Eduardo Núñez-Pérez[2], Pedro Alberto Limón-Leyva[4], Kevin Fierro-Ruiz[2] and Francisco Cuenca-Jiménez[5]
[1] *Universidad Tecnológica del Sur de Sonora-ULSA Noroeste, México*
[2] *Universidad La Salle Noroeste, México*

[3] *Centro de Ingeniería y Desarrollo Industrial (CIDESI), México*
[4] *Instituto Tecnológico de Sonora, México*
[5] *Universidad Nacional Autónoma de México, México*
**Corresponding author: ejimenezl@msn.com*

Abstract. This paper presents the modeling of the inverse kinematic problem related to the motions of a planar delta robot using the algebra of unitary Quaternions. The mathematical model resulting from the inverse kinematic analysis has an associated system of 8 nonlinear algebraic equations with 8 polynomial unknowns. The Newton-Rapshon method was used to solve the mathematical model of the robot. Subsequently, using the inverse model of the robot, a database was constructed that relates the Cartesian coordinates of the end effector to the angles and axes of the rotations of the links. This database was used to train a multilayer neural network in order to have an equivalent model of the inverse problem. A series of experiments were performed to obtain an improved network configuration by varying four training parameters. The results obtained show that the improved trained network can be used to solve the inverse problem of the studied robot.

Keywords: Robot, Neural networks, Newton-Rapshon, kinematics

Part IV Oral Presentations

Online Oral Presentation Guidelines

- Online Oral Presentation will be conducted via Microsoft Teams Meeting.
- All presenters are requested to reach the Online Session Room prior to the schedule time and complete their presentation on time.
- **All presentation times are shown in Korea Standard Time (GMT/UTC+9:00).**
- If a presenter is not able to show up via Teams, the session chair / conference secretary will play the pre-recorded video presentation during his/her scheduled presentation time, if listeners have questions about the presentation, please contact the conference secretary to forward the questions.
- If a presenter cannot show up on time or have problem with internet connection, the session chair has the right to rearrange his/her presentation, and let the next presentation start.
- Signed and stamped electronic presentation certificate would be issued via e-mail after presentation.

Best Oral Presentations Selection

The session chair will select one best presentations from his/her session based on the following criteria:

- ✓ Research Quality
- ✓ Presentation Performance
- ✓ Presentation Language
- ✓ PowerPoint Design
- ✓ **Effective Communications**

Best Oral Presentations Award

The Best Oral Presenter from each session will receive an official certificate and a free registration to the MLIS 2023.

Session 1_Neural Networks and Image Processing in Healthcare

Session Time: 15:00-17:50 November 9th, 2022 (Korea Standard Time (UTC/GMT+9:00)
Session Room Link: ***http://www.academicconf.com/teamslink?confname=MLIS2022***
Session Chairs: ***Prof. Rex Bringula, University of the East/National Research Council of the Philippines, Philippines***

15:00-15:15	ML1446	A neural network approach to optimizing treatments for depression using data from specialist and community psychiatric services in Australia, New Zealand and Japan *Dr. Aidan Cousins, University of New South Wales, Australia*
15:15-15:30	ML1507	Performance evaluation of a novel hybrid neural network framework in electrocardiogram and chest X-Ray classification *Dr. Vidya K Sudarshan, Nanyang Technological University, Singapore*
15:30-15:45	ML1462	Wavelet pooling scheme in the Convolution Neural Network (CNN) for breast cancer detect ion *Dr. Ratapong Onjun, Suranaree University of Technology, Thailand*
15:45-16:00	ML1467	On the wavelet convolution neural network for breast cancer image analysis *Dr. Kittikorn Sriwichai, Suranaree University of Technology, Thailand*
16:00-16:20	ML1414	Attitudes towards online learning during COVID-19: a cluster and sentiment analyses *Prof. Rex Bringula, University of the East/National Research Council of the Philippines, Philippines*
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17:10-17:25	ML1485	A two-stage architecture for breast cancer detection *Dr. Chiranjeevi Karri, University of Porto, Portugal*
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Abstracts of Oral Session 1

ML1446: A neural network approach to optimizing treatments for depression using data from specialist and community psychiatric services in Australia, New Zealand and Japan

Aidan Cousins[1], Lucas Nakano[2], Emma Schofield[1], Rasa Kabaila[3]

[1] *Faculty of Medicine and Health, Rural Clinical School, University of New South Wales, Port Macquarie 2444, Australia*

[2] *Sofia University, Tokyo, Japan*

[3] *Mid North Coast Local Health District, Community Mental Health Services, Port Macquarie 2444, Australia*

[*] *Corresponding E-mail: a.cousins@student.unsw.edu.au*

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

Keywords: Depression; Machine learning; Treatment optimization; Mental health; LSTM

ML1507: Performance evaluation of a novel hybrid neural network framework in electrocardiogram and chest X-Ray classification

Vidya K Sudarshan[1,2,*], Reshma A Ramachandra[2], Smit Ojha[3] and Ru San Tan[4,5]

[1] *School of Computer Science and Engineering, Nanyang Technological University, NTU, Singapore*

[2] *CTX7095 Analytics, India*

[3] *School of Business, University of Nottingham, United Kingdom*

[4] *National Heart Centre, Singapore*

[5] *Duke-NUS Medical School, Singapore*

[*] *Corresponding E-mail: vidya.sudarshan@ntu.edu.sg*

Abstract. Performance is one of the significant parameters commonly assessed when using any artificial intelligence based neural network models. Recently, neural network models with high

performance are in demand everywhere particularly in medical field for bio-data interpretation and diagnosis. Thus, in this paper, performance evaluation of a hybrid model called VEntNet in classification of electrocardiogram (ECG) signals and chest X-ray images as normal and having different abnormalities is presented. VEntNet framework consists concatenation of hand-crafted entropy (Shanon, Yager, Vajda, Renyi and Kapur) features extracted from the data with deep features extracted using a VGGG19 neural network and softmax activation function for performing multi-class categorization of concatenated features as normal or as having either of three different types of the abnormalities. The performance evaluation of VEntNet model demonstrated the results of (i) 98.78% accuracy, 99.08% sensitivity, and 99.08% specificity for four-class classification (Normal, Tuberculosis, COVID and Pneumonia) of Chest X-Ray images and (ii) 98.44% accuracy, 95.83% sensitivity, and 100% specificity for ECG signal classification as class 1 sinus bradycardia, class 1: atrial flutter and atrial fibrillation, class 2: normal and class 3: ventricular trigeminy, ventricular flutter and ventricular tachycardia. In addition, the ablation study conducted demonstrated improved performance accuracy by hybrid model VEntNet compared to VGG19 network without the hybrid framework. Thus, concatenation of hand-crafted and deep features showed an increase in performance accuracy by 1%. Our proposed hybrid model can be used as a single tool for screening both ECG signals and Chest X-ray images in hospitals, thereby potentially saving time.

