IEEE

TECHNICAL UNIVERSITY OF VARNA

John Vincent Atanasoff

born on October 4, 1903,
in Hamilton, New York,
United States

JOHN ATANASOFF SOCIETY OF AUTOMATICS AND INFORMATICS

OCTOBER 4th - PROFESSIONAL DAY OF BULGARIAN SPECIALISTS ON COMPUTERS, INFORMATION TECHNOLOGIES AND AUTOMATICS

VARNA STU

ABSTRACT BOOK

INTERNATIONAL CONFERENCE AUTOMATICS AND INFORMATICS 2024,

VARNA, BULGARIA

Welcome to ICAI'2024

Dear participants,

It is a great honor and pleasure to welcome you to the International Conference Automatics and Informatics`2024 in the campus of the Technical University in the beautiful city of Varna, Bulgaria.

The International Conference Automatics and Informatics (ICAI) traditionally is held under the patronage of the President of the Republic of Bulgaria during the John Atanasoff days in October every year. The conference has over 55 years of history and has significantly contributed to the development of automation and computer technology in Bulgaria.

The purpose of the conference is to bring together international researchers and industrial practitioners interested in the development and implementation of modern technologies for automation, information, computer science, artificial intelligence and others.

First of all, the congratulations go to the participants who contributed with their papers. Without your high quality articles, we would not be here today.

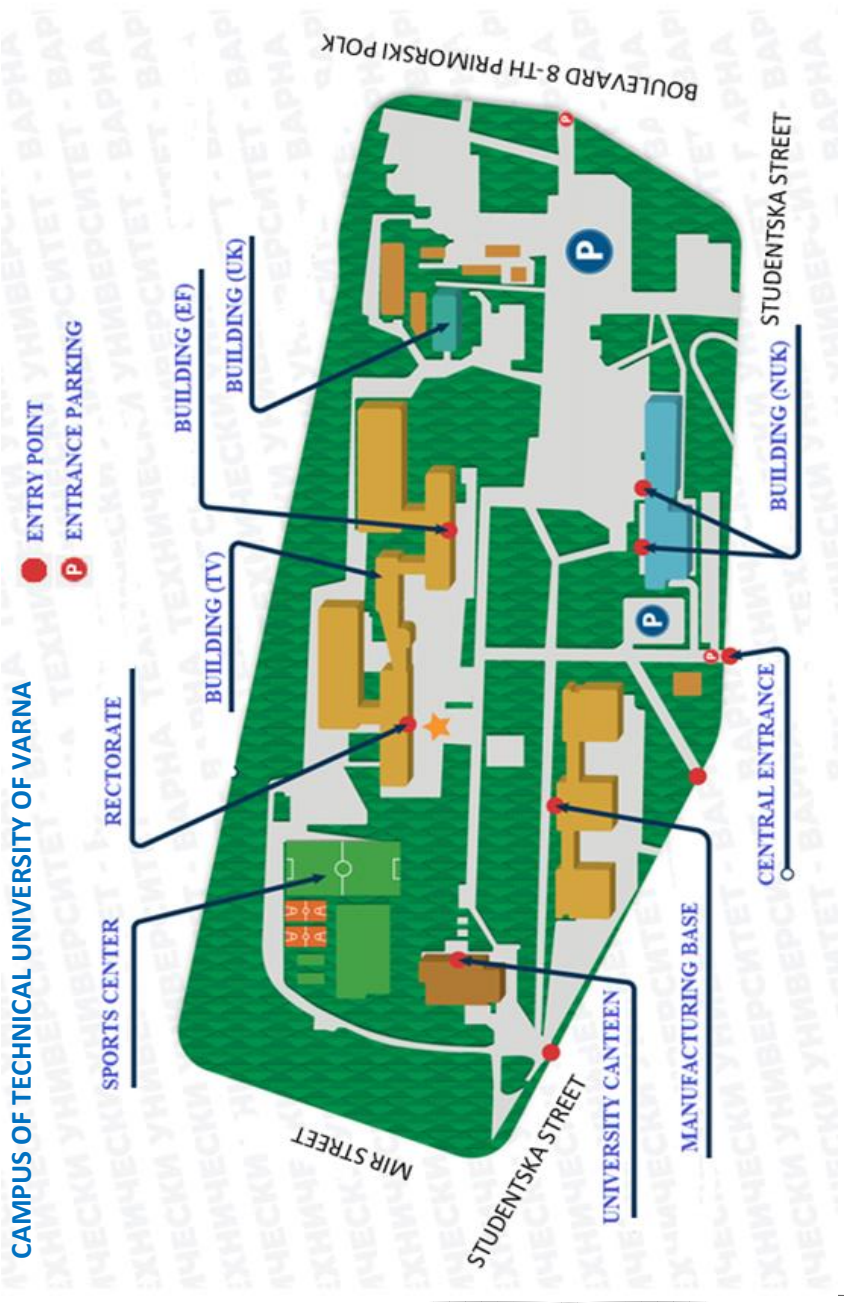
We would like to express our deepest gratitude to hard working reviewers whose effort contributed for high quality of the paper selection process.

Please, have a look at the conference program to find the most important topics for you.

We wish you a productive meetings and hope you enjoy your stay in Varna!

Through our conference, we want to build bridges between scientists around the world.

The Committees and Chairs of ICAI'2024


CAMPUS OF TECHNICAL UNIVERSITY OF VARNA
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UNIVERSITY CANTEEN
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IEEE INTERNATIONAL CONFERENCE AUTOMATICS AND INFORMATICS'2024 (ICAI'24),

10 - 12 October 2024, VARNA (Technical University of Varna)

