



ICCTA 2022

8th

**2022 8th International Conference on
Computer Technology Applications**

ECCS 2022

**Workshop: 2022 2nd European Conference
on Communication Systems**

May 12-14, 2022

Vienna, Austria

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Abdul Wahid Khan, University of Malakand, Pakistan



Welcome Message

2022 8th International Conference on Computer Technology Applications (ICCTA 2022, former ICCIT) will be held during May 12-14, 2022 in Vienna, Austria, with its workshop ECCS 2022 (2022 2nd European Conference on Communication Systems). In 2017-2020, ICCTA had been held in Turkey. Since 2021, ICCTA has been held in Austria, organized by FH JOANNEUM University of Applied Sciences.

ICCTA is the premier for the presentation and exchange of past experiences and new advances and research results in the field of computer technology applications. All the conference proceedings has been indexed Ei Compendex & Scopus already.

At the annual conference, participants gather to present research results, share visions and ideas, obtain updates on latest technologies and expand professional and social networking. These activities are realized through ICCTA's multiple diversified and exciting programs.

ICCTA2022 conference program includes keynote speeches, tutorial sessions, onsite and online oral sessions. Keynote speakers: Prof. Dr. Alois Zoitl, Linz Univ, Austria; Prof. Dr. Shaoying Liu, Hiroshima Univ, Japan; Dr. Manfred Mücke, Materials Center Leoben, Austria; Prof. Dr. Barbara Mayer, FH Joanneum, Austria. Tutorial lecture: Prof. Dr. Paul Hofmann, FH Joanneum, Austria. Oral sessions: Computer and Information Science; Computer Aided Design and Information Management; Software and Information Engineering; Intelligent Algorithms and Computing; Network and Information Security; Computer Application Intelligent Business.

The chairman and keynote speakers played a great role in conducting the proceedings of the conference and on behalf of the conference committee, we would like to express sincere thanks for your long-term support and help on our work. We were grateful for the reviewers, who had also been very helpful in efficiently reviewing the manuscripts and made valuable suggestions for the authors to improve their work. At the same time, we also extended our heartfelt thanks to the understanding and support of every author.

We hope you could benefit from the conference, and looking forward to meeting you again!

ICCTA & ECCS 2022 Conference Committees

 2022 8th International Conference on Computer Technology Applications

 Workshop: 2022 2nd European Conference on Communication Systems

Materials Prepared by the Presenters

Online Presentation: PowerPoint or PDF files.

Duration of Each Presentation

Keynote Speech: 40 Minutes of Presentation including Q&A. Invited Speech: 30 Minutes of Presentation including Q&A.

Regular Oral Presentation: 15 Minutes of Presentation including Q&A.

Note:

The regular oral presentation time arrangement is for reference only. In case any absence or some presentations are less than 15 minutes, please join your session earlier. An excellent presentation will be selected from each session which will be announced and awarded an excellent presentation certificate.

Onsite Conference Venue (May 13, 2022)

Ibis Wien Mariahilf



Website: <https://ibis-wien-mariahilf.meinhotel.top/>

Address: Mariahilfer Gürtel 22-24, 06. Mariahilf, 1060 Vienna, Austria

E-mail: h0796@accor.com

Ibis Wien Mariahilf is only 1,650 feet away from Mariahilfer Straße, Vienna's largest shopping street. The café-bar and reception are open 24 hours a day. WiFi is free everywhere. The stop of the Hop On Hop Off Tour Bus (red line) is right outside the hotel. Air conditioning and cable TV are standard in all rooms. Each is fitted with a telephone and work desk. Wheelchair-accessible rooms are also available. International food is served at the spacious La Table restaurant. Buffet breakfast is available from the early hours until midday.

Vienna West Station is only 1,150 feet away, offering access to the U3 Metro line and national train routes. St. Stephan's Cathedral is 5 metro stops away from here.

Just a 5-minute walk away from Ibis Mariahilf is Gumpendorfer Straße Metro Station, on the U6 line. From here, guests can reach Schönbrunn Palace in less than 7 minutes.

Note:

For security reasons, participants are required to wear conference badges during the conference. The conference leader onsite has the right to stop those without the conference badges from entering the meeting room. Please note that the Organizing Committee will not accept liability for any kind of damage, losses of personal belongings or injuries occurring to persons during the conference.

We kindly ask you to check and comply with the current Covid-19 regulations.

Zoom will be the online platform for this conference. Instructions are listed as below:

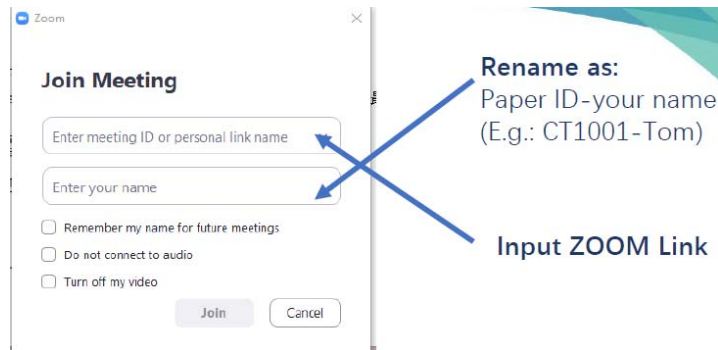
1. Download the ZOOM on your PC and complete the ZOOM install.

Zoom Download: <https://zoom.us/> Author in China: <https://zoom.com.cn/download>

2. Join in the conference by Room No. or Link.

Note: The Room No. or Link will be available only during the scheduled time.

Note: Please find your Zoom Link according to the schedule.



3. Set up your Name.

- If you are conference committee member or keynote speaker, please set up your name by this format: your position-Full Name, such as, Keynote—Tracy Lee
- Or, if you are author, please set up your name by this format: Paper ID-Full Name, such as, R001—Gretchen Liu
- Or, if you are listener, please set up your name by this format: Listener-Full Name, such as, Listener—Gretchen Liu

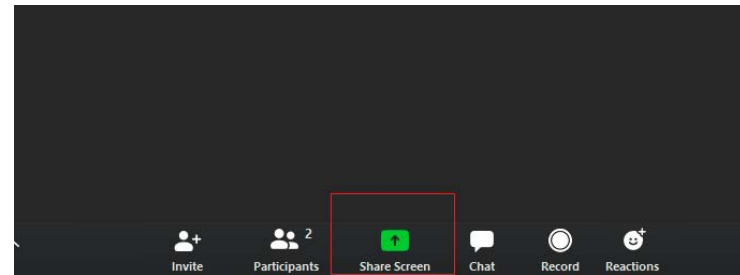
Tips: Please unmute audio and start video while your presentation.

It's suggested to use headset with microphone or earphone with microphone.

Note: ZOOM conference rooms will be open 30 mins before scheduled time.

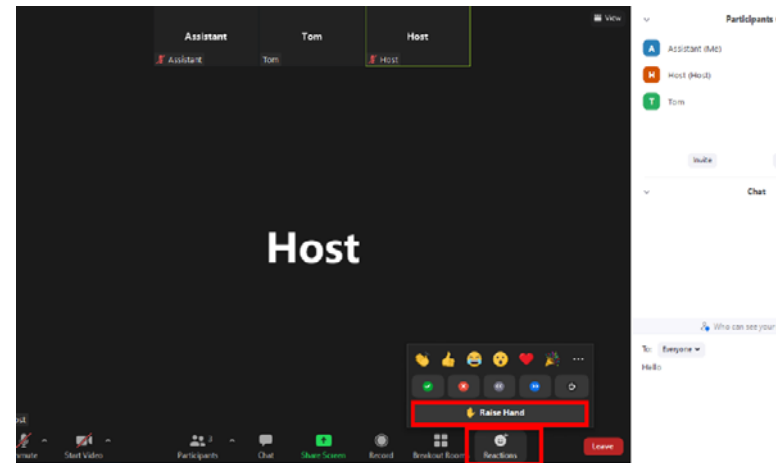
4. How to share your slides

Share your screen to all participants when you make the presentation, by click the following button. Please prepare your presentation file in advance.

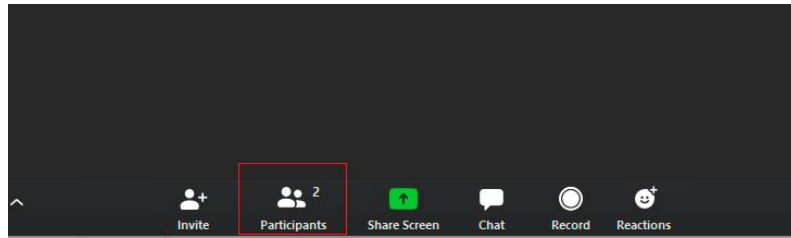


5. Other functions

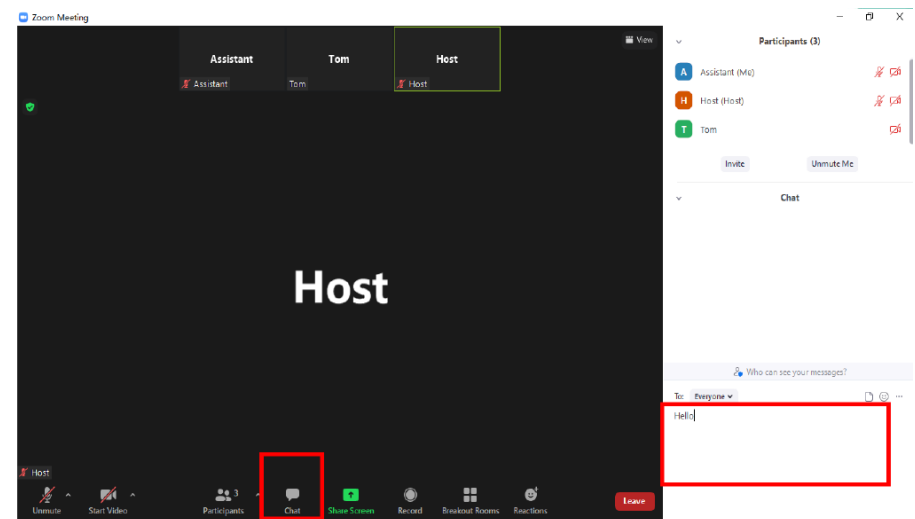
a. Click below button to raise your questions in Q&A session.