Keywords: Neural Network; Tuberculosis; COVID; Pneumonia; Arrhythmia; Chest X-Ray; Electrocardiogram; Entropy; VGG19

ML1462 To avoid repeatability issues, this abstract will be available after the full paper is published in the conference proceedings.

ML1467 To avoid repeatability issues, this abstract will be available after the full paper is published in the conference proceedings.

ML1414 To avoid repeatability issues, this abstract will be available after the full paper is published in the conference proceedings.

ML1463 To avoid repeatability issues, this abstract will be available after the full paper is published in the conference proceedings.

ML1415 To avoid repeatability issues, this abstract will be available after the full paper is published in the conference proceedings.

ML1485: A two stage architecture for breast cancer detection

Chiranjeevi Karri
Post-Doctoral Researcher (PDF), University of Porto, Porto, Portugal
Corresponding E-mail: chiru404@gmail.com

Abstract. Breast cancer is the one of the major diseases in mostly women but some time men also effected with it. Identification of breast cancer at early stage is very crucial task for researchers because of breast complex tissues and lip nodes. This paper provides different deep learning models for breast cancer detection. The proposed model pipeline has two phases: breast localization and segmentation. In first phase, rough regions of breast are detected with YOLOv5 and detected regions are cropped to avoid imbalance between breast region and background. In second phase, the detected regions are segmented with various models like UNet, VNet, SegResNet and HighResNet for effective detection of cancer regions. The experiments were conducted on public dataset and models performance is evaluated in terms of quantitative and qualitative analysis.

Keywords: Breast Cancer, UNet, Segmentation, YOLOv5

ML1411: Internet of Things (IoT) for smart society 5.0

Noor Zaman Jhanjhi
School of Computer Science and Engineering, SCE, Taylor's University, Selangor, Malaysia
Corresponding E-mail: Noorzaman.jhanjhi@taylors.edu.my

Abstract. We live in the cutting-edge technological era, which has a high impact on our daily lives, and rapid development witnessed each day. A better example of this is the smart society 5.0 concept recently released by the Japanese government. This leads the existing society 4.0 information-based vision to smart society 5.0 human-centric concept alongside the Industrial revolution IR 4.0 to IR 5.0. The smart society rightly can be identified as "A human-centred society that balances economic advancement with the resolution of social problems by a system that highly integrates cyberspace and physical space." This heavily depends on the Internet of Things (IoT) use/adaption and other cutting-edge technologies, such as AI, Blockchain, Big data, Cybersecurity, etc. A massive amount of information from sensors in physical space is collected in cyberspace using the IoT. Which can be used for analysis, and the results will be fed back to the physical space in various forms. IoT will be acting as a backbone for collecting the data for multiple applications. It raises all the higher use and importance of IoT devices, which will bring several challenges and benefits at the same time. The challenges could be more towards privacy and security.

Session 2_ IoT and Artificial Intelligence

Session Time: 9:30-12:10 November 10th, 2022 Korea Standard Time (UTC/GMT+9:00)
Session Room Link: ***http://www.academicconf.com/teamslink?confname=MLIS2022***
Session Chairs: ***Dr. Koduri Srinivas, DBSG(Retd), NRSC, ISRO, India***

9:30-9:45	ML1419	Phenomenological and cognitive architecture of an IoT digital agent *Dr. Francesco Rago, Megatris Comp. LLC, USA*
9:45-10:10	ML1504	Blockchain-enabled 6G wireless network *Prof. Hamed Taherdoost, University Canada West, Canada*
10:10-10:25	ML1520	Expected impact of digital Bulgaria 2025 program *Dr. Linda Bower, Dallas, Texas, USA*
10:25-10:40	ML1502	Anomalous jet identification via sequence modeling *Dr. Alan Kahn, Columbia University, USA*
10:40-10:55	ML1477	Frost forecasting system with multiple models of machine learning *Mr. Shugo Yoshida, Meiji University, Japan*
10:55-11:10		**BREAK**
11:10-11:25	ML1459	A novel fault diagnosis method based on deep learning for rolling bearings *Prof. Jong-Myon Kim, University of Ulsan, South Korea*
11:25-11:40	ML1465	IoT-based driver distraction prevention system *Dr. Liwei Jiang, National Taipei University of Nursing and Health Sciences*
11:40-11:55	ML1497	Improving anomaly detection in IoT-based solar energy system using SMOTE-PSO and SVM model *Dr. Yu Wang, National Taipei University of Nursing and Health Sciences*
11:55-12:10	ML1515	Trends of Geospatial Artificial Intelligence (GeoAI) *Dr. Yongze Song, Curtin University, Australia*

Abstracts of Oral Session 2

ML1419: Phenomenological and cognitive architecture of an IoT digital agent

Francesco Rago
Megatris Comp. LLC, US
Corresponding E-mail: Francesco.rago@megatris.info

Abstract. IoT applications deliver fast-moving data from sensors and devices. The challenge for many organizations is making sense of all that data and empowering Digital Agents use reference models from neuroscience to model an activity of processing information starting from sensory perceptions. Place cells, the brain's navigational system and grid cells in entorhinal cortex are the cognitive mapmakers. They form a coordinate system that's independent of location. They represent environments of three dimensions (or higher, in the case of cognitive spaces) using multifield neurons of 3D grid cells, whose neighbouring fields form a local order, but lack any global lattice arrangement of the fields.
This neuroscience model was used to design the integrated layers, phenomenological and cognitive, of an IoT Digital Agent. To generalize IoT structural knowledge, artificial neural networks are embedded with hierarchy and fast Hebbian memory, and generalize structural knowledge. Spatial neuronal representations an instance of more general organizing principles also called continuous attractor neural networks (CANN) in which a large and noisy population of neurons can reliably encode "positions" in low-dimensional sensory manifolds and continuously update their values over time according to input stimuli.
Network architectures defined in a spatial context is useful for inference on different types of relational knowledge. This is a realization of Tolman's ideas about cognitive maps for general-purpose reasoning: the Tolman-Eichenbaum Machine that unifies Space and Relational Memory. They are represented separately and can then be re-combined to represent novel experiences. Reinforcement learning and planning manage behaviour, operating on states and actions are taken based on the current context.