http://icai-conf.org

CONFERENCE PROGRAM

THE GIVEN TIME IS ACCORDING TO THE BULGARIAN TIME ZONE - SOFIA UTC+3 HOURS

Thursday, October 10th

In the NUK gallery
08.00 - 09.00 REGISTRATION OF PARTICIPANTS

Stream 1 (Conference Hall NUK)
09.00 - 09.15 WELCOME AND OPENING CEREMONY

Stream 1 (Conference Hall NUK)
09.15 - 09:50 PLENARY SESSION 1

Chairman: Kosta Boshnakov

The Inception of Electronic Digital Computing

Vladimir Getov
University of Westminster in London

09.50 - 10:00 DISCUSSION

Stream 1 (In attendance) **(Room A – Hall 109TV)**	**Stream 2 (Online)** **(Room B)**
10:00 – 11:30 SESSION A1 **"CYBERSECURITY"** **Chairman: Veneta Aleksieva**	**10:00 – 11:30 SESSION B1** **"CONTROL THEORY"** **Chairman: Aleksandra Grancharova**
1. Probabilistic Corporate Cybersecurity Stack, Willian Dimitrov, Dragostin Tsekov and Valentin Rujenov (170) **2. A Simulation Tool for ZigBee Application Layer Security,** Marieta Yordanova, Aydan Haka, Veneta Aleksieva and Hristo Valchanov (43) **3. Attack and Hack with Padding Oracle,** Ivan Ivanov and Mariyana Dimitrova (148) **4. Exploring the Possibilities of Geocoding Systems with Equal Area Tessellation,** Pavel Petrov (45)	**1. Adaptive Gradient Time Delay Estimator-Based Model-free Fast Nonsingular Terminal Sliding Mode Control for Upper-Limb Exoskeleton Driven by PAMs,** Penghao Li, Haoping Wang and Yang Tian (79) **2. Fractional Order Ultra-Local Model-Based Sliding-Mode-Assissted Disturbance Observer and Model-Free Control**, Liuchang Zhang, Haoping Wang and Yang Tian (90) **3. Linearization of the algebraic Riccati inequality for continuous and discrete-time descriptor systems,** Andrey Yonchev (75) **4. Phase Root Locus - Application in Internal Model Control Systems,** Vesela Karlovasergieva, Nina Nikolova, Boris Grasiani and Georgi Stefanov (177)
11:30 – 13:00 SESSION A2 **"MEASUREMENT AND MONITORING"** **Chairman: Nikola Nikolov**	**11:30 – 13:00 SESSION B2** **"APPLICATION OF MACHINE LEARNING"** **Chairman: Valeri Mladenov**
1. Development of a Measuring System for Studying the Force Load of Tillage Machinery in the Precision Agriculture using a Strain Resistance Integrating Period-Meter, Svilen Stoyanov, Desislava Mihaylova, Asparuh Atanasov and Steliyana Hristova (32) **2. Precise Ambient Air Temperature Data Logging and Data Processing,** Panayot Petrov and Valentin Mollov (96)	**1.Intelligent Automated Testing Frameworks for IoT Networks Utilizing Machine Learning for Advanced Anomaly Detection**, Marian Ileana and Maria Miroiu (135) **2.Integrating Industrialization into Heat Wave Risk Classification using Machine Learning,** Kevin Geng and Sajeev Magesh (115) **3.A Deep Learning Framework for Memory Retrieval from Lifelogging Data,** Mohd Aman, Musfira Jilani,

3. Evaluating the Performance and Optimizing the Flow Measurement of a Vortex Flowmeter Using Specialized Software, Pavel Dimitrov and Mariela Alexandrova (3)	Cristina Muntean, Pramod Pathak and Paul Stynes (158) **4.Robust UAV Image Stitching via Multiscale Feature Matching and Local Homography Matrix Estimation**, Rou Li and Wei Xue (131)
13:00 – 14:00 LUNCH in the UNIVERSITY CANTEEN	
14:00 – 15:30 SESSION A3 "CONTROL THEORY AND APPLICATIONS" **Chairman: Kamen Perev**	**14:00 – 15:30 SESSION B3 "COMMUNICATION AND CYBER SECURITY 1"** **Chairman: Willian Dimitrov**
1. Controllability and Observability Gramians for the Circular Membrane with Radial Symmetry, Kamen Perev (54) **2. Replacing the coefficient of the PID controller with a mathematical function,** Petar Panayotov and Goran Goranov (103) **3. From Automation Pyramid to Industry 4.0: Transitioning Process and Practical Applications,** Pavel Dimitrov and Mariela Alexandrova (68) **4. Optimal geometrical synthesis of cylindrical gear transmissions,** Dimitrinka Dahterova and Ina Nikolova (94)	**1. Flogista: audio encryption with filtered triple Logistic map,** Borislav Stoyanov, Tsvetelina Ivanova, Dimitar Dobrev and Plamen Ribarski (37) **2. Signal Detection in Impulse Interference,** Ivan Garvanov, Magdalena Garvanova, Georgi Tsonkov, Desislava Garvanova, Maria Mindova and Daniela Borissova (107) **3. Analysis and processing of certificates for various purposes,** Maleyka Abbaszade Vugar Akbarov and Khatayi Mammadov (136) **4. Rapid Deployment of Low-Cost Wireless Monitoring Solution for Smart Building**, Radu-Nicolae Pietraru, Robert-Alexandru Craciun and Daniel-Marian Merezeanu (57).
15:30 – 17:00 SESSION A4 "MODELING AND SIMULATION" **Chairman: Nikolay Djagarov**	**15:30 – 17:00 SESSION B4 "ANALYSIS AND DESIGN OF ELECTRICAL AND ELECTRONIC DEVICES 1"** **Chairman: Angel Marinov**
1. Study of the Processes in Double Star Ship's Synchronous Propulsion Motor, Nikolay Djagarov and Zhivko Grozdev (30) **2. Study of Operating Modes of a Synchronous Motor without Damper Winding,** Nikolay Djagarov and Zhivko Grozdev (31)	**1. Synthesis and Analysis of Low-Pass and High-Pass Voltage-Controlled Voltage Source Active Filters for Educational Purposes in the Communication Circuits Course,** Adriana Borodzhieva and Snezhinka Zaharieva (38)

3. Evaluating computer software model adequacy of electromagnetic processes, Marin Marinov and Rosen Dimitrov (130) **4. Supply Chain Logistics Marine Simulator,** Bozhidar Dyakov, Milena Karova , Aneta Varbanova, Ivaylo Penev and Danail Dimitrov (111) **5. Camera calibration for robotic lab setup,** Zhivko Zhekov and Elena Vasileva (26)	**2. A New Method for Synthesis of Complementary Pairs of Sequences and Mismatched Filters,** Borislav Bedzhev and Dilyan Simitrov (92) **3. Two Recursive Methods for Synthesis of Complementary Pairs and Quads of Sequences with Odd Lengths,** Borislav Bedzhev and Dilyan Dimitrov (91) 4. **Modeling a microprocessor with RISC architecture,** Ilian Varbov, Petar Minev, Matyo Dinev and Valentina Kukenska (40)
17:00 – 17:30 COFFEE BREAK	
17:30 – 19:00 SESSION A5 "OPTIMIZATION OF COMMUNICATION SYSTEMS" Chairman: Ventsislav Nikolov	**17:30 – 19:00 SESSION B5 "AI APPLICATION METHODS" Chairman: Gancho Vachkov**
1. Optimisation models and algorithms for wireless communications within an office building, Zlatan Ganev (51) **2. Multi-hop transmission model for optimization of wireless communications and WSNs**, Zlatan Ganev (52) **3. Spam Detection System Based on Hybrid Scorin**, Stefka Popova, Hristo Nenov and Donika Stoyanova (114) **4. An Automatic Spam Detection System Based on Hybrid Scoring Models,** Stefka Popova, Hristo Nenov and Velislav Kolesnichenko (122)	**1. Image compression-then-encryption model based on A1 attractor,** Tsvetelina Ivanova, Dimitar Dobrev, Borislav Stoyanov and Plamen Ribarski (36) **2. Handwritten Alphabet Recognition Using Convolutional Neural Networks**, Nafeesath Parappurath Puthiyapurayil, Meerah Karunanithi, Yasir Jamal, Sakina Juzar Neemuchwala, Rand Kouatly and Ahmed Hassan (157) **3. Binarization via Local Gradient-like Differences in four Directions**, Stefan Panov and Svetlana Panova (163) **4. The Serbian Retrieval Augmented Generation System based on Hybrid Search,** Aleksandar Cenić, Suzana Stojković and Matin Jovanović (61)
19:00 COCKTAIL in the NUK gallery	