b. See all participants by click it.



c. Send messages or questions in Chat Window



Date	Arrangement	Zoom Link - Password: 051214
May 12. 2022	Online Test-Speakers, Committees, Session Chairs & All authors (Presenters)	https://us02web.zoom.us/j/81898593525
May 13. 2022	Onsite Section Opening Ceremony & Keynote Speeches & Tutorial Parallel Sessions (1-2)	https://us02web.zoom.us/j/81898593525
May 14. 2022	Online Section Parallel Sessions (A-D)	Session A&C: https://us02web.zoom.us/j/81898593525 Session B&D: https://us02web.zoom.us/j/85849674461

May 12, 2022

	Online Test	Zoom Link - Password: 051214
10:00-12:00	Test for online attendees Parallel Sessions (A-D) Online Session A- A1063, A1017, A1016, A1007, A1038, A1005, A1004, A1020 Online Session B- A1015, A1054, A1036, A1045, A1030, A1052, A1061, A1006, A1027 Online Session C- A1043, A1001, A3002, A1064, A1019, A1009, A1012, A1055 Online Session D- A1023, A1026, A1060, A1056, A1029, A1046, A1010	https://us02web.zoom.us/j/81898593525
14:00-16:00	Test for Keynote Speeches & Tutorial	

May 13, 2022-Onsite

Conference Venue: Ibis Wien Mariahilf

Address: Mariahilfer Gürtel 22-24, 06. Mariahilf, 1060 Vienna, Austria

Conference Room: Nestroy (on the ground floor)

Online Zoon link: <https://us02web.zoom.us/j/81898593525> (Password: 051214)

08:00 – 15:00	Registration of the conference participants
09:00 – 09:10	Opening Ceremony ---Prof. Dr. Vitaliy Mezhuyev, FH Joanneum, Austria
09:10 – 09:50	Keynote Speech I ---Prof. Dr. Alois Zoitl, Johannes Kepler University, Linz, Austria Title: Hic sunt dracones? Developing software for networked production automation systems
09:50 – 10:30	Keynote Speech II (Online) ---Prof. Dr. Shaoying Liu, Hiroshima Univ, Japan Title: Agile Formal Engineering Methods for High Productivity and Reliability
10:30 – 10:50	Morning Coffee Break & Group Photo
10:50 – 11:30	Keynote Speech III ---Dr. Manfred Mücke, Materials Center Leoben, Austria Title: Probabilistic Hybrid Models for Effective Design of Condition Monitoring Systems
11:30 – 12:10	Keynote Speech IV ---Prof. Dr. Barbara Mayer, FH Joanneum, Austria Title: Learning and research factory for digital production: the Smart Production Lab of FH Joanneum
12:10 – 13:30	Lunch (Break Time) --- Restaurant (on the ground floor)
13:30 – 14:10	Tutorial ---Prof. Dr. Paul Hofmann, FH Joanneum, Austria Hidden Markov Models and their Application for Predicting Failure Events
14:15 – 16:15	Onsite Session 1---Computer and Information Science Session Chair: Prof. Dr. Barbara Mayer, FH Joanneum, Austria A1062, A3004, A1047, A1013, A3005, A1028, A3007, A1024
16:15 – 16:30	Afternoon Coffee Break
16:30 – 18:30	Onsite Session 2---Computer Aided Design and Information Management Session Chair: Prof. Dr. Vitaliy Mezhuyev, FH Joanneum, Austria A1058, A1057, A1008, A1037, A1031, A1034, A1032, A1053
18:30 – 20:00	Dinner --- Restaurant (on the ground floor)

May 14, 2022

<p>Password: 051214</p> <p>Zoom Link:</p> <p>Online Session A&C: https://us02web.zoom.us/j/81898593525</p> <p>Online Session B&D: https://us02web.zoom.us/j/85849674461</p>		
10:00-12:15	<p>Online Session A- Software and Information Engineering</p> <p>Session Chair: Assoc. Prof. Abdul Nasir Abd Ghafar, University Malaysia Pahang, Malaysia A1063, A1017, A1016, A1007, A1038, A1005, A1004, A1020</p>	<p>Online Session B- Intelligent Algorithms and Computing</p> <p>Session Chair: Assoc. Prof. Muhammad Ilyas, University of Malkand, KPK, Pakistan A1015, A1054, A1036, A1045, A1030, A1052, A1061, A1006, A1027</p>
14:00-16:00	<p>Online Session C- Network and Information Security</p> <p>Session Chair: Prof. Cyrus F Nourani, Akdmkrd-DAI-TU Berlin, Germany A1043, A1001, A3002, A1064, A1019, A1009, A1012, A1055</p>	<p>Online Session D- Computer Application Intelligent Business</p> <p>Session Chair: Prof. Franz Haas, Graz University of Technology, Austria A1023, A1026, A1060, A1056, A1029, A1046, A1010</p>
16:00	<p>Closing Ceremony</p> <p>Zoom Link: https://us02web.zoom.us/j/81898593525</p> <p>Password: 051214</p> <p>Prof. Dr. Martin Tschandl, Prof. Dr. Vitaliy Mezhuyev, FH Joanneum, Austria</p>	



Prof. Dr. Alois Zoitl, Johannes Kepler University, Linz, Austria

May 13, 2022 / 9:10-9:50

Speech Title: Hic sunt dracones? Developing software for networked production automation systems

Bio: Alois Zoitl holds a PhD degree in Electrical Engineering with focus on dynamic reconfiguration of real-time constrained control applications and a Master degree in Electrical Engineering with the focus on distributed industrial automation systems from Vienna University of Technology.

Currently he is a Professor for cyber-physical systems for engineering and production with the LIT | CPS Lab at Johannes Kepler University, Linz. Before that he was the scientific research group leader for Industrial Automation at the research institute fortiss in Munich, Germany. Before that he was the head of the research field Distributed Intelligent Automation Systems (Odo Struger Laboratory) at the Automation and Control Institute (ACIN), Vienna University of Technology.

He is co-author of more than 150 publications (3 books, 6 book chapters, 19 journal articles) and the co-inventor of 4 patents in the mentioned areas. His research interests are in the area adaptive production systems, distributed control architectures, and dynamic reconfiguration of control applications as well as software development and software quality assurance methods for industrial automation. Alois Zoitl conducted and lead several industry funded R&D projects as well as coordinated and participated in several public funded (national as well as European) R&D projects.

He is a founding member of the open-source initiatives Eclipse 4diac, providing a complete IEC 61499 solution, and OpENer. Furthermore, he is a member of the IEEE, the PLCopen user organization, and GMA. Since 2009 he is an active member of the IEC SC65B/WG15 for the distributed automation standard IEC 61499. He was named convenor of the group in May 2015.

Abstract: Industry faces major challenges as product life-cycles shorten, product variability increases, and global markets become more volatile. To remain competitive, production facilities and equipment must be adaptable to respond quickly and efficiently to these changes. A key success factor in achieving these goals is the control and automation infrastructure. New distributed architectures are a possible approach to address these requirements. The amount of software in production automation systems is constantly increasing. This is reinforced by the demand for increased networking of these systems. Current technologies are already reaching their limits. This leads to increasing development efforts and costs. It seems as if control software turns into an indomitable beast which is very difficult to control. New interaction and communication patterns as well as new ways of programming automation systems consisting of networked control units are required. In the context of this talk we would like to give an overview of the current and future requirements for production automation systems. The current approaches to programming production automation systems will be considered. In particular, it will be shown how model-driven or low code software development can help to tame the beast and reduce development efforts. An important aspect here is Open Source Software, which still has great potential especially in the production automation system environment.



Prof. Dr. Shaoying Liu, Hiroshima Univ, Japan

May 13, 2022 / 9:50-10:30 (Online)

Zoom Link: <https://us02web.zoom.us/j/81898593525> (Password: 051214)

Speech Title: Agile Formal Engineering Methods for High Productivity and Reliability

Bio: Shaoying Liu holds a B.Sc and a M.Sc degree in Computer Science from Xi'an Jiaotong University, China, and the Ph.D in Computer Science from the University of Manchester, U.K. He worked as Assistant Lecturer and then Lecturer at Xi'an Jiaotong University, Research Associate at the University of York, and Research Assistant in the Royal Holloway and Bedford New College at the University of London, respectively, in the period of 1982 -1994. He joined the Department of Computer Science at Hiroshima City University as Associate Professor in April 1994, and the Department of Computer Science in the Faculty of Computer and Information Sciences at Hosei University in April 2000. In April 2001 he was promoted to a Professor. From 1st April 2020, he has been working at Hiroshima University as a Professor.

He was invited as a Visiting Research Fellow to The Queen's University of Belfast from December 1994 to February 1995, a Visiting Professor to the Computing Laboratory at the University of Oxford from December 1998 to February 1999, and a Visiting Professor to the Department of Computer Science at the University of York from April 2005 to March 2006. From 2003 he is also invited as an Adjunct Professor to Shanghai Jiaotong University, Xi'an Jiaotong University, Xidian University, and a Visiting Professor to Shanghai University, Xi'an Polytechnic University, Beijing Jiaotong University, and Beijing University in China, respectively. He is IEEE Fellow, British Computer Society (BCS) Fellow, and member of Japan Society for Software Science and Technology.

Abstract: With the rapid development and spreading applications of IoT systems and information systems, how to ensure software productivity and reliability has become a tremendous challenge to conventional software engineering. To overcome this challenge, we have developed the “Agile Formal Engineering Methods” (AFEM) as a research area since 1989 to study how formal methods can be effectively integrated into conventional software engineering technologies and process models so that formal techniques can be tailored, revised, or extended to fit the need for improving software productivity and reliability in practice (e.g., through the enhancement of the usability of formalism and the tool supportability of the relevant methods). As a result of our efforts, we have developed a specific AFEM called Agile Structured Object-Oriented Formal Language (Agile-SOFL) that offers a Three-Step Specification Approach, Specification Animation for Validation, Incremental Specification-Based Implementation, and Specification-Based Testing techniques. In this talk, after reviewing the commonly used development methods, I will focus on the introduction of Agile-SOFL and explain how it can be used to improve software productivity and reliability. Finally, I will describe several important and new research directions and topics for future software engineering.