Keywords: IoT, Artificial Intelligence, Artificial General Intelligence, Multi Agent Systems

ML1504: Blockchain-enabled 6G wireless network

Hamed Taherdoost
University Canada West, Canada
Corresponding E-mail: hamed.taherdoost@gmail.com

Abstract. The 6G revolutionizes the end-user experience in networking by providing higher frequency, higher capacity, and lower latency in comparison to 5G cellular technology. Expecting to facilitate significant improvements in the wireless system area relying on 6G technology, network infrastructure is required to get updated aiming to provide more secure wireless systems and address the use case requirements accordingly. Blockchain as a distributed ledger technology addresses most of the current limitations of the 6G technology including security concerns. The shortcomings and limitations of 6G technology and the provided opportunities by blockchain-enabled services to facilitate 6G networks will be discussed in this speech.

ML1520: Expected impact of digital Bulgaria 2025 program

Linda Bower
Economist-Consultant, Dallas, Texas, USA
Corresponding E-mail: lindaleebower@usa.net

Abstract. For over three decades, Bulgaria has been advancing the level of technology in the country. The government forged a strategic framework to implement e-government, and this strategy has been successfully implemented: the government has gone paperless, citizens have mobile access to government services, and schools receive curriculum materials electronically. The program continues with the Digital Bulgaria 2025 program. This program has a vision beyond government operations and seeks to bring the benefits of digital technology to all sectors of the economy and society. The goal is to create an environment to foster the widespread use of information and telecommunications technologies (ICT), along with new technologies for businesses and citizens. Continued progress in e-government is an important part of the program, as well as modernizing education, improving the digital ICT skills of the workforce, and increasing the number of highly qualified ICT specialists. Significant benefits are expected from the implementation of this strategy.

ML1502: Anomalous jet identification via sequence modeling

A. Kahn[1*], J. Gonski[1], I. Ochoa[2], D. Williams[1], G. Brooijmans[1]
[1] *Nevis Laboratories, Columbia University, Irvington, NY, USA*
[2] *Laboratory of Instrumentation and Experimental Particle Physics, Lisbon, Portugal*
Corresponding E-mail: alan.kahn@cern.ch

Abstract. This paper presents a novel method of searching for boosted hadronically decaying objects by treating them as anomalous elements of a contaminated dataset. A Variational Recurrent Neural Network (VRNN) is used to model jets as sequences of constituent four-vectors. After applying a pre-processing method which boosts each jet to the same reference mass, energy, and orientation, the VRNN provides each jet an Anomaly Score that distinguishes between the structure of signal and background jets. The model is trained in an entirely unsupervised setting and without high level variables, making the score more robust against mass and ?? correlations when compared to methods based primarily on jet substructure. Performance is evaluated on the jet level, as well as in an analysis context by searching for a heavy resonance with a final state of two boosted jets. The Anomaly Score shows consistent performance along a wide range of signal contamination amounts, for both two and three-pronged jet substructure hypotheses. Analysis results demonstrate that the use of Anomaly Score as a classifier enhances signal sensitivity while retaining a smoothly falling background jet mass distribution. The model's discriminatory performance resulting from an unsupervised training scenario opens up the possibility to train directly on data without a pre-defined signal hypothesis.

Keywords: High-Energy Physics, Unsupervised Learning, Anomaly Detection

ML1477 To avoid repeatability issues, this abstract will be available after the full paper is published in the conference proceedings.

ML1459 To avoid repeatability issues, this abstract will be available after the full paper is published in the conference proceedings.

ML1465 To avoid repeatability issues, this abstract will be available after the full paper is published in the conference proceedings.

ML1497 To avoid repeatability issues, this abstract will be available after the full paper is published in the conference proceedings.

ML1515: Trends of Geospatial Artificial Intelligence (GeoAI)

Yongze Song
School of Design and the Built Environment, Curtin University, Perth, 6102, WA, Australia
**Corresponding E-mail: yongze.song@curtin.edu.au*

Abstract. Geographical artificial intelligence (GeoAI) provides essential tools and approaches for addressing Earth and spatial issues. GeoAI has been implemented in a wide range of applications in ecological, environmental, urban, social, disease, and human behaviour fields. In recent few years, an increasing number of new models have been developed to enhance the methods and applications of GeoAI. In the presentation, I will introduce the latest trends of GeoAI from the aspects of concepts, methods, applications, and the comparison between GeoAI and traditional spatial analysis. A systematic review of GeoAI implementations will be introduced in the presentation. Future trends will be discussed to inform the challenges and opportunities of GeoAI.

Session 3_ Algorithm and Mathematics

Session Time: 15:00-18:10 November 10th, 2022 Korea Standard Time (UTC/GMT+9:00)
Session Room Link: ***http://www.academicconf.com/teamslink?confname=MLIS2022***
Session Chairs:
15:00-16:15 Prof. Christer Oscar Kiselman, Uppsala University, Sweden
16:25-18:10 Dr. Koduri Srinivas, DBSG(Retd), NRSC, ISRO, India

15:00-15:15	ML1500	An entropic approach to technology enables learning and social computing *Dr. Henrique Vicente, University of Évora, Portugal*
15:15-15:30	ML1495	Design of a triple band planar inverted-F antenna (PIFA) by using artificial neural networks *Dr. Lahcen Sellak, Ibn Zohr University, Morocco*
15:30-15:45	ML1516	Fuzzy TOPSIS approach and its application in multicriteria decision making process *Dr. Saima Mustafa, Arid Agriculture University Rawalpindi, Pakistan*
15:45-16:00	ML1505	Lexi-search based multi-sensor data fusion with higher order singular value decomposition *Dr. Koduri Srinivas, DBSG(Retd), NRSC, ISRO, India*
16:00-16:15	ML1442	Empirical evaluation of the asymptotic behavior of the complexity analysis of hard random 3-CNF formulas *Dr. Sergey Uvarov, Institute of control Science RAS, Russia*
16:15-16:25		**BREAK**
16:25-16:50	ML1448	Unrolled variational bayesian algorithm for image blind deconvolution *Dr. Emilie Chouzenoux, University Paris Saclay, France*
16:50-17:15	ML1513	Digital geometry, mathematical morphology, and discrete optimization: a survey *Prof. Christer Oscar Kiselman, Uppsala University, Sweden*
17:15-17:30	ML1457	Appling social network analysis and data mining techniques to support decision-making: a case study *Dr. Manuela Freire, University of Coimbra, Portugal*
17:30-17:55	ML1423	Design and multi-objective optimization of a photovoltaic system by a genetic algorithm *Ms. Khadidjatou Thiaw, University of Alioune Diop, Senegal*
17:55-18:10	ML1478	Yosida complementarity problem with yosida variational inequality problem and yosida proximal operator equation involving XOR-operation *Dr. Imaran Ali, Kalasalingam Academy of Research and Education, India*

Abstracts of Oral Session 3

ML1500 To avoid repeatability issues, this abstract will be available after the full paper is published in the conference proceedings.