Friday, October 11th

Stream 1 (Hall 109TV)
09.00 - 09:45 PLENARY SESSION 2

Chairman: Valentina Markova

Interpretable Machine Learning for Explainable Artificial Intelligence

Alexander Gegov
School of Computing, University of Portsmouth, UK

09.45 - 10:00 DISCUSSION

Stream 1 (In attendance) (Room A – Hall 109TV)	Stream 2 (Online) (Room B)
10:00 – 11:30 SESSION A6 "SOCIAL ASPECT OF ENGINEERING" Chairman: Milena Karova	**10:00 – 11:30 SESSION B6 "COMPLEX INDUSTRIAL SYSTEMS CONTROL" Chairman: Idilia Batchkova**
1. Conversational AI for Students with Hearing Disabilities: Approach to the Text Quality Evaluation, Radka Nacheva (172)	**1. Future Enterprise as a self-organizing Complex system**, Simona Iuliana Caramihai, Dragos Constantin Popescu and Ioan Dumitrache (138)
2. Social Engineering Threats in Cybersecurity: Risk Mitigation through Behavioral Insights, Ivaylo Tsanov (62)	**2. Modelling of the Deployment of ERP Systems,** Radoslav Hrischev, Nikola Shakev and Sevil Ahmed-Shieva (10)
3. The Role of Social Psychology in the Creation of Ethical AI Systems, Ivaylo	**3. Smart Manufacturing Integration of Heterogeneous Information Systems via OPC UA. A Case Study**, Plamen

Tsanov (63) **4. Evaluating the Accessibility of Electronic Educational Resources in PDF Format,** Bonimir Penchev and Latinka Todoranova (88)	Vasilev, Ani Boneva, Veronika Ivanova and Tsetso Tsvetanov (25) **4. Risk and quality in the test production stage of the rapid prototyping process,** Svilen Simeonov (123)
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1. Behavior of Voice Codecs QoS Metrics in the IP Network Overload Zone, Vladimir Vichev and Todorka Georgieva (59) **2. IP Network Performance Analysis in VoIP Environment,** Vladimir Vichev and Todorka Georgieva (58) **3. Technical overview & performance evaluation of Virtio-loopback,** Timos Ampelikiotis, Alvise Rigo and Daniel Raho (55) **4. Implementing a High-Precision Boat Navigation System Using Raspberry Pi with RTK and GPS Integration via ESP32,** Ivan Grigorov, Nasko Atanasov, Nikola Nikolov and Dian Dzhibarov (169)	**1. Application of Machine Learning Agriculture Between Developing and Developed Countries: A Systematic Literature Review,** Mario Leonardi, Muhammad Resnandya Rafif, Nicholaus Putra and Ali Gunawan (47) **2. Neural Classifier of Honey Plants Pollen Using a Combination of Textural and Geometric Features**, Lyubomir Zaykov and Diana Tsankova (1) **3. Supporting Digitization of a Cultural and Historical Heritage Platform**, Iliya Nedelchev, Veneta Tabakova-Komsalov, Ivan Stoyanov, Stanimir Stoyanov, Vanya Ivanova and Tsvetomira Kazashka (39) **4. Adaptive Neuro-Fuzzy Inference System for Beverage Identification Based on VIS/NIR Spectral Analysis,** Mariyana Sestrimska, Veselin Nachev, Tanya Titova and Plamen Nikovski (9)
13:00 – 14:00 LUNCH in the UNIVERSITY CANTEEN	
14:00 – 15:30 SESSION A8 **"MODELING AND CONTROL IN INDUSTRY"** **Chairman: Hristo Nenov**	**14:00 – 15:30 SESSION B8** **"COMMUNICATION AND CYBER SECURITY 2"** **Chairman: Miroslav Markov**

1. Enabling SME Participation in Cross-Border Agricultural Futures: A Tokenized Pooling Model with OTC Clearing Integration, Deyan Paroushev and Petko Ruskov (146) **2. Algorithmic model for complex assessment of the competitiveness of an industrial enterprise,** Krasimira Dimitrova (49) **3. IoT system for AQI monitoring and control**, Ivan Ganchev and Zhanlin Ji (117) **4. Sensor data processing methodology based on flexible architecture and secure data storage,** Valentin Mollov and Panayot Petrov (86)	**1. Android Agile Test-Driven Development,** Manish Kaushik, Rand Kouatly and Mohammed Nazeh Alimam (164) **2. A comparative analysis of Jenkins as a data pipeline tool in relation to dedicated data pipeline frameworks,** Angel Georgiev, Vladimir Valkanov and Penyo Georgiev (87)
15:30 – 17:00 SESSION A9 "OPTIMIZATION AND COMPANY PRESENTATIONS" **Chairman: Mariela Alexandrova**	**15:30 – 17:00 SESSION B9 "COMPUTING 1"** **Chairman: Sevinç Gülseçen**
1. Evaluation of Energy Efficiency of Si and GaN FET for Power Electronic Converters, Angel Marinov, Kristiyan Mihalev, Firgan Feraodv and Svetlozar Zahariev (99) **2. Minimum Complete Pareto Front of a Biobjective Minimum Spanning Trees Problem,** Lasko Laskov and Marin Marinov (76) **3. Senseye – AI Based Predictive Maintenance by Siemens,** Nikola Petkov **4. Rittal's digitalization – customer-oriented,** Alexander Georgiev	**1.IoT Continuum for Energy Management**, Simeon Tsvetanov, Dimitar Chalamov and Stela Ruseva (176) **2.Laboratory set-up for the research of roller conveyors for logistics warehouses,** Vladimir Hristov and Ivan Chekurov (178) **3.A Systematic Review on Detection of Aortic Dissection by Utilizing Deep Learning,** Hatice Koç, Nilgün Bozbuğa and Sevinç Gülseçen (149) **4.SWOT Analysis Of The Possibility Of Using AI For Education,** Nikolay Yanev, Iglika Getova, Teodora Hristova, Iva Kostadinova, Georgi Dimitrov and Elizabet Mihaylova (33)
17:00 – 17:30 COFFEE BREAK	
Stream 1 (Online) **(Room A)**	**Stream 2 (Online)** **(Room B)**
17:30 – 19:00 SESSION A10	**17:30 – 19:00 SESSION B10**