Dr. Manfred Mücke, Materials Center Leoben, Austria

May 13, 2022 / 10:50-11:30

Speech Title: Probabilistic Hybrid Models for Effective Design of Condition Monitoring Systems

Bio: As a research engineer with CERN, Manfred worked on lowering turn-around times for the implementation of numerical algorithms on FPGAs. He received his PhD in Electronics Engineering in 2007 from Graz University of Technology. Subsequently, he joined the Research Lab Computational Technologies and Applications at the University of Vienna as a post-doc. Since 2014, Manfred is with the Materials Center Leoben as a Key Researcher in Embedded Computing and Machine Learning. His research interests include the creation of hybrid models for condition monitoring, uncertainty quantification, automatic code generation and embedded inference.

Abstract: As we push manufacturing to ever smaller lots, the operating conditions of both production lines and products are getting more and more diverse. Consequently, we need to automate the design process of quality control and condition monitoring systems to cope with the increasing variability. Relevant steps in this design process include machine-readable specification of knowledge, machine-readable system specification, design of experiments, hybrid model construction and reasoning about the model (to specialise a generic model for different tasks and evaluate the costs of different variants). In order to reason about a hybrid model, a common representation of uncertainty is required. Using random variables for this task, we arrive at probabilistic hybrid models. I will introduce different model construction approaches and point out open issues in respective tooling (reasoning as well as code generation).



Prof. Dr. Barbara Mayer, FH Joanneum, Austria

May 13, 2022 / 11:30-12:10

Speech Title: Learning and research factory for digital production: the Smart Production Lab of FH Joanneum

Bio: Barbara Mayer holds a PhD in control theory with focus on model predictive control of hybrid systems from TU Vienna and a Master degree in Technical Mathematics of TU Graz. Since 2017, she is a Assoc. Professor for automation and digital production at the Institute Industrial Management at the university of applied sciences FH JOANNEUM in Kapfenberg, Austria. She is Head of Smart Production Lab, the learning and research factory for digital production of the Institute, and the research group Digital Shopfloor. Before she was software designer and later leader of software development of a middle-sized Austrian company in the field of Automation, where she collected industrial experience. Her fields of research are model predictive control, non-linear modeling, IoT, and distributed control. Barbara Mayer conducted and led several industry funded R&D projects as well as coordinated and participated in several public funded national R&D projects. She is participating on initiatives of the Platform Industry 4.0 and is member of the scientific advisory board of the European R&D project EuProGigant.

Abstract: The Institute of Industrial Management has conducted interdisciplinary developments on smart production in numerous projects. The results can especially be experienced by students as well as industrial companies in the learning and research factory for digital production, the Smart Production Lab at the FH JOANNEUM in Kapfenberg, Austria. More than 30 interdisciplinary use cases developed over the last three years show vivid examples and a holistic view on smart production in the research fields of Digital Shopfloor, ERP and MES; Supply Chain Management, Future of Work and Management Control. In this talk an insight on activities as well as in selected use cases is given. Furthermore, the development of a paperless vertically integrated production is presented.



Prof. Dr. Paul Hofmann, FH Joanneum, Austria

May 13, 2022 / 13:30-14:10

Tutorial Title: Hidden Markov Models and their Application for Predicting Failure Events

Bio: Paul Hofmann is Associate Professor at FH Joanneum, Austria. Before joining FH Joanneum, he was Executive in Residence at Senseforce.io and Chief Innovation Officer at Alpega. He is an Advisory Board Member to Chimera IoT and a Computer Science Advisory Board Member at Stony Brook University. Paul served as CTO AI and Data Science NA, at Accenture Resources. He was the CTO of two successfully acquired startups, SpaceTime Insight (now Nokia) and Saffron Technology (now part of Intel). He also served from 2012 to 2014 as Board Member at Primal, an AI startup. Paul was Vice President Research at SAP Labs at Palo Alto from 2006 to 2011. Paul has also worked for the SAP Corporate Venturing Group. Prior to joining SAP, Paul was Senior Plant Manager at BASF's Global Catalysts Business Unit in Ludwigshafen, Germany. Paul was visiting scientist at MIT, Cambridge in 2009. Paul was Researcher and Assistant Professor at top German and US Universities, like Northwestern University in Evanston/Chicago, Illinois, USA and at Technical University in Munich, Germany. He was a visiting scientist at MIT and gave lectures at UC Santa Cruz, HPI Postdam, Dresden Technical University and Joanneum Graz. He received his Ph.D. in Physics at the Darmstadt University of Technology, Germany, after completing his bachelor in biotechnology and a master's degree in Chemistry from the University of Vienna.

Abstract: We show how Markov mixed membership models (MMMM) can be used to predict the degradation of assets. We model the degradation path of individual assets, to predict overall failure rates. Instead of a separate distribution for each hidden state, we use hierarchical mixtures of distributions in the exponential family. In our approach the observation distribution of the states is a finite mixture distribution of a small set of (simpler) distributions shared across all states. Using tied-mixture observation distributions offers several advantages. The mixtures act as a regularization for typically very sparse problems, and they reduce the computational effort for the learning algorithm since there are fewer distributions to be found. Using shared mixtures enables sharing of statistical strength between the Markov states and thus transfer learning. We determine for individual assets the trade-off between the risk of failure and extended operating hours by combining a MMMM with a partially observable Markov decision process (POMDP) to dynamically optimize the policy for when and how to maintain the asset.

Onsite Session 1---Computer and Information Science

Session Chair: Prof. Dr. Barbara Mayer, FH Joanneum, Austria

14:15 – 16:00, May 13, 2022 | Conference Room: Nestroy (on the ground floor)

A1062, A3004, A1047, A1013, A3005, A1028, A3007, A1024

<p>A1062 14:15-14:30</p>	<p>Model of effective cost management in the time of corona crisis: a PLS-SEM approach Vitaliy Mezhuyev, Martin Tschandl, Claudia Brandstätter Presenter: Vitaliy Mezhuyev, FH Joanneum, Austria</p> <p>Abstract: Companies all over the world are affected by the Corona crisis. It is especially important for companies to keep the key business parameters under control in difficult economic times. This paper allocates the factors that influence cost management effectiveness during the corona crisis. The proposed influence model was evaluated in an empirical study involving Austrian companies and validated with Partial Least Squares - Structural Equation Modelling (PLS-SEM) approach. The results show, that allocated factors have a positive effect on the effectiveness of cost management and explain about half of the variance of the corresponding variable, giving moderate explanatory power to the proposed model. The results demonstrate to what extent the use of cost management tools can be a helpful instrument for crisis management.</p>
<p>A3004 14:30-14:45</p>	<p>Free-Space Optical Communication over F Turbulence Channel with Nonzero Boresight Pointing Errors Osamah S. Badarneh and Rawan Derbas Presenter: Osamah Badarneh, German Jordanian University, Jordan</p> <p>Abstract: In this paper, we investigate the impact of nonzero boresight pointing errors on the performance of free-space optical (FSO) communication systems over Fisher-Snedecor Fatmospheric turbulence channels. To this end, we derive simple and accurate approximations for the probability density function (PDF) and the cumulative distribution function (CDF). The derived PDF and CDF statistics are used to obtain analytical expressions for the outage probability and average bit error rate under two detection techniques, namely intensity modulation direct detection and heterodyne detection techniques. In addition, approximate expressions for the ergodic channel capacity in the high- and low-SNR regimes are derived. The analysis is numerically evaluated and supported by Monte-Carlo simulation results for different turbulence and pointing error scenarios. The results demonstrate that the derived approximate expressions are fairly accurate and provide a precise evaluation of the underlying analyses.</p>

<p>A1047 14:45-15:00</p>	<p>Cluster-oriented virtual machine low latency consolidation algorithm Michal Polák, Jan Fesl Presenter: Michal Polák , FIT CTU in Prague , Czech Republic</p> <p>Abstract: With the growing amount of data processed in the virtual environment, many researchers focus their efforts on optimizing the load distribution on data centers according to various criteria. In this article, we propose optimization at the network infrastructure load of the data center. The new heuristic algorithm, based on grouping virtual machines into clusters, was compared with heuristics based on a genetic algorithm. The performed measurements indicate that clustering-based heuristics, although data-dependent, shows promising characteristics with significantly lower computational complexity. The algorithm was tested on a rigorous number of instances, proving its general usability.</p>
<p>A1013 15:00-15:15</p>	<p>Split Feature Space Ensemble Method using Deep Reinforcement Learning for Algorithmic Trading Marcell Németh, Gábor Szűcs Presenter: Gábor Szűcs, Budapest University of Technology and Economics, Hungary</p> <p>Abstract: In the financial sector, machine learning is a promising tool, which can be utilized in stock trading as well. The aim of the research was to develop and refine deep reinforcement learning models to execute stock trading that maximizes revenue and minimizes investment risk. The main focus of this paper is on a new ensemble technique based on splitting the feature space and the optimization of decision-making by agents learning in parallel. As the consequence of the splitting, the space formed by all input features is replaced by subspaces, where each subspace is covered by a functional group of technical indicators. Based on the feature space splitting idea, we proposed a new ensemble method, called the Split Feature Space Ensemble Method, and developed three model variants of it. The experimental results show that the proposed method outperforms the standard ensemble approach.</p>
<p>A3005 15:15-15:30</p>	<p>On the Hardware Reliability of Generalized Space Modulation Techniques Omar Hiari, Raed Mesleh, Neveen Aljanini Presenter: Omar Hiari, German Jordanian University, Jordan</p> <p>Abstract: Space modulation techniques (SMTs) are a family of multiple input multiple output (MIMO) transmitter hardware models that have been highlighted for their efficient and cost-effective implementations. Moreover, given the added interest in reliability in wireless systems through ultra-reliable low latency (URLLC) as an example, recent literature has taken interest in the analysis of reliability of SMT hardware. SMTs however have shown that the requirement to always have a power of two number of antennas can be wasteful when antenna failures occur. Generalized SMTs (GSMTs), on the other hand, provide an alternative implementation approach where an arbitrarily number of antennas is deployed which can reduce waste and maintain higher spectral</p>