ML1495: Design of a triple band planar inverted-F antenna (PIFA) by using artificial neural networks

Lahcen Sellak[1,*], Samira Chabaa[1,2], Saida Ibnyaich[2], Abdelouhab Zeroual[2] and Atmane Baddou[1]

[1] LISAD Research Team, Industrial Engineering Department, National School of Applied Sciences, Ibn Zohr University, Agadir, Morocco

[2] I2SP Research Team}, Department of physics, Faculty of Sciences, Cadi Ayyad University, Morocco

Corresponding E-mail: lahcensellak17@gmail.com

Abstract. A considerable demand for wireless devices that support multi-band frequency has recently been caused by the fast development of wireless networks.

When designing multi-band antennas, it can be hard to reach the appropriate operating frequencies for a given technology without the aid of a technique that can simplify the process easier and need less design time. The aim of this work is applying artificial neural network (ANN) model based multilayer perceptron (MLP) to design a triple band planar inverted-F antenna (PIFA) that can be operate at three resonances frequencies of GSM band 0.9 GHz, DCS bands 1.8 GHz, Wi-Fi and Bluetooth band 2.45 GHz. The main purpose of the ANN approach design is that it dispenses with the need to repeat execute HFSS or other labor-intensive and time-consuming analysis procedures and instead enables estimation of the antenna parameters. The triple band is obtained by applying the MLP model with the desired frequency as inputs to forecast the dimensions of the radiating patch and the added slots in the radiating patch. Statistical metrics including MSE, MAE, and RMSE are used to confirm the MLP model's performance, and the results show that these metrics have acceptable error levels. The proposed triple band PIFA antenna obtained by applying ANN model presents three operating frequency 0.93 GHz, 1.84 GHz and 2.44 GHz, and good adaptation in term of reflection coefficient S_{11}, for the resonance frequency f_1 = 0.93 GHz the S_{11} is -14.42 dB, -20.3203 dB at f_2= 1.84 GHz and -13.43 dB at f_3=2.42 GHz. The proposed antenna presents also a good gain in each resonance frequency, it is 4.7161 dB, 4.8272 dB for the middle frequency and 8.2876 dB for the higher frequency.

Keywords: PIFA, Antenna, Artificial Neural Networks, Multilayer Perceptron, Prediction, Multi-Band, HFSS Software

ML1516: Fuzzy TOPSIS approach and its application in multicriteria decision making process

Saima Mustafa[*], Sidra Firdous, and Hina Basharat

Department, of Mathematics and Statistics, PMAS, Arid Agriculture University Rawalpindi, Pakistan

Corresponding E-mail: saimamustafa28@gmail.com

Abstract. Decision making is a process of reasoning which is used for the selection of a particular belief and is determined as the more reliable problem-solving technique when we have to select the

best alternative from the number of available alternative possibilities. In the present study, fuzzy Topsis approach has been used in decision making process for the investigation of major segment to obtain the best alternative. We have applied fuzzy TOPSIS (Technique for order preferences by similarity to ideal solution) and found it as an effectual measure for the evaluation and selection of best alternative. The selection of alternatives is done on the basis of closeness coefficient.

Keywords: Fuzzy Decision Making, Linguistic Variable, Triangular and Trapezoidal Fuzzy Numbers, Fuzzy Topsis

ML1505: Lexi-search based multi-sensor data fusion with higher order singular value decomposition

Koduri Srinivas
Chairman (Designate), IEEE COE, Hyderabad Head, DBSG(Retd), NRSC, ISRO, India
Corresponding E-mail: kodurisrinivas@gmail.com

Abstract. Earth observations imaging systems collect data at different spatial and radiometric resolutions due to transmission bandwidth, weight, space, power and other technical constraints. Fusion of multi-sensor images enables a synergy of complementary information obtained by sensors of different spectral ranges. A multidimensional data fusion with standard SVD based on matrix theory for satellite imagery was implemented by author during early part of 2001 and its results were published subsequently.

In this presentation, we make a case for a Higher Order Singular Value Decomposition (HOSVD) for Multi-sensor satellite data fusion techniques using tensors for image processing instead of using a standard Singular Value Decomposition based on matrix theory. As is well known, it is crucial to preserve the multidimensional structure of the data tensors in order to extract meaningful latent variables and reveal the hidden structures of the data tensors. It is well known that a higher order singular value decomposition (HOSVD) of tensors is a generalization of matrix SVD.

A 3D HOSVD decomposes a multidimensional image with three unfoldings. In other words, we need to generate three SVD's corresponding to each of the unfoldings. This is a more natural and flexible decomposition that permits us to optimize dimensionality reduction in the spatial, temporal, and chromatic domain.

Tensor-based information processing methods are data-driven and effective to represent high-dimensional data and extract related features. Tensor decomposition methods are rigorous ways to reveal the structure embedded in a multidimensional dataset and find many applications including signal and image processing, bioinformatics, visualization, pattern recognition, data mining, brain modelling, and environmental modelling. numerical linear algebra, chemometrics, psychometrics, econometrics, etc., During analysis stage, parameter tuning for optimization with tensor decomposition techniques is known to one of the most efficient techniques. A HOSVD, is therefore, an efficient data-driven decomposition technique and is also used to extract the features of the tensor. The analysis part is computationally more expensive, but the synthesis has the same cost as existing SVD algorithms.