"ENERGY EFFICIENT CONTROL" **Chairman: Kosta Boshnakov**	**"ANALYSIS AND DESIGN OF ELECTRICAL AND ELECTRONIC DEVICES 2"** **Chairman: Yasen Gorbunov**
1. Prospects of Intelligent Techniques for Energy Efficient Control of Drying Process, Desislava Delicheva and Snejana Yordanova (41)	**1. Program module for spectral analysis of continuous periodic signals,** Radoslava Gabrova, Hristina Andreeva and Kamen Toromanov (77)
2. Modeling and Analysis of a Real Residential Heating System, Nikolay Komitov and Margarita Terziyska (69)	**2. A modular approach of PV-systems modelling using real meteorological data,** Svetlozar Zahariev (108)
3. Smart IoT-Based Home Automation System, Nikolay Komitov and Margarita Terziyska (83)	**3. Algorithm for Maritime Target Detection,** Ivan Garvanov and Magdalena Garvanova (106)
4. Implementation of ESD in automatic temperature, pressure and level control system in raw gypsum calcination plant, Viktor Tsolov and Nikola Nikolov (165)	**4. Development and Practical Application of a Small Laser Engraving Machine,** Stanislav Simeonov, Marin Zhilevski and Mikho Mikhov (95)
20:00 GALA DINNER in the BM City restaurant (it is located behind the Festival and Congress Center)	

Saturday, October 12th

Stream 1 (Online)

09.00 - 09:45 PLENARY SESSION 3

Chairman: Veneta Aleksieva

Machine Learning Methods for Trustworthy Autonomous Systems

Lyudmila Mihaylova
University of Sheffield

09.45 - 10:00 DISCUSSION

Stream 1 (Online) **(Room A)**	**Stream 2 (Online)** **(Room B)**
09:00 – 10:30 SESSION A11 **"INTELLIGENT ROBOTICS"** **Chairman: Yasen Gorbunov**	**09:00 – 10:30 SESSION B11** **"COMMUNICATION AND CYBER SECURITY 3"** **Chairman: Willian Dimitrov**
1. Generative AI-Driven Personnel Training in Industrial Robotics through Intelligent HXM, Stela Stoykova and Nikola Shakev (89) **2. Distributed 3D camera distance measurement system for intelligent mobile robots**, Radoslav Vasilev, Nayden Chivarov and Maya Staikova (73) **3. Cascade Control of PMDC Motor on FANUC M-430iA/4FH Robot**, Vesela Karlova-Sergieva and Nina Nikolova (71) **4. Automated control of a stand for determining the critical angles of static stability of agricultural robots**, Veselin Mengov, Vladimir Kotev, Georgi Komitov and Evgeni Kehayov (154)	**1.Some Cybersecurity Issues in Artifical Intelligence Systems,** Vassil Sgurev and Lyubka Doukovska (173) **2.Preserving Privacy and Security in Online Assessment Process: Exploration and Analysis**, Iskra Trifonova and Malinka Ivanova (6) **3.Using Reed-Solomon codes to securely transmit data over radio frequencies using broadband communications,** Alla Levina and Nikita Galkin (56). **4.Performance and Accuracy Assessment of Detecting Network Intrusions with eSOM-Based Techniques,** Dimitrios Simeonidis, Pavel Petrov, Georgi Penchev, Stefka Petrova, George Dimitrov and Volodymyr Petrivskyi (16)
10:30 – 12:00 SESSION A12 **"COMPUTING 2"** **Chairman: Ivaylo Penev**	**10:30 – 12:00 SESSION B12** **"PROCESS MEASUREMENT AND CONTROL"** **Chairman: Plamen Daskalov**
1. Hardware implementation of lightweight cryptographic algorithms: An overview, Dilyana Dimitrova and Ivaylo Dimitrov (150) **2. Exploring Web3 Challenges: Implications for Investigative Techniques and Evidence Acquisition in Digital Forensics,** Blerim Krasniqi and Eliza Petrova Stefanova (4) **3. Text Mining Student Comments for Teaching Performance Evaluation using VADER and Latent Dirichlet**	**1. Switching Multi-regulator Control of Electro-Hydraulic Servo System,** Georgi Mihalev, Stanimir Yordanov and Krasimir Ormandzhiev (112) **2. Application of a Modified Multiparametric PID Controller for Control of an Electrohydraulic Servo System,** Stanimir Yordanov, Georgi Mihalev, Krasimir Ormandzhiev and Stefan Ivanov (113) **3. Single-channel ultrahigh frequency moisture meter with direct measurement**

Allocation Algorithm, Jenny Resuello, Larmie Feliscuzo) and Cheryl Pantaleon (27) **4. Features of FDM printing of test specimens,** Miglena Paneva and Peter Panev (101)	**of moisture content of bulk materials**, Palvan Kalandarov, Shakhnoza Ubaydullayeva, Nikola Nikolov and Mariela Alexandrova (20) **4. In-Situ Optical Emission Spectroscopy for Process Monitoring and Material Identification in Laser Powder Bed Fusion,** Ema Vasileska, Mite Tomov, Xiaoshuan Zhang and Valentina Gecevska (50)
13:00 – 14:00 LUNCH	
14:00 – 15:30 SESSION A13 "ADVANCED METHODS IN LEARNING AND TEACHING 1" Chairman: Aydan Haka	**14:00 – 15:30 SESSION B13 "AI APPLICATION IN HEALTH CARE" Chairman: Tanya Pencheva**
1. A Comparative Analysis of Generative AI Models for Improving Learning Process in Higher Education, Nurassyl Kerimbayev, Zhanbota Menlibay, Magdalena Garvanova, Saltanat Djaparova and Vladimir Jotsov (134) **2. Effective management of educational resources – Automated scheduling of lectures,** Boris Stoykov, Mariyan Apostolov, Simeon Arnaudov and Nikolay Nichev (121) **3. Review Using AI Learning Models to Develop E-Learning Platforms,** Lyazzat Zhaidakbayeva, Makpal Dildabayeva and Raushan Sambetova (152) **4. The Impact of a Web Platform with Motivational Elements on Student Engagement in the Learning Process,** Nikolay Nikolov (116)	**1.Methods and Applications of Artificial Intelligence In Mental Health Care**, Vitali Atias and Katerina Atias (65) **2.Enhancing Model Robustness Using Differential Debugging in Jupyter Notebooks: A Case Study with Noisy Breast Cancer Data**, Martin Vassilev and Alexander Penev (105) **3.Malaria Cell Classification Using CNN: A Deep Learning Approach,** Nafeesath Parappurath Puthiyapurayil, Meerah Karunanithi, Muhammad Qasim Ali, Rand Kouatly, Ali Vaisifard and Ahmed Hassan (155) **4.Classifying Human Emotions through EEG data with Machine Learning,** Gaganjot Kaur, Meenu Gupta and Rakesh Kumar (11)
15:30 – 17:00 SESSION A14 "ADVANCED MEASUREMENT APPLICATION 2" Chairman: Aydan Haka	**15:30 – 17:00 SESSION B14 "PROCESS CONTROL" Chairman: Nikola Nikolov**
1. Emerging technologies: focus on distance learning, Boris Stoykov, Mariyan Apostolov, Simeon Arnaudov and Nikolay Nichev (120)	**1. Design and Development of a 3D printed gripper,** Damjan Pecioski, Albion Shaipi and Dejan Shishkovski (78)