	<p>efficiency values for longer. As such, this work extends on the analysis of SMTs to compare them to GSMTs from a reliability aspect. It is revealed that except for one of the techniques, not much advantage is gained from a reliability or availability perspective by switching to GSMTs.</p>
<p>A1028 15:30-15:45</p>	<p>A Preliminary Result of Food Object Detection using Swin Transformer DAEIL JUNG, SIMON SHIM, CHARLES CHOO, DOOSUNG HWANG, YUNMOOK NAH, SEJONG OH Presenter: DAEIL JUNG, Dept. of Computer Science Dankook University Youngin, Republic of Korea</p> <p>Abstract: An inappropriate diet is one of the main causes of poor health. However, it is difficult to sustain a quantitative diet assessment in the general living environment. Food object detection is a key method for solving this problem; still, it is difficult to find studies that apply recent object detection techniques. In addition, the currently used high-performance food object detection models have a special architecture that combines two deep learning models - food localization and food classification - in series to achieve high accuracy. The disadvantage of this architecture is that it is difficult to predict the scalability of a model. In this study, we built an end-to-end food object detection model using the Swin Transformer, which is one of the latest backbone models. The experiment was conducted to compare the performance of the UECFOOD dataset with other food object detection studies. For the UECFOOD-100 dataset, a mAP(mean Average Precision) of 0.522 was obtained; also, a mAP of 0.52 was obtained for the UECFOOD-256 dataset. The findings show that the proposed model that uses only end-to-end object detection produces better performance than previous studies using a combination of food localization and food classification.</p>
<p>A3007 15:45-16:00</p>	<p>Structured-Sparse Recovery Detectors for Large--Scale Differential Space Shift Keying MIMO System Mustafa Alshawaqfeh, Ammar Gharaibeh and Raed Mesleh Presenter: Mustafa Alshawaqfeh, German-Jordanian University, Jordan</p> <p>Abstract: Differential space shift keying (DSSK) multiple-- input multiple--output (MIMO) system promises further simplifications to the receiver circuitry as it avoids complex carrier recovery circuits and channel estimation algorithms. Yet, DSSK optimum maximum--likelihood (ML) receiver suffers from huge computational complexity that hinders DSSK applicability especially for large MIMO configurations. Hence, this paper aims at utilizing the inherent sparsity nature of DSSK signals to design efficient low--complexity receivers for DSSK MIMO systems. In addition, a group matching pursuit (GMP) detector is developed, in which, a novel reformulation of the detection problem is presented such that the real and imaginary parts of the DSSK signals are combined with sparsity grouping structure. As well, permutation ranking and permutation unranking algorithms are incorporated to alleviate the need for look-up tables, and preserve MIMO requirements. Reported results reveal that proposed low complexity detectors significantly reduces the complexity as compared to ML, with moderate degradation in bit error performance.</p>

A1024 16:00-16:15	<p>An Improved Clustering Algorithm for Segmentation MRI Brain Images Using Small- World Network Fatemeh Galandari, Azam Noroozi Presenter: SEYYEDMOHAMMAD JAVADIMOGHADDAM Department of Computer Engineering, Bozorgmehr University of Qaenat, Qaen, Iran</p> <p>Abstract: The process of image segmentation is widely used in dividing the medical image into various clusters. Magnetic Resonance Image (MRI) is an essential auxiliary instrument to diagnose abnormalities. However, the drawback of the MRI image is the presence of noise. Reducing the noise is vital to achieving a suitable quality in segmentation. This paper presents an improved fuzzy clustering in which a small-world network architecture tries to increase the quality of the MRI images specially related to the brain. The small-world network increases the clustering accuracy because of shortcuts between the cluster, which causes finding a suitable cluster. Experimenting on a real data set shows an improvement over image segmentation quality while increasing the time consuming is negligible.</p>
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Onsite Session 2--- Computer Aided Design and Information Management

Session Chair: Prof. Dr. Vitaliy Mezhuyev, FH Joanneum, Austria

16:30 – 18:30, May 13, 2022 | Conference Room: Nestroy (on the ground floor)

A1058, A1057, A1008, A1037, A1031, A1034, A1032, A1053

<p>A1058 16:30-16:45</p>	<p>Selection of an IoT Platform: A Framework for a Two-Stage Multi-Criteria Decision Making Process Barbara Mayer, Katharina Maria Lackner Presenter: Barbara Mayer, FH Joanneum University of Applied Sciences, Austria</p> <p>Abstract: Internet of Things (IoT) is one of the main enablers of industries' digital transformation. IoT platforms have become essential parts in IoT architectures to enable the generation of added value from gathering data on the field level. A big variety of products and solutions are available on the market. However, industries, IoT applications, and IoT architectures differ considerably regarding their requirements in functionality and scale. The selection process thus poses major challenges for industrial companies. Several sets of criteria have been presented in literature, but there is still a lack of methods and tools for a practical individual selection process. This paper provides a framework for an individual two-stage selection process based on a multi-criteria assessment. This allows companies firstly to weight the given set of criteria according to their individual needs and secondly, to follow a two-stage assessment including an interview-related part and a practical evaluation. Additionally, the paper shows first validation results based on the selection process for an IoT platform for the Institute's research and learning factory, the Smart Production Lab.</p>
<p>A1057 16:45-17:00</p>	<p>Need for skilled workers in the area of Data Science and Cloud Computing in Styria Raphaelae Raab, Wolfgang Granigg, Michael Melcher Presenter: Raphaelae Raab, FH JOANNEUM, Austria</p> <p>Abstract: The aim of this paper is to discuss the results of a survey conducted to assess the need for skilled workers in the areas Data Science & Cloud Computing in Styria, Austria. Firstly, the relevant roles and skills in the abovementioned areas had to be selected. Initially, this selection process is described. Consequently, a survey was designed and given to a representative group of companies. The survey includes questions regarding the need for skilled workers with respect to the domains and the selected skills in the areas Data Science & Cloud Computing. Moreover, the respondents were asked about the</p>

	<p>importance of further education and the necessity of academic education in these areas. Overall, our survey concludes that the requirements for skilled workers in the areas of Data Science and Cloud Computing in Styria will increase significantly in the coming years.</p>
<p>A1008 17:00-17:15</p>	<p>Adaptive application development and integration process for modern automotive software Tobias Rösch, Martin Sommer, Eric Sax Presenter: Tobias Rösch, EvoBus GmbH, Germany</p> <p>Abstract: Due to fast progress in information technologies and long lifecycles of vehicles, there are ever-increasing expectations in modern automotive software development regarding the flexibility to integrate updates and new functions quickly into already existing systems. This paper proposes a process, that is especially suitable for the development of new functions in higher programming languages and the usage of machine learning models. When developed in a tool like MATLAB, code generators can be used to integrate the function step-by-step into a service-oriented automotive E/E-architecture. It is based on a classic V-model process and uses integration steps according to the XiL approach. The key aspect is the frontloading of verification and validation into the steps as early as possible to keep iteration cycles fast. The proposed process is applied to the development of a Neural Network Model Predictive Control (NNMPC) for a Heating, Ventilation and Air-Conditioning (HVAC) unit of a city bus. The resulting NNMPC is then integrated into a system based on the AUTOSAR adaptive platform. That allowed the function to be developed and integrated quickly and seems to be a promising approach to bring new functions into already existing automotive E/E-architectures.</p>
<p>A1037 17:15-17:30</p>	<p>Discovering information inefficiencies in manufacturing processes with modified value stream mapping Joachim Komar, Anja Pflieger-Landthaler, Birgit Rabel Presenter: Joachim Komar, FH Joanneum, Austria</p> <p>Abstract: Manufacturing environments that rely on empowered shopfloor workers with decentralized decision making, as proposed in the Industry 5.0 vision, call for adapted approaches to production management. Aside from personal competencies, efficient decision making in VUCA environments primarily requires high-quality, up-to-date information. Based on popular value stream mapping methods, this paper proposes an approach to systematically analyze the shopfloor decision making in terms of information efficiency. The modified value stream mapping approach (MVSM) offers support for discovering informational bottlenecks in manufacturing processes, which subsequently can be addressed with targeted optimization measures. Qualitative results from the first practical implementations indicate the capabilities, limitations and improvement potentials of the proposed approach.</p>
<p>A1031 17:30-17:45</p>	<p>Prediction of Metabolic Syndrome based on Non-invasive Measurement Features for Chronic Disease Management SIMON SHIM, CHARLES CHOO, DOOSUNG HWANG, YUNMOOK NAH, SEJONG OH Presenter: Hyunseok Shin, Dankook University, South Korea</p>