The details of analysis stage with respect to SVD for each unfolding is illustrated with a multidimensional array. The criterion for tuning parameter for optimization is presented by an analysis of the unfoldings generated from Quickbird Multispectral data and merging the same with Quickbird PAN data. The details of computer algorithm are explained with pseudocode in python.
A case is also made for Lexi-search when using 4D HOSVD and its higher dimensions. Lexi-search become extremely important in such cases as the number of unfoldings goes up. Some authors have described this phenomenon as a story of raining a series of SVDs. Lexi-search offers an elegant way to keep track of the most "efficient" unfolding for such higher order SVD's.

ML1442 To avoid repeatability issues, this abstract will be available after the full paper is published in the conference proceedings.

ML1448: Unrolled variational bayesian algorithm for image blind deconvolution

Yunshi Huang, Emilie Chouzenoux*, Jean-Christophe Pesquet
CVN, University Paris Saclay, CentraleSupélec, Inria, 91190 Gif-sur-Yvette, France
Corresponding E-mail: emilie.chouzenoux@centralesupelec.fr

Abstract. Aims: We consider the problem of image blind deconvolution through a variational Bayesian algorithm.
Methods: We introduce our algorithm VBA (variational Bayesian algorithm) accounting efficiently for a wide range of priors on the unknowns. Then, VBA iterations are embedded into a deep neural network architecture, following the recently introduced deep unrolling paradigm.
Results: Our experiments illustrate the excellent performance of our new method on two datasets, comprising grayscale and color images, and degraded with various kernel types. Compared to state-of-the-art variational and deep learning approaches, our method delivers a more accurate estimation of both the image and the blur kernels. It also includes an automatic noise estimation step, so that it requires little hyperparameter tuning. The proposed method is very competitive in terms of computational time during the test phase, while showing similar train time to its deep learning competitors.
Conclusions: This talk presents our novel method for blind image deconvolution that combines a variational Bayesian algorithm with a neural network architecture. The main core of the proposed architecture is highly interpretable, as it implements unrolled iterates of a well sounded Bayesian-based blind deconvolution method.

Acknowledgements: The authors acknowledge support from the Agence Nationale de la Recherche of France under MAJIC (ANR-17-CE40-0004-01) project, and from the European Research Council Starting Grant MAJORIS ERC-2019- STG-850925.

ML1513: Digital geometry, mathematical morphology, and discrete optimization: a survey

Christer Oscar Kiselman
Department of Information Technology, Uppsala University, Sweden
Corresponding E-mail: christer.kiselman@it.uu.se

Abstract. We study difficulties that appear when well-established definitions and results in Euclidean geometry, especially in the theory of convex sets and functions in vector spaces, are translated into a discrete setting. Solutions to these problems are sketched.

ML1457 To avoid repeatability issues, this abstract will be available after the full paper is published in the conference proceedings.

ML1423: Design and multi-objective optimization of a photovoltaic system by a genetic algorithm

Khadidjatou Thiaw[1, *], Amadou Diao[2], Amy Sadio[1], Senghane Mbodji [1]
[1]*Recherche team in renewable energie materials and laser of Department of Physics, University of Alioune Diop, Bambey/Senegal*
[2]*Semiconductors, and solar energy laboratory, Faculty of sciences and techniques, University of Cheikh anta Diop, Dakar/Senegal*
Corresponding E-mail: khadijathiaw47@gmail.com

Abstract. This study is focused on an optimal sizing method based on genetic algorithms (GA) in order to design a high-performance photovoltaic system that is installed in the Alioune Diop University of Bambey/Senegal. The multi-objective optimization allowed us to find a better trade- off between the Total Life Cycle cost (TLCC) and the Loss of Power Supply Probability (LPSP). The goal is to minimize the TLCC while maintaining a good satisfactory of the system with a desired LPSP, under certain constraints. The expressions of the TLCC and the LPSP, are established according to the total photovoltaic energy and the battery capacity. The toolbox of Matlab software is used to implement the optimization problem with twelve blocks of the site and its different corresponding loads. The obtained results have led to a several combinations of the photovoltaic and battery capacity of which the best one is selected based the lowest LPSP, that guaranted a better load coverage during the night. The results of this proposed method are compared with intuitive method that has been applied in first. For the block with the lowest load demand, the proposed optimization model has given to a reduction of 48% and 70% in the storage capacity and the TLCC respectively for a LPSP of 0.007 %.
Keywords: LPSP, TLCC, Optimization

ML1478: Yosida complementarity problem with yosida variational inequality problem and yosida proximal operator equation involving XOR-operation

Imran Ali
Department of Mathematics, School of Advanced Sciences, Kalasalingam Academy of Research and

Education (Deemed to be University), Tamil Nadu, India
Corresponding E-mail: imranali@klu.ac.in

Abstract. Due to the importance of Yosida approximation operator, we generalized the variational inequality problem and its equivalent problems by using Yosida approximation operator. The aim of this work is to introduce and study a Yosida complementarity problem, a Yosida variational inequality problem, and a Yosida proximal operator equation involving XOR-operation. We prove an existence result together with convergence analysis for Yosida proximal operator equation involving XOR-operation. For this purpose, we establish an algorithm based on fixed point formulation. Our approach is based on a proximal operator technique involving a subdifferential operator. As an application of our main result, we provide a numerical example using the MATLAB program R2018a. Comparing different iterations, a computational table is assembled and some graphs are plotted to show the convergence of iterative sequences for different initial values.

Keywords: Algorithm, Inequality, Sequence, Operator, Solution

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Session 4_ Machine Learning and Neural Networks

Session Time: 9:30-12:45 November 11th, 2022 Korea Standard Time (UTC/GMT+9:00)
Session Room Link: ***http://www.academicconf.com/teamslink?confname=MLIS2022***
Session Chairs: ***Prof. Sen Qian, Institute of High Energy Physics, Chinese Academy of Science, China***