2. Streamlining Feedback Processes in Virtual Educational Systems, Nurassyl Kerimbayev, Aliya Akramova, Zhanat Umirzakova and Karlygash Adamova (67) **3. Exploring the Impact of Educational Serious Game in a Gamified LMS,** Milen Sotirov, Valentina Petrova and Donika Nikolova-Sotirova (72) **4. Learning through Gamification: A Case Study on the Development and Integration of a University Educational Serious Game**, Milen Sotirov, Valentina Petrova and Donika Nikolova-Sotirova (64)	**2. Comparative analysis of different forms of grinding bodies and media, including innovative ones in ball mill**, Miglena Paneva, Peter Panev and Nikolay Stoimenov (102) **3. Methodology for Predicting and Optimizing Process Parameters and Accuracy Indicators of Complex Plastic Parts Through Virtual Prototypes**, Todor Todorov, Georgi Todorov and Yavor Sofronov (171) **4. Rapid prototyping of process-driven applications using low-code development platforms: A case study from the Greek public sector,** Marios Konstantinos Gialitakis, Nikolaos Nousias, George Tsakalidis, and Kostas Vergidis (74)
17:00 – 17:15 CLOSING CEREMONY **Stream 1 (Online)**	

PLENARY SESSION 1	**Stream 1**
Chairman: Kosta Boshnakov	University of Chemical Technology and Metallurgy, BG
Thursday, October 10th 09:00 – 10:00	Conference Hall NUK

The Inception of Electronic Digital Computing

Vladimir Getov *University of Westminster in London, UK*

Abstract: Discovering and developing new ways to speed up computation, especially the more complex and laborious mathematical problems, has occupied human thought for millennia. Among the many great minds who have worked to overcome this challenge are such geniuses as Leonardo da Vinci, Blaise Pascal, and, more recently, Charles Babbage, who conceived and tirelessly constructed his mechanical computing machines as early as the first half of the 19th century. Of all the brilliant scientists who shaped the automatic computing efforts during the 1930s and 1940s, John Vincent Atanasoff was the

first to use digital electronics for arithmetic operations and his invention marked the beginning of the modern information revolution.

The timeline of the early projects presented in the paper shows that 85 years ago – in October 1939 – the first breadboard proof-of-concept prototype of an electronic digital computer became operational at Iowa State College. Using fresh insights and some nearly forgotten facts, the paper also reviews the origins of the IEEE Computer Society (CS) and the role of organized professional activities, as well as the customer demand for spreading new ideas and design solutions for the fast-developing computer industry. It recognizes and explains the contribution of John Vincent Atanasoff to the invention and early development of electronic digital computing that changed the world. Indeed, his design principles have propagated to most of the commercially available modern computers and remain at the core of electronic digital computing technologies to the present day.

PLENARY SESSION 2	**Stream 1**
Chairman: Valentina Markova	Technical University of Varna, BG
Friday, October 11th 09:00 – 10:00	Stream 1(Hall 109TV)

Interpretable Machine Learning for Explainable Artificial Intelligence

Alexander Gegov *School of Computing, University of Portsmouth, UK*

Abstract: Machine Learning (ML) has recently established itself as the main approach to designing and implementing Artificial Intelligence (AI). However, in spite of the significant improvement in terms of classification and prediction accuracy, most ML models suffer from lack of interpretability and the recommendations made by most AI systems suffer from lack of explainability. This is a significant problem especially for safety critical applications where wrong recommendation may have serious consequences.

The lecture will highlight recent developments and future perspective in making ML models interpretable and AI systems explainable. In particular, it will cover the following related topics:

- Interpretable and black box ML models
- Model specific and agnostic explanation methods for ML models
- Global and local explanation methods for ML models
- Making AI systems more reliable and trustworthy
- Improving AI systems performance in classification and prediction
- Using AI systems for decision and control

PLENARY SESSION 3	**Stream 1**
Chairman: Veneta Aleksieva	Technical University of Varna, BG
Saturday, October 12th 09:00 – 10:00	Stream 1(Online)

Machine Learning Methods for Trustworthy Autonomous Systems

Lyudmila Mihaylova *University of Sheffield, UK*

Abstract: There is a fast development of different machine learning methods – for object classification, tracking, action recognition and other tasks with multiple types of data – from images and videos to data from wireless sensor networks. Autonomous image and video analytics faces a number of challenges due to the huge volumes of data that sensors provide, the changeable environmental conditions and other factors. However, it is important to know when the methods work well and when they are not reliable, e.g. how much could we trust the obtained results? How could we characterise trust is a related question. How could we quantify the impact of uncertainties on the developed solutions? This talk will discuss current trends in the area of machine learning and show results for image and video analytics for autonomous systems.

This talk will present recent results on automated behaviour analysis for decision making. Recent results for automated video analytics will be presented with Gaussian process methods, deep learning and other methods. Their pros and cons will be discussed. Some of these results are part of Digital twins, recently developed new tools that incorporate machine learning and artificial intelligence methods. This talk will discuss the big potential of Digital Twins, the opportunities and challenges that they bring.

SESSION A1 "CYBERSECURITY"	**Stream 1**
Chairman: Veneta Aleksieva	Technical University of Varna, BG
Thursday, October 10th 10:00 – 11:30	Hall 109TV

Probabilistic Corporate Cybersecurity Stack

Willian Dimitrov — *University of Library Studies and Information Technologies, BG*
Dragostin Tsekov — *University of Library Studies and Information Technologies, BG*
Valentin Rujenov — *University of Library Studies and Information Technologies, BG*

Abstract: The research presents a meta-view of the impact of corporate organizational components on the constitution of a security operation center. It proposes an approach based on Bayesian networks for measuring the impact of components.