	<p>Abstract: Metabolic syndrome is a chronic disease in which metabolism-related abnormal factors are complex. Metabolic syndrome is currently diagnosed by determining the number of abnormal factors based on physical measurements and blood tests. Metabolic syndrome causes complications in patients with diabetes or the cardiovascular system; therefore, prevention and management are particularly important. Metabolic syndrome can be prevented effectively by allowing individuals to manage it themselves; however, blood tests are a major obstacle to the public. Therefore, this study is conducted to devise a method that can easily predict metabolic syndrome without requiring a blood test. A dataset containing data of 69,944 adult Korean men and women is used to develop a predictive model. This dataset contains not only physical measurements and blood test results, but also life logs pertaining to diet, food intake, drinking, and smoking. Using these data, we identify features that contribute significantly to the prediction of metabolic syndrome, except for items associated with blood test. Finally, we propose a predictive model that allows the public to easily manage metabolic syndrome using only non-invasive factors. Furthermore, we investigate methods to improve the predictive performance from the perspective of four subgroups, based on waist circumference and blood pressure.</p>
<p>A1034 17:45-18:00</p>	<p>Data-driven approach to optimize the relative density in additive manufacturing processes Raphael Hartner, Simon Zigala Presenter: Raphael Hartner, University of Applied Sciences FH JOANNEUM, Austria</p> <p>Abstract: Additive manufacturing (AM) is a modern production technology to manufacture complex designs which are otherwise impossible to produce with conventional production technologies. However, the inherently large number of influential parameters, such as layer height and extrusion rate, lead to difficulties during the ramp-up phase for new products until the optimal parameter combination is found. Unfortunately, conventional techniques for optimization (e.g., finite element analysis) are resource-intensive and mostly design specific. Additionally, even though sophisticated methods from the domain of machine learning can be utilized as well, to the best of our knowledge, existing research largely focuses on in-situ process monitoring or ex post quality inspection. However, these methods do not support the selection of suitable process parameters in advance. Thus, a combined methodology consisting of traditional aspects and machine learning is proposed. First, supposedly influential factors are selected, a repeated factorial design of experiments is conducted to generate high-quality data samples, and the target value is measured. Second, the random forest algorithm is utilized to determine the feature importance of each influential factor. Third, the most relevant features are used to train several machine learning models to predict the target quality characteristic. Fourth, a repeated k-fold cross validation is employed to evaluate the models, so that the best model can be selected in spite of the small data set. This methodology was validated for the relative density of extrusion-based AM parts. As it was shown, the best model can reliably (R-squared of 0.92) predict the relative density purely based on process parameters. Consequently, the resulting model can be utilized to support an efficient ramp-up phase and future work can focus on extending the methodology for other AM technologies and quality characteristics.</p>

<p>A1032 18:00-18:15</p>	<p>Analysis of Misclassified Cases in a Metabolic Syndrome Prediction Model Kyungmin Kim, Hyungseok Shin Presenter: SE JONG OH, Dankook University, South Korea</p> <p>Abstract: Metabolic syndrome (MetS) refers to a phenomenon in which dangerous adult diseases, such as arteriosclerosis, hypertension, obesity, diabetes, and hyperlipidemia, occur simultaneously in one person. It has become one of the most common diseases. Recently, machine learning prediction models for MetS have been proposed to this end. Their prediction accuracies are under 0.9 and need to be improved further for a practical use in the medical field. In this study, we propose an analysis of misclassified cases in a MetS prediction model as a point of feature importance and interaction. We adopt a case-based feature importance/interaction approach for the analysis. The results help us understand the roles of features in the prediction model. Furthermore, this study can be used to improve the performance of prediction models.</p>
<p>A1053 18:15-18:30</p>	<p>An Initial Comparison of Selected Agent-Based Simulation Tools in the Context of Industrial Health and Safety Management Raphael Raab, Wolfgang Granigg, Michael Melcher Presenter: Raphael Raab, FH JOANNEUM, Austria</p> <p>Abstract: Agent-based approaches are becoming more and more popular for the modelling and simulation of natural phenomena, behaviour-specific patterns as well as in the health and safety area. In this paper we aim to evaluate and compare selected agent-based software tools. A selection is necessary due to this field being a fast evolving one, which offers numerous software frameworks and tools. Since our focus lies in the health and safety area, the primary selection criterion was the applicability in the field of social sciences. Furthermore, the modeling strength of the software tools was considered. Based on these selection criteria NetLogo, GAMA and Repast are used for an initial comparison, which involves technical details, modelling, simulation and data exchange. We conclude that in our context, NetLogo and GAMA appear to be more suitable than Repast. The latter - although very versatile - requires a high amount of programming skill. GAMA's primary strength on the other hand is the heavy focus on GIS data involvement, while NetLogo is not only very intuitive in learning but offers also a large number of features.</p>

Online Session A--- Software and Information Engineering

Session Chair: Assoc. Prof. Abdul Nasir Abd Ghafar, University Malaysia Pahang, Malaysia

10:00-12:00, May 14, 2022 | Zoom Link: <https://us02web.zoom.us/j/81898593525> (Password: 051214)

A1063, A1017, A1016, A1007, A1038, A1005, A1004, A1020

<p>A1063 10:00-10:15</p>	<p>Way - A Fast Front-end Generator Framework Based on Python Processing Jinwei Lin, Jinbin Lin, Jinhuang Lin Presenter: Jinwei Lin, Monash University, Malaysia</p> <p>Abstract: This paper has provided a new methodology of designing web front-end frameworks. Way is designed as a convenient and efficient front-end developing framework. Way has combined the advanced characteristics of the convenient developing of JavaScript (JS) front-end frameworks and the strong support SEO of native HTML developing. The main idea of the design and implementation of Way is using the Python scripting as a monitor and interpreter, which make the developer focus more on the design idea rather than coding. One of the most significant characteristics of Way is that the developer can develop a native HTML project in a high efficiency of using a JS framework when using Way. The paper discusses and analyses the background, advantages and disadvantages of using a JS framework, and the relationships between JS frameworks and SEO. Subsequently, the paper analyses the basic design principle of Way and presented the significant implementation methods of Way. Followed by the discussions and analysis of the advantages and performances of Way. The expansibilities and developing trends of Way has been discussed in the end of the paper. As an open-source framework in GitHub, Way is a new and useful design idea more than a practical web front-end desing and developing framework.</p>
<p>A1017 10:15-10:30</p>	<p>Composite metamorphic relations for integration testing Sofia Iakusheva, Anton Khritankov Presenter: Sofia Iakusheva, Moscow Institute of Physics and Technology, Russia</p> <p>Abstract: Metamorphic testing is a testing method for problems without test oracles. Integration testing allows for detecting errors in complex systems that may not be found during the testing of their components. In this paper, we propose a novel approach that applies metamorphic testing in integration testing. The main idea is to develop a composite metamorphic relation for the system represented as an acyclic graph. This relation is a logical function of metamorphic relations for the parts of the system (vertices of the graph). It takes into account the features of the parts. Also, it can simplify the search for</p>

	<p>failure by identifying the subsystem with error. In this paper's theoretical part, we describe an algorithm of relation design. Then, we apply our method to a bioinformatics system for comparative genetic analysis of tissues using production tools. This experiment proves our method can be applied to real-life pipelines and find errors in them.</p>
<p>A1016 10:30-10:45</p>	<p>Automatic Refactoring and Compile Time Optimization of Cpp Projects by Directly Including Header Files Julian Reisch, Peter Großmann Presenter: Julian Reisch, Synoptics GmbH, Germany</p> <p>Abstract: The compilation of a project from source to machine code can take up to hours of computation time which in large part depends on how many lines of code are compiled. In the programming language C++, source code is written in separate header and source files. The code in a header file is compiled in each source file it is included in. In order to minimize the compilation time of the project, code should therefore be included only in source files where it is actually used. We present an optimization model that minimizes the number of lines of code that are included and hence compiled but not used. The restrictions of the model are the dependencies in the code. For example, when a function is called in a source file, the header file where this function is defined in must be included in the source file. The variables of the model are which file includes which other files. We propose the solution method to replace indirect includes by more direct ones. We provide computational results on real-world C++ projects and show that the compilation times can be reduced by up to 9%.</p>
<p>A1007 10:45-11:00</p>	<p>A new preemptive task scheduling framework for heterogeneous embedded systems Jose Antonio Ayala-Barbosa, Paul Erick Mendez-Monroy Presenter: Antonio Ayala, National Autonomous University of México, Mexico</p> <p>Abstract: In recent years, the graphics processing units (GPUs) have been used to generate real-time applications in embedded systems; due to the programmability, high performance and low power consumption of GPUs, leveraging the ability to process multiple workloads simultaneously. However, application programming frameworks using GPUs presented in the literature lack the flexibility to handle real-time events and the dynamic behavior of the application. Existing GPU schedulers do not consider the preemption of higher priority tasks or are only considering temporary preemption, causing a task to occupy all GPU resources until it ends once launched, this causes delays in higher priority tasks generated dynamically by events and increases the rate of lost deadlines and failures in critical applications. To consider this problem, we propose a new programming framework to schedule preemptive tasks based on their priority and allocate them through dynamic load balancing. The proposed framework seeks to generate a minimum of context switch and maximize the cores' utility into a heterogeneous embedded system. The design was presented for an Nvidia Jetson Tx2 card, featuring 5 modules of the programming framework.</p>

<p>A1038 11:00-11:15</p>	<p>Ontology-Based Cognitive Service Discovery & Composition Hassina Nacer, François Charoy, Samir Youcef Presenter: Linda OUCHAOU, University of Science and Technology Houari Boumedienne, Algeria</p> <p>Abstract: Cloud cognitive computing has received a lot of attention lately especially for tackling real-world problems such as vision, natural language processing, fraud detection, sentiment analysis and speech recognition. This paradigm is based on cloud serverless computing and it provides machine learning based functions to end users. Part of the appeal in adopting this paradigm is its simplicity and the future promises a fast-growing serverless-native ecosystem in which service discovery and composition methods must be provided. However, serverless platforms still lack automated searching methods and the research community's attention regarding this issue has been limited. In this paper, we propose an ontology-based approach for discovering and composing cognitive functions in serverless platforms in order to automate the searching process and semantically answer users' requirements. We also carried a set of experiments to verify the Correctness and the feasibility of our approach and discuss the influence of cognitive services nature on the outcomes of the discovery and composition approach</p>
<p>A1005 11:15-11:30</p>	<p>Metrics for machine learning evaluation methods in cloud monitoring systems Valerii Petrov, Anna Gennadinik, Elena Avksentieva Presenter: Valerii Petrov, ITMO University, Russia</p> <p>Abstract: During the machine learning pipeline development, engineers need to validate how efficient machine learning methods work to assess the quality of the made forecast. Due to the wide deployment and implementation of the machine learning models and methods across monitoring systems, the actual scientific problem is the assessment of these methods in the monitoring systems. This research has concluded, that the current standard metrics are not sufficient to get the accurate assessment for the used machine learning methods. This research has provided a new complex rating for anomaly detection regarding the use-cases of cloud monitoring systems. The main difference from the standard metrics is that the new approach includes better integration to the business processes, demanding resources, and a critical glance to the false-positive alerts. The new approach might be used in the model assessment in monitoring systems with the similar requirements: • Cost-effective use of computing resources • Low amount of false-positives • Fast detection of anomalies Furthermore, the current research proposes new methods for computation capacity planning to the different anomaly detection methods. This method is not even limited to anomaly detection and could be used as a base to develop capacity planning for other machine learning techniques and approaches.</p>
<p>A1004 11:30-11:45</p>	<p>Predicting the Progress of Vehicle Development Projects using an Attention-based Encoder-Decoder Model Böhme, O. and Meisen, T. Presenter: Oliver Böhme, Bergische Universität Wuppertal, Germany / Volkswagen AG</p>