9:30-10:00	ML1508	Robust deep learning for uncertainty: tutorial using convex programming *Dr. Michael Botros Shenouda, Industrial Research & Development, Canada*
10:00-10:30	ML1518	DEVS modeling and simulation design of AI/machine learning systems *Dr. Bernard P. Zeigler, University of Arizona, USA*
10:30-10:45	ML1458	SD-depth: light-weight monocular depth estimation using space and depth CNN for real-time applications *Dr. Hatem Ibrahem, Chungbuk National University, South Korea*
10:45-11:00	ML1481	Analysis and detection of disinformation from social media post using machine learning techniques *Dr. Alemu Kumilachew Tegegnie, Bahir Dar University Institute of Technology, Ethiopia*
11:00-11:15		**Break**
11:15-11:30	ML1461	Data-driven fault classification of induction motor based on recurrence plot and deep convolution neural network *Prof. Jong-Myon Kim, University of Ulsan, South Korea*
11:30-11:45	ML1464	Numerical investigation on three local-adaptive *k*-point multiquadric neural networks *Mr. Pichapop Paewpolsong, Suranaree University of Technology, Thailand*
11:45-12:00	ML1519	PMT pulse-shape analysis by using a convolutional neutral network in nuclear radiation detection *Dr. Jifeng Han, Sichuan University, China*
12:00-12:15	ML1517	Scan to BIM mapping automation pipeline *Dr. Kang Taewook, Korea Institute of Civil Engineering and Building Technology, South Korea*
12:15-12:30	ML1472	An education tool that supports junior learners in studying machine learning *Mr. Hayato Horanai, Meiji University, Japan*
12:30-12:45	ML1454	Machine learning-based current density simulation for direct borohydride fuel cell *Dr. Amira Mohamed, Chungbuk National University, South Korea*

Abstracts of Oral Session 4

ML1508: Robust deep learning for uncertainty: tutorial using convex programming

Michael Botros Shenouda
Industrial Research & Development, Canada
Corresponding E-mail: botrosmw@mcmaster.ca

Abstract. We consider robust designs of Artificial Neural Networks (ANN) and Convolutional Neural Networks (CNN) with input noise that results from a mismatch between the input model and actual input data. More specifically, we propose robust designs for the training of two-layer neural network with Rectified Linear Unit (ReLU) activation under two models of this mismatch: a bounded model and stochastic model. For each model, we propose a robust optimization approach that suits the mismatch model. Also, both results are applicable to CNN.

For example, for the bounded mismatch model, we formulate the problem as minimization of the loss function for all possible realizations of the noise within the bounded region, and we show it is equivalent to a mini-max optimization problem. We provide a convex solution to the mini-max problem that is polynomial time. Moreover, the presented convex formulation can cover different types of bounded regions.

For the stochastic mismatch model, we formulate the problem as probabilistic minimization of the loss function, and we show that it is equivalent to a Chance Constrained Optimization (CCO) problem. We also provide a polynomial time convex formulation that is guaranteed to solve this CCO problem. Furthermore, the convex formulation is independent of the particular probability distribution of the input noise (but dependent on its variance.)

Keywords: Robust Deep Learning, Input Mismatch, Bounded Mismatch, Stochastic Mismatch, Convex Optimization, CNN

ML1518: DEVS modeling and simulation design of AI/machine learning systems

Bernard P. Zeigler
Professor Emeritus, Department of Electrical and Computer Engineering, University of Arizona, USA
Chief Scientist, RTSync Corp, Arizona, USA
IEEE Fellow, International Society for Modeling and Simulation Fellow and Hall of Fame INFORMS Lifetime Professional Achievement Award
Corresponding E-mail: zeigler@rtsync.com

Abstract. The discipline of Modeling and Simulation (M&S) offers a strong computational foundation, concepts, and tools for the field of computational intelligence. Simulation has proven to be a widely used tool for computational experimentation with a view to developing and improving intelligent system techniques. At the core of the M&S discipline of is operational characterization of the elements: real system data, experimental frame, model, and simulator, as well as the relationships that must bind

these components together to constitute a meaningful application. Mathematical system theory provides the underlying substrate for expressing this ontology and paves the way to sound conceptualization of complex systems.

In this talk, we show how the two main and orthogonal, pillars of M&S theory – levels of system specification with associated morphisms, and systems specification formalisms – help develop models of complex intelligent systems. We discuss Discrete Event System Specification (DEVS) models that exhibit intelligent behaviors and can be developed, observed and tested in computational form. To do this, we review the basics of the systems theory underlying DEVS as an M&S abstraction. Then we show how DEVS represents individual atomic agents and their hierarchical compositions to realize temporal event behaviors by having the necessary states, processing signals, and memory features while coordinating themselves in space and time. Mathematical system-theory proofs of such models' canonical minimal realizations support the claim that their structures must be embedded in any plausible model of intelligent behavior. Thus, we argue that discrete event models of this nature constitute waypoints in the search for implementations involving basic architectural structure patterns. Implications of this methodology for construction and realization of intelligent natural (brain), and artificial machine learning and intelligent systems are then discussed.

ML1458 To avoid repeatability issues, this abstract will be available after the full paper is published in the conference proceedings.

ML1481: Analysis and detection of disinformation from social media post using machine learning techniques

Alemu Kumilachew Tegegnie*, Derejaw Lake Melie
Bahir Dar University Institute of Technology, Ethiopia
Corresponding E-mail: alemupilatose@gmail.com

Abstract. Aims: disinformation is a serious problem of the society in the modern world. It is transmitted with intention of misleading the users to impose or achieve political agenda or propaganda against an individual, government, country, society, organization or political party. The major aim of this study is to design a machine learning model that can detect the disinformation as early as possible and analyzes its behaviors and pattern of spreading.

Methods: the data is collected in four different languages (English, Amharic, Afan Oromo, and Tigrinya). The data is processed and trained with ML to develop four separate models – each can detect the news as disinformation or not after it has passed through a language detection model. A total 524 dataset are trained with supervised machine learning algorithms (LR, MNB, RF and PAC). NLP text analysis tools, feature extraction and TfidfVectorizer are used.

Results: the overall classification result is showed here

Evaluation Criteria	Label	LR	MNB	PAC	RF
Precision	0	0.87	0.83	0.84	0.78
	1	0.83	0.84	0.80	0.86

Recall	0	0.80	0.82	0.76	0.86
	1	0.89	0.86	0.88	0.79
F1-score	0	0.83	0.82	0.84	0.82
	1	0.86	0.85	0.80	0.82

In addition, the first 20 features indicative to disinformation (in terms of unigrams, bigrams & trigrams) are identified.

Conclusions: Motivated by the proliferation of disinformation or fake news in recent years and the challenges it poses in Ethiopian political sphere, this paper tried to develop a machine learning model to detect disinformation (fake news) from social media posts. Accordingly, ML algorithms have showed better performance in the detection of disinformation.

ML1461 To avoid repeatability issues, this abstract will be available after the full paper is published in the conference proceedings.