A Simulation Tool for ZigBee Application Layer Security

Marieta Yordanova — *Technical University of Varna, BG*
Aydan Haka — *Technical University of Varna, BG*
Veneta Aleksieva — *Technical University of Varna, BG*
Hristo Valchanov — *Technical University of Varna, BG*

Abstract: Nowadays Internet of Things (IoT) technologies are widely used in different areas of life. One of the areas in which IoT expand is wireless sensor networks (WSN). There are various technologies to implement WSN for IoT. One of the most used technologies is ZigBee because of the energy efficiency that is provided. Various simulation systems can be used to ensure long lasting and effective deployment, validation of a particular technology for IoT purposes. Cybersecurity in IoT technologies is a critical element to ensure the confidentiality and integrity of the transmitted information.
Considering the challenges of cybersecurity in IoT, this paper presents a proposal for simulation environment enabling to simulate and investigate Application Layer security related processes in ZigBee for IoT technology. The functionality of the proposed simulator has been verified in laboratory conditions. It is fully applicable for both training and security study in ZigBee technology.

Attack and Hack with Padding Oracle

Ivan Ivanov — *University of Telecommunications and Posts, BG*
Mariyana Dimitrova — *University of Telecommunications and Posts, BG*

Abstract: From ancient times the cryptography is one of the key elements to keep data protected and secured. The necessity for the governments and business to keep their data and communication secure and safe originated the need for different kinds of cryptographic mechanisms and algorithms. Symmetric and asymmetric encryption has been developed together with different kinds of encrypting algorithms, encryption standards and cryptographic protocols to protect the data and the messages when it is in peace, in transfer or stored on a device. The goal is to provide integrity and confidentiality of the data and message contents. Very often, due to errors in the design, documentation and of the widespread libraries allows violations against the encryption algorithms and protocols. This report examines one of the most famous symmetric encryption cryptographic protocols, i.e. the cipher block chaining (CBC) mode [1] which gives the possibility for the hackers to perform Padding Oracle attacks [2]. This attack can affect most of the communication channels secured by such protocols. A python code is used to show the padding workflow algorithm. For the tests in the experimental part are used python programing language and Burp Suite [3] installed on Kali Linux [4] to exploit Padding Oracle. This report highlights the padding decryption problem which is actual problem in the cybersecurity area.

Exploring the Possibilities of Geocoding Systems with Equal Area Tessellation

Pavel Petrov *University of Economics - Varna, BG*

Abstract: The research is focused on equal-area tessellation geocoding systems, which use triangle, square, rectangle, pentagon, and hexagon figures as a basis for dividing the spherical earth surface. The obtained, because of the division, almost equal-area tessellation provides interesting opportunities for quick visualization of the so-called "heat maps" because equal-area tessellation enables the data associated with certain cells to be easily analyzed in terms of distribution of measured values per unit area. In this regard, the most essential features of the systems using spherical triangles, squares, rectangles, pentagons and hexagons are outlined, with more attention being paid to the S2 Geometry systems offered by the company Google, based on spherical squares, the H3 system offered by the company Uber, based on pentagon and hexagon figures, and the HashGeo system. These systems can be effectively used in a number of geographic information systems (including related to transport and flow management), due to the fact that a number of program libraries have been developed in different programming languages, which are distributed under an open-source license. The study can serve as a basis for choosing an appropriate geocoding system, in the need for analysis and visualization of dynamic, rapidly changing data associated with geographic location.

SESSION B1 "CONTROL THEORY"	**Stream 2**
Chairman: Aleksandra Grancharova	University of Chemical Technologies and Metallurgy, BG
Thursday, October 10th 10:00 – 11:30	Online

Adaptive Gradient Time Delay Estimator-Based Model-free Fast Nonsingular Terminal Sliding Mode Control for Upper-Limb Exoskeleton Driven by PAMs

Penghao Li — *Nanjing University of Science and Technology, CN*

Haoping Wang — *Nanjing University of Science and Technology, CN*

Yang Tian — *Nanjing University of Science and Technology, CN*

Abstract: In this paper, an Adaptive Gradient Time Delay Estimator-Based Model-free Fast Nonsingular Terminal Sliding Mode Controller (AGTDE-MFNTSMC) is proposed to achieve accurate trajectory tracking of upper-limb exoskeleton driven by pneumatic artificial muscles (PAMs). The dynamic of PAMs is modeled by an ultra-local model, to approximate the dynamic of the PAM system; meanwhile, the Adaptive Gradient Time Delay Estimation algorithm is designed to reduce the impacts of the unknown part of system and various disturbances. Furthermore, a MFNTSMC Controller is used to stabilize the PAM system. Finally, the effectiveness of the proposed controller is demonstrated via simulations using MATLAB/ Simulink, and compared with previous controllers of Model-Based Sliding Mode Control and TDE-intelligent PD control.

Fractional Order Ultra-Local Model-Based Sliding-Mode-Assissted Disturbance Observer and Model-Free Control

Liuchang Zhang — *Nanjing University of Science and Technology, CN*

Haoping Wang — *Nanjing University of Science and Technology, CN*

Yang Tian — *Nanjing University of Science and Technology, CN*

Abstract: This paper proposes a fractional order sliding-mode-assisted disturbance observer-based model-free control (FO-SAMDOMFC) for fractional order system with disturbance. This scheme is composed of fractional order model-free con-troller (FO-MFC) and sliding-mode-assisted disturbance observer (SMADO). The design of the control law and SMADO is based on fractional order ultra-local-model to simplify the controller structure. The proposed SMADO is used to eliminate the lumped disturbance and the designed control law guarantees the con-vergence of the closed loop system's tracking error. Next, the stability of the closed-loop system is proved by the fractional extension of Lyapunov's direct method. Finally, the simulation results based on MATLAB/Simulink are realized, and the results compared with other

controllers are given to show the feasibility and advancement of the proposed strategy.

Linearization of the algebraic Riccati inequality for continuous and discrete-time descriptor systems

Andrey Yonchev *Technical University of Sofia, BG*

Abstract: This article is devoted to performing linearization of algebraic Riccati inequality for continuous-time and discrete-time descriptor systems. Such inequalities take part in solving some important problems in control theory like robust and optimal control, filtering and system identification and etc. In the proposed linearization procedure we theoretically derive the gradient of a particular function related to the considered algebraic Riccati inequality for descriptor systems. The linearization approach, which we investigate, is valid under some conditions proper for the descriptor systems. Some theorems and their proofs are presented.

Phase Root Locus - Application in Internal Model Control Systems

Vesela Karlova-Sergieva *Technical University of Sofia, BG*
Nina Nikolova *Technical University of Sofia, BG*
Boris Grasiani *Technical University of Sofia, BG*
Georgi Stefanov *Technical University of Sofia, BG*

Abstract: This paper proposes the capabilities of the complex plane for the localization and tuning of frequency performance indicators used in the synthesis of control algorithms in systems with internal model control (IMC). The resulting effective combination is analytically described and visualized on a basic experimental model. The classical and robust performance of the control system are discussed.