	<p>Abstract: The automotive industry is facing a technological transformation. Increasing requirements from customers, markets and the law are raising the complexity of its products. As the car evolves into a “smartphone on wheels”, its development engineers are facing unprecedented challenges. The growing technical product complexity is also pushing conventional project management methods to their limits. This results in changed constraints, which make it all the more necessary to predict the course of a vehicle development project, in advance. The use of deep learning methods offers great potential here. The goal of this paper is to predict the course of vehicle development projects. One of the major challenges are the nonlinearity and aperiodicity of the multivariate data resulting from short- and long-term dynamic behaviour. In order to address these challenges, we apply different state-of-the-art methods for multivariate time series prediction onto a real-world dataset and compare as well as evaluate the results quantitatively. As result, we propose a multilevel attention-based seq2seq prediction model for multivariate time series. With this work we lay the foundation for the early detection of deviations from an ideal project course and thereby contribute to the virtual validation of vehicle development projects.</p>
<p>A1020 11:45-12:00</p>	<p>Building a Graph-Based Recommender using Community Embeddings Anton Bekehr, Peter Panfilov Presenter: Anton Bekehr, Palantir Technologies, Germany</p> <p>Abstract: A recommender system is intended to obtain the rating or preference a user would give to an object on the basis of his or her previous object ratings or preferences. Recommender systems are used in many businesses and organizations in order to improve their process management and decision practices or enhance the quality of services. Graphs, such as social networks, emerge naturally from various real-world situations while many real-world problems can be expressed by or reduced to the graph embedding problems that been studied heavily in computer science research. In this work, we explore the application of graph embedding to the design and development of a friend recommender system for the users of the social network. Using graph embeddings for recommendation tasks can improve upon recommender systems because of data compression, the feature vector format, and sub-quadratic time complexity of graph embeddings. We suggest and study a ComE BGMM+VI algorithm that is essentially a proprietary modification of the ComE community embeddings algorithm where Bayesian Gaussian mixture model (BGMM) and variational inference (VI) are used for community embedding and detection. Graph and community embeddings generated with this algorithm are used to build a recommender system for Facebook friend suggestions. For our experiments we use datasets from popular use-cases of Zachary’s Karate Club graph dataset and Social Circles from Facebook dataset. Recommendations generated are evaluated by the top-N hit-rate for users with at least 50 friends. A prototype friend suggestions recommender demonstrates a top-10 leave-one-out hit-rate of 43.6% and run-time optimized hit-rate of 32.9%.</p>

Online Session B--- Intelligent Algorithms and Computing

Session Chair: Assoc. Prof. Muhammad Ilyas, University of Malkand, KPK, Pakistan

10:00-12:15, May 14, 2022 | Zoom Link: <https://us02web.zoom.us/j/85849674461> (Password: 051214)

A1015, A1054, A1036, A1045, A1030, A1052, A1061, A1006, A1027

<p>A1015 10:00-10:15</p>	<p>ARIMA Model for Stock Market Prediction Reem Alotaibi Presenter: Dr.Reem Alotaibi, King Abduaziz University, Saudi Arabia</p> <p>Abstract: Stock market prediction is an essential and challenging task. Prediction plays an important role in the stock market as investors make their decisions based on future forecasting. There are many methods and tools available to predict prices to increase profits and minimize risks. Machine learning algorithms are widely used in stock market prediction. In this article, we will explore the popular ARIMA forecasting model to predict returns on stock from stock market data.</p>
<p>A1054 10:15-10:30</p>	<p>Comparison of a Physically Inspired Agent-Based Model with a Simulated Annealing Algorithm for the Vehicle Routing Problem Kerstin Lenger, Klaus Lichtenegger, Wolfgang Granigg Presenter: Klaus Lichtenegger, FH JOANNEUM - University of Applied Science, Austria</p> <p>Abstract: Vehicle Routing Problems (VRP) are of significant practical importance for many logistic applications, including disposal of waste. Many methods, mostly heuristics, have been proposed for (approximately) solving such problems. In this article, we explore a class of physically inspired approaches, which can be interpreted in an electrostatic or a thermal framework. First, the approaches are been formulated in the continuum, where molecular dynamics methods are available. While the approach works in principle, it faces several problems (like orbits arising from angular momentum conservation) and thus is likely to be not very efficient. Therefore, we study a similar setup on a graph, where most of these problems do not arise in the first place. We compare results of agent-based simulations with results obtained with Simulated Annealing, as one of the standard heuristic approaches to the VRP. While, in a first test, the well-established Simulated Annealing method performs better than the proposed method, the results are not far off, and in special situation (in particular for very large systems) the latter may actually be preferable.</p>

<p>A1036 10:30-10:45</p>	<p>Banking Data Enrichment Pipeline Ronak Doshi, G. Srinivasaraghavan, Neeraj Bansal, Amit Gupta Presenter: Ronak Doshi, International Institute of Information Technology Bangalore, India</p> <p>Abstract: In the present day, there has been a rapid growth of fintech companies all around the globe, providing services like market data analytics, banking solutions, mobile banking, expense management, etc. Many such fin-tech companies rely majorly on banking data. However, bank data, like transactions and holdings data, contains very concise intricate string descriptions which are not machine readable. These string descriptions do not follow any standardized protocols making them harder to convert into organized data. Hence, we propose an intelligent data enrichment pipeline that employs deep-learning based BERT model to classify the transaction contract type and advanced data structures like suffix trees and tools like regular expression to extract all the valuable information. The pipeline returns categorized and structured machine-readable data objects which can form the backbone of all the fintech software. We were able to achieve contract type classification accuracy of 98.4% and were able to extract all the valuable data from the string description. In order to understand the working of the BERT based deep-learning model, we reverse engineered the model using attention networks. The results of the same are also presented in this paper.</p>
<p>A1045 10:45-11:00</p>	<p>Modified Support Vector Machine using Giza Pyramids Construction Algorithm Kendrell Derek P. Acibar; Juan Gabriel V. Mejia; Ariel Antwaun Rolando C. Sison; Dan Michael A. Cortez; Khatalyn E. Mata; Richard C. Regala; Antolin J. Alipio; Mark Christopher R. Blanco Presenter: Juan Gabriel V. Mejia, Pamantasan ng Lungsod ng Maynila, Philippines</p> <p>Abstract: Support vector machine (SVM) is a machine learning algorithm used for classification. The SVM problem lies in finding the optimal value of the C parameter. This problem affects the result in achieving higher performance by overfitting. The C value determines the degree of error for misclassification that the model will accept for the sake of generalization. In this paper, the Giza Pyramids Construction Algorithm was proposed to find the optimal value of C. The datasets used are MNIST and Chars74K datasets. The achieved accuracy of GPC-SVM is 96.75% for the MNIST handwritten digits, 97.27% for the handwritten digits, and 85.71% for natural images using Chars74K dataset.</p>
<p>A103 11:00-11:15</p>	<p>Application of Apriori Algorithm for CRM Improvement - Case Study from Montenegro Milena Đukanović, Sunčica Rogić, Lazar Novičević, Vesna PopovićBugarin, Mihailo Jovanović Presenter: Sunčica Rogić, University of Montenegro, Montenegro</p> <p>Abstract: In this paper, a case study of market basket analysis is conducted, using the Apriori algorithm. This method constructs a set of association rules,</p>

	<p>aiming to find the groups of products that are often purchased together. The algorithm was applied to the real-life data set from a cosmetics retailer from Montenegro. The resulting rules can help decision-makers gain insight into interesting sets of products that appear in transactions together, which is of great importance for designing future marketing strategies. This approach, as well as several other data mining methods, are proved to be significant in knowledge discovery and the decision-making process for CRM improvement.</p>
<p>A1052 11:15-11:30</p>	<p>Productivity Improvement using Gravitational Search Algorithm: a Case of Film Roll Industry Assoc.Prof.Arnat Watanasungsuit, Ph.D., Assoc.Prof.Choosak Pornsing, Ph.D., and Choat Inthawongse, Ph.D. Presenter: Dr.Choat Inthawongse, Muban Chombueng Rajabhat University, Thailand</p> <p>Abstract: In this article, the Gravitational Search Algorithm (GSA) has been applied to find an optimal solution for a one-dimensional cutting-stock problem (1D-CSP). It aims to improve the productivity of the Film Roll cutting design as a 1D-CSP using a mathematical program. The proposed model has been implemented and tested in a case study factory. Four factors, namely, 1) the total number of rolls, 2) the percentage of the total scraps, 3) the percentage of utilization, and 4) the processing time; have been examined. The results show that film roll cutting design using the mathematical programs with GSP takes faster processing time than a traditional staff's ruling cutting design. Also, the initial film roll usage lessens by 9 percent and the number of scraps left from cutting decreases by 1.27 percent when compared with the staff's cutting method. Ultimately, the observed cost-saving during our experiment reduces up to 6,500 USD.</p>
<p>A1061 11:30-11:45</p>	<p>Bangla Music Lyrics Classification Shafi Ahmed, Md Humaion Kabir Mehedi, Moh. Absar Rahman, Jawad Bin Sayed Presenter: Shafi Ahmed, Brac University, Dhaka, Bangladesh</p> <p>Abstract: Music is one of the most important factors of human lives. People express their inner thoughts, emotions and feelings with the combination of both lyrics and musical instruments. With the passage of time, languages have also evolved and the structure of the languages have also changed. By listening to music, we can understand which genre the song belongs to. So, we came to an idea of classifying genre based on the lyrics of music. There are few works where the researchers worked on classifying genre based on lyrics. However, those works were based on different languages such as English, Hindi and Spanish. As a result, we got an opportunity to work on Bangla language. In this paper, we have used different machine learning (ML) models and a custom CNN model to classify Bangla Lyrics on "Bangla Song Lyrics" dataset which is available on Kaggle. Our proposed CNN model achieved highest accuracy of 69.36% with an F1-score of 69.17% among all models.</p>