ML1464 To avoid repeatability issues, this abstract will be available after the full paper is published in the conference proceedings.

ML1519: PMT pulse-shape analysis by using a convolutional neutral network in nuclear radiation detection

Jifeng Han[1], Jialiang Zhu[2], Zhonghai Wang[1], Guofeng Qu[1*], Xingquan Liu[1], Weiping Lin[1], Zixu Xu[1], Yu Huang[1], Min Yan[1], Xin Zhang[1], Lei Chen[1]

[1] Key Laboratory of Radiation Physics and Technology of the Ministry of Education, Institute of Nuclear Science and Technology, Sichuan University, Chengdu, 610064, China

[2] Science and Technology on Reactor System Design Technology Laboratory, Chengdu, 610213, China

Corresponding E-mail: qians@ihep.ac.cn

Abstract. In recent years, some materials from the elpasolite crystal family have been under development for either or both gamma ray and neutron detection. These include Cs2LiYCl6 (CLYC) and Cs2LiLaBr6 (CLLB). Since these crystals have different luminescence decay times under neutron and gamma irradiation. The pulse shape discrimination (PSD) is widely used to discriminate between neutron and gamma signals in nuclear detection. In our previous work, the PSD Figure-of-Merit (FOM) value was optimized to 2.5 for CLYC, 1.2 for CLLB by using PSD method. However, the discrimination between neutrons and gamma rays becomes more difficult in the low gamma-equivalent energy region. Therefore, we trained the neutron and gamma waveforms measured by CLYC and CLLB crystal coupled PMT under Am-Be source irradiation based on the Convolutional Neural Network (CNN) method. The PSD FOM value of the CNN method was better than 6.0 at the gamma-equivalent energy region of more than 300 keV. In addition, we constructed CNN model for complicated n-g discrimination under piled-up condition, the accuracy for the particle identification is over 97% for each class (g+g, g+n, n+g and n+n). The timing information carried by the PMT

waveform is also important when reconstructing the particle trajectory and discrimination of particles. With the development of fast analog-to-digital converter, the whole waveform information could be available. Compared with the traditional Constant Fraction Discrimination (CFD) timing method, a new one based on the CNN model for the timing of a pair of Cherenkov-detection MCP-PMTs improves the coincidence time resolution (CTR) by 50%. These results show that the CNN model is not only suitable for identification of neutron gamma signals, but also for the reconstruction of particle trajectories.

Keywords: CNN, PSD, Neutron-gamma identification, CTR, Time Resolution

ML1517: Scan to BIM mapping automation pipeline

Kang Taewook
Korea Institute of Civil Engineering and Building Technology, South Korea
Corresponding E-mail: laputa99999@gmail.com

Abstract. The number of scan-to-BIM projects that convert scanned data into Building Information Modeling (BIM) for facility management applications in the construction fields has been increasing. This conversion features an application purpose-oriented process, so the Scan-to-BIM work parameters to be applied vary in each project. Inevitably, a modeler manually adjusts the BIM modeling parameters according to the application purpose, and repeats the Scan-to-BIM process until the desired result is achieved. This repetitive manual process has adverse consequences for project productivity and quality. If the Scan-to-BIM process can be formalized based on predefined rules, the repetitive process in various cases can be automated by re-adjusting only the parameters. In addition, the predefined rule-based Scan-to-BIM pipeline can be stored and reused as a library. This study proposes a rule-based Scan-to-BIM Mapping to support application-oriented Scan-to-BIM process automation, variability and reusability. The proposed method was implemented using an automatic generation algorithm, and its effectiveness was verified.

Keywords: Rule; Scan-to-BIM; Mapping

ML1472 To avoid repeatability issues, this abstract will be available after the full paper is published in the conference proceedings.

ML1454 To avoid repeatability issues, this abstract will be available after the full paper is published in the conference proceedings.

Session 5_ AI Application and Intelligent System

Session Time: 15:45-18:25 November 11th, 2022 Korea Standard Time (UTC/GMT+9:00)
Session Room Link: ***http://www.academicconf.com/teamslink?confname=MLIS2022***
Session Chairs: ***Prof. Kaoru Sumi, Future University Hakodate, Japan***

15:45-16:00	ML1480	An adaptive network model for the role of the microbiome-gut-brain axis in insomnia *Sulagna Banerjee, Woosong University, South Korea*
16:00-16:15	ML1425	Forecasting and XAI for applications usage in OS *Dr. Ma Ruimin, Saint-Petersburg State University, Russia*
16:15-16:40	ML1484	Future of the metaverse in artificial intelligence in education *Prof. Kaoru Sumi, Future University Hakodate, Japan*
16:40-16:55	ML1427	Convolutional LSTM for delamination imaging in composite laminates *Dr. Paweł Kudela, Polish Academy of Sciences, Poland*
16:55-17:10		**Break**
17:10-17:25	ML1493	Some features of monitoring and diagnostic systems technical status of hydro units *Dr. Valerij Zvaritch, National Academy of Sciences of Ukraine, Ukraine*
17:25-17:40	ML1466	An intelligent system for safe and satisfactory individual travel tours in Tokyo *Mr. Yuto Maejima, Meiji University, Japan*
17:40-17:55	ML1488	Serious games as open innovation and sustainable development workplace instructional tools *Dr. Eleni Makri, Insight SFI Research Centre for Data Analytics/UCD, Ireland*
17:55-18:10	ML1514	Stuck inside a cloud *Mr. Toby McCoy, Trinity Business School, Ireland*
18:10-18:25	ML1499	Ball position feature embedded group activity recognition model for team sport games *Dr. Ankhzaya Jamsrandorj, University of Science & Technology, South Korea*

Abstracts of Oral Session 5

ML1480: An adaptive network model for the role of the microbiome-gut-brain axis in insomnia
Sulagna Banerjee
Woosong University, Artificial Intelligence, South Korea
Corresponding E-mail: j.treur@vu.nl

Abstract. This paper presents an adaptive network model simulating the role of the gut microbiome for triggering biological mechanisms that alter the circadian cycle, mood and insomnia via the microbiome-gut-brain axis. Simulation graphs provided insight into how these immune and endocrine pathways interact with each other when the levels of the probiotics, Lactobacillus and Bifidobacteria, and pathogenic bacteria were altered. Varying these factors in simulations produced different outcomes for insomnia and sleep deprivation.