SESSION A2 "MEASUREMENT AND MONITORING" **Stream 1**

Chairman: Nikola Nikolov Technical University of Varna, BG

Thursday, October 10th 11:30 – 13:00 Hall 109TV

Development of a Measuring System for Studying the Force Load of Tillage Machinery in the Precision Agriculture using a Strain Resistance Integrating Period-Meter

Svilen Stoyanov — *Technical University of Varna, BG*
Desislava Mihaylova — *Technical University of Varna, BG*
Asparuh Atanasov — *Technical University of Varna, BG*
Steliyana Hristova — *Insititute of Soil Science, Agrotechnologies and Plant Protection-Sofia, BG*

Abstract: The present research shows a measuring system for studying the force load of the working organs of a motor cultivator with strain gauges. As a converter of the change in the resistance of the strain gauge bridge, a double-sided integrating measuring period-meter, original design, was used. To investigate the capabilities and measurement ranges of the system, modeling was performed in Multisim. A series of experiments were carried out on the experimental field at the Dobrudzha Technological College, Dobrich, which proved the functionality of the measuring system. The obtained results provide an opportunity to optimize technological processes of tillage machinery and serve as a basis for improvement the efficiency of processing in the precision agriculture.

Precise Ambient Air Temperature Data Logging and Data Processing

Panayot Petrov — *Technical University of Sofia, BG*
Valentin Mollov — *Technical University of Sofia, BG*

Abstract: The ambient temperature affects the equipment functioning. It is important to continuously monitor the ambient temperature in real-time and in different sample-points within the equipment's area. The fast and correct processing of this information leads to the prompt feedback for temperature control and temperature drift-compensation. The temperature data logging and effective post-processing is important for analyzes and long-term precautions. This paper presents efficient method for ambient air temperature data logging and data processing, using analog temperature sensor with fast thermal response.

Evaluating the Performance and Optimizing the Flow Measurement of a Vortex Flowmeter Using Specialized Software

Pavel Dimitrov — *Technical University of Varna, BG*
Mariela Alexandrova — *Technical University of Varna, BG*

Abstract: An evaluation of the performance and optimization of flow measurement of a vortex flowmeter using specialized software is presented in this paper. Advanced software tools are utilized to analyze the flow characteristics and the impact of the so-called Installation effect. Furthermore, optimization techniques are applied to improve the flowmeter's performance within its lower range. Improvements in measurement accuracy are demonstrated by the results.

SESSION B2 "APPLICATION OF MACHINE LEARNING"	**Stream 2**
Chairman: Valeri Mladenov	Technical University of Sofia, BG
Thursday, October 10th 11:30 – 13:00	Online

Intelligent Automated Testing Frameworks for IoT Networks Utilizing Machine Learning for Advanced Anomaly Detection

Marian Ileana — *National University of Science and Technology POLITEHNICA Bucharest, RO*

Maria Miroiu — *National University of Science and Technology POLITEHNICA Bucharest, RO*

Abstract: The widespread deployment of Internet of Things (IoT) networks has brought new challenges in terms of ensuring system reliability and security. This paper presents intelligent automated testing frameworks designed specifically for IoT environments, leveraging machine learning for advanced anomaly detection. Traditional testing methods are often insufficient in the dynamic and heterogeneous landscape of IoT systems. The approach explores the use of machine learning algorithms to identify patterns and anomalies in real-time, thereby increasing the robustness and resilience of IoT networks. By integrating predictive analytics and real-time monitoring, the proposed framework not only detects failures but also anticipates potential problems, thus facilitating system maintenance. This innovative approach underscores the importance of intelligent automation in addressing the complexities of modern IoT ecosystems.

Integrating Industrialization into Heat Wave Risk Classification using Machine Learning

Kevin Geng — *Independent Researcher, US*

Sajeev Magesh — *University of Dublin, California, US*

Abstract: The intensifying frequency and severity of heatwaves, driven by climate change, pose significant threats to human health, agriculture, and ecosystems, especially in industrialized regions. Traditional studies on heatwave risk often focus on meteorological variables, while neglecting the influence of industrialization and urbanization. This paper addresses this gap by employing advanced machine learning models, specifically Multi-Layered Perceptron (MLP) and Support Vector Machine (SVM), and Logistic Regression (LR) to analyze the relationship between industrialization factors and heatwave risk across California's diverse census tracts. Using data from the National Risk Index (NRI) and the Smart Location Database (SLD), we found that the MLP model, which achieved a cross-validation accuracy of 94.81%, outperformed the SVM and LR models in capturing the impact of industrial metrics such as employment density, land use, and proximity to transit on heatwave vulnerability. Our results reveal the significant role industrialization

plays in exacerbating heatwave risk, particularly in urban areas affected by the Urban Heat Island effect. These findings suggest that integrating industrialization factors into heat wave risk assessments is essential for protecting vulnerable communities and guiding more effective urban planning.

A Deep Learning Framework for Memory Retrieval from Lifelogging Data

Mohd Aman — *National College of Ireland, Mayor Street, IE*
Musfira Jilani — *National College of Ireland, Mayor Street, IE*
Cristina Muntean — *National College of Ireland, Mayor Street, IE*
Pramod Pathak — *Technological University Dublin, IE*
Paul Stynes — *National College of Ireland, Mayor Street, IE*

Abstract: An emerging trend known as lifelogging is a process of digitally documenting and processing the data of an individ-ual's daily experiences. Lifelogging creates data which can be noisy and with continuity, therefore, it is challenging to give a comprehensive means of retrieving events or moments of interest to the public. This research proposes a deep learning framework to improve memory retrieval from lifelogging data. The proposed framework combines text-image embeddings and ensembles of a zero-shot deep learning model. The framework is implemented using three versions of the Contrastive Language-Image Pre-training (CLIP) model based on the combination of 12 datasets created by seven users containing more than 100000 images. The results are evaluated based on the average precision@k metric for different values of k. Specifically, on the given dataset, the ensemble model consisting of ResNet50x64 and ViT-L/14 in the ratio 3:1 gives highest precision of 0.90 at k = 5. The proposed retrieval framework can be used to elp people with Alzheimer's and other forms of dementia for recalling useful information.

Robust UAV Image Stitching via Multiscale Feature Matching and Local Homography Matrix Estimation

Rou Li — *Anhui University of Technology, CN*
Wei Xue — *Anhui University of Technology, CN*

Abstract: Due to some factors such as optical aberrations and large parallax, a few stitching methods lead to artifacts and distortions in the panoramic image. To alleviate this issue, this paper proposes a robust unmanned aerial vehicle (UAV) image stitching algorithm based on multiscale feature matching and local homography matrix estimation. We firstly employ a multiscale feature matching method to establish a reliable correspondence between two sets of points, so as to suppress artifacts in overlapping areas better. Then, we estimate the local homography matrix to alleviate the distortion of target image by combining similarity transformation of matched feature points with projection transformation. Finally, we use a sigmoid metric to quantify the color differences in the overlapping region and achieve a smooth transition between

the images by introducing a seam-cutting method. Extensive experiments demonstrate the effectiveness and robustness of our method for UAV image stitching.