<p>A1006 11:45-12:00</p>	<p>DDPG based on multi-scale strokes for financial time series trading strategy JUN-CHENG CHEN, CONG-XIAO CHEN, LI-JUAN DUAN, ZHI CAI Presenter: CONG-XIAO CHEN, Beijing University of Technology, China</p> <p>Abstract: With the development of artificial intelligence, more and more financial practitioners apply deep reinforcement learning to financial trading strategies. However, it is difficult to extract accurate features due to the characteristics of considerable noise, highly non-stationary, and non-linearity of single-scale time series, which makes it hard to obtain high returns. In this paper, we extract a multi-scale feature matrix on multiple time scales of financial time series, with the help of the classic financial theory-Chan Theory, and put forward to an approach of multi-scale stroke deep deterministic policy gradient reinforcement learning model (MSSDDPG) to search for the optimal trading strategy. We carry out experiments on the datasets of the Dow Jones, S&P 500 of U.S. stocks, and China's CSI 300、 SSE Composite, evaluate the performance of our approach compared with the buy-and-hold strategy, turtle trading strategy, Deep Q-learning reinforcement learning strategy, and deep deterministic policy gradient strategy. The result shows that our approach gets the best performance in China CSI 300、 SSE Composite, and get an outstanding result in Dow Jones, S&P 500 of U.S.</p>
<p>A1027 12:00-12:15</p>	<p>Digitization in Production: A Use Case on a Cloud-based Manufacturing Execution System Ernst Peßl, Birgit Rabel Presenter: Ernst Peßl, FH JOANNEUM, Austria</p> <p>Abstract: All types of companies, including manufacturing companies, are facing a major shift due to the influence of digitization. To fulfill the requirements of digital production, the classic hierarchical architecture of the automation pyramid will change to decentralized distributed communication participants in the cloud. This will lead to a flattening of the pyramid towards service-oriented network architectures in the cloud. The paper focuses on the necessary theoretical aspects concerning dissolution of the automation pyramid in relation to Manufacturing Execution Systems and cloud computing. The second purpose of this paper is to show, how dissolution in an industrial environment can be realized by means of a use case. This demonstrates how manufacturing companies can participate in cloud solutions for Manufacturing Execution Systems.</p>

Online Session C--- Network and Information Security

Session Chair: Prof. Cyrus F Nourani, Akdmkrd-DAI-TU Berlin, Germany

14:00-15:45, May 14, 2022 | Zoom Link: <https://us02web.zoom.us/j/81898593525> (Password: 051214)

A1043, A1001, A3002, A1064, A1019, A1009, A1012, A1055

<p>A1043 14:00-14:15</p>	<p>Design and Implementation of Hardware and Peripheral System for IoT Gateway YEN-JEN CHEN, EN-CHENG LIN Presenter: EN-CHENG LIN, Ming Chi University of Technology, Taiwan</p> <p>Abstract: This paper uses Linkit Smart 7688 Duo development board developed by MediaTek as the core of the overall IoT gateway system design, which compares other development boards and IoT gateways on the market. Smart 7688 Duo development board is about 40% lower in price than Raspberry Pi, and the hardware CPU clock is higher than NEXCOM NIO 51 gateway. This implementation provides a low-cost and highly customizable solution that allows system integrators to more effectively provide their customers with the most appropriate IT services. The proposed IoT gateway design utilizes the Linkit Smart 7688 Duo with MIPS and MCU dual-core chip, Arduino development environment and industrial protocol Modbus to design the data transfer of each sensor in the peripheral system. The IoT gateway obtains the sensor data and transmits it to the server using Message Queuing Telemetry Transport (MQTT). The data acquisition accuracy of the developed MCU program was measured with 2 sensors of hydrogen sulfide (H₂S) and methane (CH₄). The overall system architecture and peripheral systems are designed to realize the IoT gateway taking into account the internal heat dissipation and module wiring, and also the appearance of the chassis is designed to carry the IoT gateway system, so as to achieve a high-quality product prototype that is accurate, economical, and customizable.</p>
<p>A1001 14:15-14:30</p>	<p>Remote Monitoring and Control of Appliances using a state machine in an IoT Network Wasee Ahmed, Deboky Saha, S M Azmi Hoque, Suvro Debnath, Tanvinur Rahman Siam Presenter: Deboky Saha, BRAC University, Bangladesh</p> <p>Abstract: With the number of machines growing exponentially in the world, monitoring the state of them is becoming a necessity. Such a requirement can only be met using Internet of Things (IoT). The proposed appliance monitoring system is developed based on the IoT. The aim of this work is to send and store data in the database instantaneously as well as to control the appliance upon necessity. In this system, the current flowing through the appliance is set</p>

	<p>as the data which is stored in MySQL database of the server. Upon exceeding set parameters, the server sends command to cut off the power of the appliance at the machine end which in turn saves it from danger. The entire communication mechanism is based on Message Queuing Telemetry Transport (MQTT) protocol. A web page has been designed to observe data and also be able to manually control the appliance. A mobile app called “pahara” is developed which allows observation of the data from the server at any given time. Result shows that data transfer rate is almost instantaneous for MQTT protocol and the proposed system is economically cheap.</p>
<p>A3002 14:30-14:45</p>	<p>The Design and Implementation of an Information Centric Networking Architecture in Contiki NG OS Alper Kamil Demir, Sedat Bilgili Presenter: Sedat Bilgili, Adana Alparslan Turkes Science and Technology University, Türkiye</p> <p>Abstract: Information Centric Networking (ICN) has been proposed as an encouraging remedy for solving complications of traditional IP based architecture. In this work, we present the design and implementation of an ICN framework in Contiki NG OS, a prominent operating system (OS) for constrained IoT devices that have limited computing and communication capabilities. Elementary end-to-end communication paradigms of Named Data Networking (NDN), inspired from ICN concepts and proposed as one of Future Internet Architectures (FIA), is integrated to Contiki NG OS developed for low-power and constrained Internet of Things (IoT) devices. Our results demonstrate the expediency of using the NDN concept for constrained IoT devices in Contiki NG OS.</p>
<p>A1064 14:45-15:00</p>	<p>A Blockchain-based Decentralized Framework for Carbon Accounting, Trading and Governance Vaani Rawat, Nitin Dahiya, Siddhant Rai, Anshul Arora Presenter: Vaani Rawat, Delhi Technological University, India</p> <p>Abstract: This work proposes the relationship between carbon trading and blockchain with an aim to find solutions to the major problem of reduction of carbon footprint on our planet. The “Kyoto Protocol ‘ of 1997 introduced the need for a mechanism to trade grants issued, allowing the restricted emissions of greenhouse gasses into the atmosphere, and creating an ecosystem for trading the surplus and deficiency of these credits/grants. In this proposed work, we aim to make this trade fraud free by using the powerful features of the blockchain such as decentralization and a trustless environment by using different smart contracts that operate between multiple stakeholders in the ecosystem. Thus, this work proposes a blockchain-based solution for trading of carbon credits to solve the problem of climate change by reducing global warming.</p>

<p>A1019 15:00-15:15</p>	<p>ASPECT-ORIENTED MODELS-BASED FRAMEWORK TO SECURE INTELLIGENT SYSTEMS Hessa Ali Alhamad, Mohammad Mahdi Hassan Presenter: Hessa Ali Alhamad, Master Student, Qassim University, KSA</p> <p>Abstract: Security is a high-priority issue for any software system. Emerging intelligent systems have unique security challenges that need to be addressed. In this paper, we propose a novel aspect-oriented models-based security framework to address security concerns in intelligent systems. The aspects of this framework derive from identified threats to intelligent systems. We use Unified Modeling Language (UML) diagrams to present each aspect.</p>
<p>A1009 15:15-15:30</p>	<p>An efficient pansharpening approach based on spatial information and multi-layer fusion Xiaotian Ji, Ping Zhang, Yang Mei, Yixun Liang, Miao Yan Presenter: Xiaotian Ji, University of Electronic Science and Technology of China, China</p> <p>Abstract: Deep learning has been widely used in recent years to solve the pansharpening problems and has been demonstrated that CNN-based methods have better performance than traditional methods. However, most existing methods crudely treat neural networks as a kind of end-to-end regressor. In this paper, we propose a new method named SmfiNet which pays more attention to extract the spatial information through a specially designed spatial processing module to extract the spatial information from panchromatic images (PAN) And by a multi-level detail injection consistent with the structural characteristics of deep learning network, which can restore the spectral information of multispectral images (MS). The proposed method in this paper combines the traditional image edge extraction method with the powerful capabilities of neural networks, increases the interpretability of the network while improve quality of fused images. In the experiential stage, the results show that SmfiNet has superior performance in improving spatial resolution and preserving spectral information and has good robustness and generalization in improving the fusion quality.</p>
<p>A1012 15:30-15:45</p>	<p>Automatic Risks Detection and Comparison Techniques for General Conditions of Technical Documents in Purchasing Order Chae-Yeon Kim, So-Won Choi, Jong-Gwan Jeong, Eul-Bum Lee Presenter: Chae-Yeon Kim, POSTECH, South Korea</p> <p>Abstract: This research is to develop a technique that recognizes the technical documents as part of purchasing order (PO) exchanged between the owner (buyer) and the supplier (seller) in capital investment, such as maintenance and replacement of equipment, automatically detect specific potential risk contained clauses and shows the comparison results. This research has selected the proof of concept (PoC) technology to (1) the performance guarantee clauses for the purchasing equipment and (2) the delivery schedule requirement clauses to be checked and compared with the utmost cares when reviewing technical documents by the plant owner. The PoC research was implemented based on the Python programming language in conjunction with the spaCy</p>