Keywords: Gut-Brain Axis, Microbiome, Insomnia, Adaptive Network Model, Self-Modelling Network

ML1425 To avoid repeatability issues, this abstract will be available after the full paper is published in the conference proceedings.

ML1484: Future of the metaverse in artificial intelligence in education
Kaoru Sumi
Future University Hakodate, Japan
Corresponding E-mail: kaoru.sumi@acm.org

Abstract. Online distance education has recently become much more prevalent, and in the field of Artificial Intelligence in Education, academic instruction using virtual space has been attracting attention. In this talk, I will discuss the various educational possibilities of using virtual spaces and agents, presenting examples from several studies. I will also introduce our own development of systems using game-based learning and a game-based story generation system that automatically generates scripts in real time on the basis of players' emotions and actions. I will discuss persuasive technology that systems can utilize to influence human behavior, along with impressions and applications of facial expressions and gestures, which are expressions of agents. To conclude, I will discuss what can happen when a virtual agent interacts with other users in a virtual space.

ML1427: Convolutional LSTM for delamination imaging in composite laminates
Paweł Kudela[1], Abdalraheem Ijjeh
Institute of Fluid Flow Machinery, Polish Academy of Sciences, Poland
Corresponding E-mail: pk@imp.gda.pl

Abstract. Due to the complex design of composite structures, typical visual inspection techniques experience some difficulty with damage detection. As a result, several nondestructive testing and structural health monitoring approaches for detecting damage in composite structures have been developed, with ultrasonic guided waves, particularly Lamb waves, gaining popularity. Apart from piezoelectric pointwise measurements, laser Doppler vibrometry has been used in recent years for full wavefield measurements of propagating Lamb waves. Damage imaging can be performed through animations of Lamb waves interacting with damage. Accordingly, an end-to-end deep learning-based model of many-to-one sequence prediction was built in this work to perform pixel-wise image segmentation. The developed model performed well on numerically generated test data. This approach can automate delamination identification and generate damage maps without requiring user involvement.

Keywords. Lamb Waves, Delamination Identification, Semantic Segmentation, Deep Learning, ConvLSTM.

ML1493: Some features of monitoring and diagnostic systems technical status of hydro units

Valerij Zvaritch, Ievgen Zaitsev, Mychailo Myslovych, Anatolii Levytsky
Institute of electrodynamics of the National Academy of Sciences of Ukraine, Ukraine
Corresponding E-mail: zvaritch@gmail.com

Abstract. It is necessary to remark, that hydro units are used in maneuverable modes, which leads to an increase in the load on all elements of hydro units. It can lead to unpredictable failure of their units and even failures in the operation of the hydroelectric power plant. Therefore, the use of diagnostic systems is appropriate for solving such problems. The most promising non-destructive diagnostic systems are vibration diagnosis systems. However, the effectiveness of their use depends on the diagnosis algorithms, which depend on the features and functioning of the diagnosed unit of the power equipment. In the contribution, some models of vibration signals of hydraulic units and features of the construction of vibration diagnostics systems of hydro units are considered.

Keywords: Linear Autoregressive Process, Vibration Diagnosis System, Hydro Unit

ML1466 To avoid repeatability issues, this abstract will be available after the full paper is published in the conference proceedings.

ML1488: Serious games as open innovation and sustainable development workplace instructional tools

Eleni Makri
Insight SFI Research Centre for Data Analytics/UCD, Research Scientist, Dublin, Ireland
Corresponding E-mail: eleni.g.makri@gmail.com

Abstract. Learning/serious games for innovative, immersive and engaged education and training constitute a mutually shared imperative issue for academics, researchers, software developers and industry stakeholders worldwide. Declaring no axiomatic tenets of successful education, learning and training for open innovation and sustainable future through game-based teaching and learning in organizational settings, this study builds on exploring sustainable development-related knowledge, attitudes and skills (KAS) researched within serious gameplay multinational organizational environment. We report on 45 employee sustainable development attributes after gaming when compared with in-person training instruction as part of co-developed company workshop sessions in 2021/2022. Post-gameplay both gender employees indicated positive sustainable development attributes. The reported favorable sustainable development continuum competencies after gaming (civic action, interpersonal and problem-solving, leadership, social justice, diversity, civic responsibility, seeking knowledge about political/societal issues, and gains in problem-solving and leadership skills) are discussed in tandem with research and practice implications and streams for further exploration as regards serious games smarter workplace sustainable development learning awareness and stakeholder engagement.

ML1514: Stuck inside a cloud

Toby McCoy
Trinity Business School, Ireland
Corresponding E-mail: tmccoy@tcd.ie

Abstract. This paper explores the rapid growth in the public valuations of SaaS companies and examines whether this growth can be explained by investment theory. SaaS companies have experienced a remarkable rise in stock market valuations in recent years. Through the construction of a SaaS Index, constituted of 20 publicly traded SaaS companies, the empirical study tests the efficacy of two traditional models of investment theory, The Capital Asset Pricing Model and Fama-French's 3 Factor Model. The Index is used as the basis for these models and additionally is supported by Linear Regression models. Ultimately, the assumptions which underlie these models are shown to be unsuitable for the SaaS Industry due its relative youth and unique characteristics. It then seeks to expand upon existing theory and practice by building a positive argument and highlighting additional possible factors including Growth, Profitability and Enterprise Value/Revenue which exhibit a greater explanatory role in share price movement. This enables the construction of a new model, of a company's revenue growth and Enterprise Value relative to revenue supported by a qualitative narrative which better accounts for the relative growth in the SaaS Index over the observed period. Ultimately, while this new model holds greater explanatory power, the underlying characteristics of SaaS companies such as the subscription model, capital efficiency and ability to scale are important and are more likely to be effective drivers of value into the future.

ML1499 To avoid repeatability issues, this abstract will be available after the full paper is published in the conference proceedings.

Part V Acknowledgements

On behalf of the MLIS 2022 Organizing Committee, we would like to take this opportunity to express our sincere gratitude to our participants. Without their support and contributions, we would not be able to hold the conference successfully in this special year. We would also like to express our acknowledgements to the Technical Program Committee members who have given their professional guidance and valuable advice as reviewers. Below are the lists of the Technical Program Committee members. For those who contribute to the success of the conference organization without listing the name here, we would love to say thanks as well.

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Website

Contact Us

Yana Shi
+86-13618614937
info@machinelearningconf.org
www.machinelearningconf.org