	<p>libraries, and further was developed to a cloud-platform-based application for user implementation. This technique preprocesses technical documents of PO in PDF format and, after recognizing and converts into the entire text, detects and extracts the risks-related sentences with logic created by analyzing the patterns of PoC clauses. This research also built a database of all units and formats that can be used in PoC clauses and developed knowledge-based rules to normalize PoC clauses expressed differently in two (buyer's and seller's) and documents. Finally, the result of comparing PoC clauses unified in the same unit and format is output to an Excel or CSV file. Also, these techniques and comparison results were verified through the confusion matrix and accuracy-check. This study is expected to reduce the workload and improve practitioners' productivity in engineering procurement processes for capital investment projects.</p>
<p>A1055 15:45-16:00</p>	<p>Curriculum Incremental Deep Learning on BreakHis dataset Mona Sabrine Mayouf, Florence Dupin de Saint-Cyr Presenter: Mona Sabrine Mayouf , IRIT, Université de Toulouse , France</p> <p>Abstract: This paper examines methodological aspects of the training procedure of neural networks for medical image classification. The research question concerns the conjecture that: feeding a network with datasets of increasing magnification leverages high-level knowledge and helps the network to better classify. This study confirms this hypothesis by an experiment carried out on a dataset of breast cancer histopathological images. Results are presented that underline the importance of the order in which data is introduced to the neural network during the training phase. Extensive experiments done on the BreakHis dataset demonstrate that curriculum incremental learning reaches 98.76% accuracy for binary classification while the best state of the art approach only reaches 96.78.%. Concerning multi-class classification, curriculum incremental learning reaches 95.93% while the state of the art approaches only reaches 95.49%. Moreover both the computational time and the stabilization time of the learning process of the incremental curriculum learning approach are reduced (respectively by 6% and by more than 20%) wrt a non curriculum learning approach.</p>

Online Session D--- Computer Application Intelligent Business

Session Chair: Prof. Franz Haas, Graz University of Technology, Austria

14:00-16:00, May 14, 2022 | Zoom Link: <https://us02web.zoom.us/j/85849674461> (Password: 051214)

A1023, A1026, A1060, A1056, A1029, A1046, A1010

<p>A1023 14:00-14:15</p>	<p>Digital Business Model for Rail Freight Transportation Sascha Stradner, Uwe Brunner, Christian Steger, Markus Feldbacher, Andre Tropper, Frank Dotzauer Presenter: Sascha Stradner, University of Applied Sciences JOANNEUM, Austria</p> <p>Abstract: Rail freight transport is characterized by a shrinking market share. The reasons for this are outdated technology, inadequate customer orientation, a high degree of inflexibility and lacking sustainability concerning the business models. The greatest challenge is creating the turnaround as quickly as possible towards more competitiveness and future viability. SMARTY builds on the results of the successful project Smart GigaWood. Fully digitalized wagons and a digital platform called Innocloud facilitate the next and most challenging step for innovation: the development of a cooperative model of resource utilization in form of a sharing platform for several customers. SMARTY serves developments on an experimental level with a small pool of Smart GigaWood wagons to create benefit in several areas, especially focuses on customer orientation. The sharing platform serves as the starting point for further development into a future digital business field of wood transportation, but it will also be applicable to other sectors like iron, steel, or energy transport. The paper considers the development of the platform as well as the development and evaluation of fitting sharing business models based on typical limitations of rail freight transport in Europe.</p>
<p>A1026 14:15-14:30</p>	<p>Gaining Impact with Mixed Reality in Industry – A Sustainable Approach Fabian Holly, Tanja Zigart, Martina Maurer, Josef Wolfartsberger, Magdalena Brunnhofer, Sabrina Romina Sorko, Thomas Moser, Alexander Schlager Presenter: Fabian Holly, Vienna University of Technology, Austria</p> <p>Abstract: Mixed reality (augmented and virtual reality) technology continues to find its way into the industry. Nevertheless, prototypes and island solutions are developed in companies, which are not embedded in the corporate strategy. This paper presents a systematic approach for finding and developing use cases accompanied by a strategic implementation and evaluation process to integrate mixed reality in the industry. Sustainability aspects like energy and resource efficiency, possible reduction of the ecological footprint, and sustainable solutions for lasting and vision-based use in companies are considered.</p>

	<p>Within several use cases with 20 industry partners in the following areas are developed: 1) novel forms of space-independent collaboration (e.g., collaborative work by integrating real-time 3D depth information of the real environment and visualization of and interaction with real-time production data) and 2) XR-supported training and learning methods (e.g., parameterizable and adaptive training scenarios, roll-out of training content for several participants and integration of gamification mechanisms). Additionally, the methodology for a sustainability assessment, technology acceptance, and a multi-criteria evaluation are shown, and first results are discussed.</p>
<p>A1060 14:30-14:45</p>	<p>Optimization Research of raw material ordering and transportation scheme based on Improved TOPSIS Evaluation Model Xinqiang Zhang, Changfeng Xu, Yixin Bao Presenter: Xinqiang Zhang, College of Technology and Art Jingdezhen Ceramic University, China</p> <p>Abstract: Reasonable selection of superior raw material suppliers is the crux of raw materials supply and scientific optimizational scheme of raw material ordering and transportation is an important measure to ensure the normal production for manufacturing enterprises. This paper evaluates the 402 raw material suppliers of the manufacturing enterprise discussed in the paper quantitatively and formulates the optimal raw material ordering and transportation scheme for the enterprise after getting the 402 supplier's evaluation score with Matlab programming and improved TOPSIS evaluation model according to the weekly supply information of the suppliers in the past five years and quantitative analysis results of the supply characteristics to the 402 suppliers. This paper selects the 50 suppliers with the highest score as the 50 most important suppliers, including S229(supplier's ID), S361, S140, S374, S108, etc. Then we establish a multi-objective optimization model under the condition of meeting the capacity requirements of the enterprise and not exceeding the maximum transportation capacity of the forwarder, and one of the objective functions is the maximum difference between the quantity of class A raw material and the quantity of class C raw material ordered, and the other objective function is the minimum volume of raw materials ordered by the enterprise. A new ordering scheme for the next 24 weeks was developed using simulated annealing algorithm and solved with Matlab software. Meanwhile Python software is used to program and python kayb algorithm is used to formulate the transportation scheme with the least loss of the enterprise for the next 24 weeks.</p>
<p>A1056 14:45-15:00</p>	<p>Object Detection for Classifying Sushi Dishes in Conveyor Belt Sushi Business R MAITRIBORIRUKS and Y LIMPIYAKORN Presenter: Rangrak Maitriboriruks, Chulalongkorn University, Thailand</p> <p>Abstract: Over the years, AI has emerged as a key enabler for disruptive innovation. Object detection is an area of deep learning that involves computer vision and image processing to detect various types of objects in images or videos. This paper presents an approach of unified, real-time object detection to implement parts of the billing system of conveyor belt sushi restaurant. Rather than manually counting the number of consumed dishes, the model</p>

	<p>implemented with YOLOv4 in this work could recognize distinct sushi plates from the image taken by a smartphone camera, and return the class label indicating the item price for further calculation of the dining charge. The model performance achieved Precision 95%, Recall 96%, and mAP 95.45%. The presented model would benefit operational efficiency, support real-time calculation of dining charge, improve service quality, reduce paper and electronic waste.</p>
<p>A1029 15:00-15:15</p>	<p>Exploration of Machine Learning Classification Models Used for Behavioral Biometrics Authentication Sara Kokal, Laura Pryor, Rushit Dave Presenter: Sara Kokal, University of Wisconsin Eau Claire, USA</p> <p>Abstract: Mobile devices have been manufactured and enhanced at growing rates in the past decades. While this growth has significantly evolved the capability of these devices, their security has been falling behind. This contrast in development between capability and security of mobile devices is a significant problem with the sensitive information of the public at risk. Continuing the previous work in this field, this study identifies key Machine Learning algorithms currently being used for behavioral biometric mobile authentication schemes and aims to provide a comprehensive review of these algorithms when used with touch dynamics and phone movement. Throughout this paper the benefits, limitations, and recommendations for future work will be discussed.</p>
<p>A1046 15:15-15:30</p>	<p>ERP lifecycle main indicators and guidelines to determine a change of ERP provider Sergi Batalla & Herbert Kohlbacher Presenter: Sergi Batalla, FH Joanneum, Austria</p> <p>Abstract: Enterprise Resource Planning (ERP) systems help companies to support their business processes within the different departments in real-time. ERP's have been evolving and improving along with the new technologies. In this context, we can differentiate 3 major types of enhancements and evolutions regarding ERP systems: updates, upgrades, and migrations. How do we know if it is time to invest in a new solution, or if there is still interest in running an ERP that has several years of service? There are several indicators to identify when an ERP is no longer suitable and must be replaced by a new generation. These key indicators are listed and explained, as well as its notoriety. The indicators are just guidelines, each enterprise is different and must align those indicators with its strategy. A use case is introduced, illustrating a medium-sized enterprise considering switching its ERP system provider. This paper is aimed at ERP consultants, IT managers and other decision makers involved in Information System strategy.</p>
<p>A1010 15:30-15:45</p>	<p>Pedestrian Detection in Crowded Scenes Based on Cascade R-CNN Gaoxiang Yu, Nan Xiang, Chuanzhong Pan Presenter: Gaoxiang Yu, Chongqing University of Technology, China</p>

Abstract: The occlusion in crowded scenes and the interference of similar objects in the background are one of the main reasons that lead to missed pedestrian detection. In response to this problem, an improved Cascade RCNN pedestrian detection algorithm using dynamic regressors is proposed. First, adjust the offset of each sample to a dynamic offset and normalization, then use the basic model of pedestrian detection to initially detect unobstructed pedestrians. The proposed algorithm has performed ablation experiments on the Caltech, CityPersons, and CrowdHuman datasets, and the missed detection rate on the Reasonable, Partial and Heavy subsets in each dataset has been reduced to a certain extent. The results show that the proposed algorithm of performance is good, which reflects the robustness of the model to a certain extent, reduces the missed detection rate of pedestrian detection in crowded scenes, and has better detection performance.

Closing Ceremony

May 14, 2022---16:00

Zoom Link: <https://us02web.zoom.us/j/81898593525>

Password: 051214

Prof. Dr. Martin Tschandl, Prof. Dr. Vitaliy Mezhuyev, FH Joanneum, Austria