SESSION A3 "CONTROL THEORY AND APPLICATIONS"	**Stream 1**

Chairman: Kamen Perev — Technical University of Sofia, BG

Thursday, October 10th 14:00 – 15:30 — Hall 109TV

Controllability and Observability Gramians for the Circular Membrane with Radial Symmetry

Kamen Perev — *Technical University of* Sofia, *BG*

Abstract: This paper considers the problem of controllability and observability gramians computation for circular membrane with radial symmetry. The circular membrane is described by second order hyperbolic partial differential equation in polar coordinate system. The derivation of the system gramians is based on state space formulation of the wave equation in the framework of abstract differential equation. This framework uses the concept of $\boldsymbol{C0}$ -strongly continuous semigroup generated by a system operator containing spatial derivatives of the underlying process. The radial symmetry of the membrane simplifies the model description and reduces it to differential equation with simple spatial variable. The time-space separation principle is used to reduce the infinite dimensional problem to simple mathematical calculations. The partial differential equation is solved by using the Fourier – Bessel series expansion. The solution of the wave equation is utilized to derive the gramians in explicit form.

Replacing the coefficient of the PID controller with a mathematical function

Petar Panayotov — *Technical University of Gabrovo, BG*
Goran Goranov — *Technical University of Gabrovo, BG*

Abstract: In some areas of the industry, synchronizing two or more rotating mechanisms is necessary. This article proposes a system for synchronizing the developing mechanism of a labeling machine, in relation to the submission of a label by PID (Proportional – Integral – Derivative) regulation of an electromagnetic brake. A software unit for controlling the holding force of a developing mechanism has been developed and implemented on a programmable logic controller SIEMENS S7-1200.

From Automation Pyramid to Industry 4.0: Transitioning Process and Practical Applications

Pavel Dimitrov — *Technical University of Varna, BG*
Mariela Alexandrova — *Technical University of Varna, BG*

Abstract: The transitioning process from Industry 3.0 to Industry 4.0 from an automation perspective is discussed in this paper, highlighting the associated requirements and limitations of the hierarchical model of the automation pyramid. An overview of the technologies related to both industrial revolutions is provided. Practical applications are presented with examples, and a conceptual model is proposed as an upgraded system that leverages Industry 4.0 technologies.

Optimal geometrical synthesis of cylindrical gear transmissions

Dimitrinka Dahterova — *Technical University of Sofia, Sliven, BG*
Ina Nikolova — *Technical University of Sofia, Sliven, BG*

Abstract: In the present study, an approach for optimal geometrical synthesis of electromechanical modules with multi-stage cylindrical gear reducers, is presented. The multivariate nature of the task for selecting electrical motor predetermines different values for the total transmission ratio, which can be realized by different variants for kinematics schemes of the gear reducer. The dimensions of the kinematics schemes are approximately defined. Thus, during the stage of geometrical synthesis conclusions can be made which schemes are unacceptable and to specify the best kinematics structures based on optimization analysis.

SESSION B3 "COMMUNICATION AND CYBER SECURITY 1" **Stream 2**

Chairman: Willian Dimitrov — University of Library Studies and Information Technologies, BG

Thursday, October 10th 14:00 – 15:30 — Online

Flogista: audio encryption with filtered triple Logistic map

Borislav Stoyanov — *University of Shumen, BG*
Tsvetelina Ivanova — *University of Shumen, BG*
Dimitar Dobrev — *University of Shumen, BG*
Plamen Ribarski — *University of Shumen, BG*

Abstract: Faster and more secure ways are needed to give assurance for the security of audio transmissions in this rapid revolution of communication. A better alternative is now critical to be more secure in today's world where everyone walks with their phones in pockets, who may send a text or voice message at any moment. To increase date transmission confidentially, we will provide a secure audio encryption model in this study based on filtered triple Logistic map. The procedure is put through several security checks. Powerful examination demonstrates that the approach with enhanced features outperforms other comparable audio encryption techniques.

Signal Detection in Impulse Interference

Ivan Garvanov — *University of Library Studies and Information Technologies, BG*
Magdalena Garvanova — *University of Library Studies and Information Technologies, BG*
Georgi Tsonkov — *University of Library Studies and Information Technologies, BG*
Desislava Garvanova — *National Science and Mathematics High School, Sofia, BG*
Maria Mindova — *University of Library Studies and Information Technologies, BG*
Daniela Borissova — *Institute of Information and Communication Technologies, BAS, BG*

Abstract: In radar, the performance of signal detectors is seriously degraded by arrival of impulse interference that extremely worsens their detectability characteristics. There are many studies, in which different Constant False Alarm Rate (CFAR) detectors have been analysed in the presence of randomly arriving impulse interference described as Bernoulli pulse sequences. In this paper, the randomly arriving impulse interference is mathematically described as Binominal pulse sequences. This model of impulse interference is used for simulation and numerical analysis of EXC CFAR detector. A comparative analysis of the results obtained by simulating the operation of the EXC CFAR detector by means of analytical expressions is made. The obtained algorithms and results can find application in the design of real radar systems.

Analysis and processing of certificates for various purposes

Maleyka Abbaszade — *The State Examination Center of Republic Azerbaijan, AZ*
Vugar Akbarov — *The State Examination Center of Republic Azerbaijan, AZ*
Khatayi Mammadov — *The State Examination Center of Republic Azerbaijan, AZ*

Abstract: The article describes the certificates obtained by the citizens who have succeeded in the exams held by the State Examination Center in various fields, their types, purpose, and importance, as well as statistical reports prepared on the basis of relevant databases are presented.

Rapid Deployment of Low-Cost Wireless Monitoring Solution for Smart Building

Radu Nicolae Pietraru — *National University of Science and Technology Politehnica Bucharest, RO*
Robert-Alexandru Crăciun — *National University of Science and Technology Politehnica Bucharest, RO*
Daniel-Marian Merezeanu — *National University of Science and Technology Politehnica Bucharest, RO*

Abstract: This paper proposes a solution for monitoring environmental parameters for smart buildings with fast implementation and low cost. The solution proposes an IoT (Internet of Things) architecture including the hardware and software architecture of the wireless monitoring sensor as well as an IoT platform solution for recording, processing and displaying data in accordance with the management requirements of a

smart building. The speed of implementation is based on the use of the IEEE 802.11 infrastructure already existing in the building. The solution is tested through an implementation in a building of the Faculty of Automatic Control and Computers, National University of Science and Technology Politehnica Bucharest.

SESSION A4 "MODELING AND SIMULATION" **Stream 1**

Chairman: Nikolay Djagarov Nikola Vaptsarov Naval Academy Varna, BG

Thursday, October 10th 15:30 – 17:00 Hall 109TV

Study of the Processes in Double Star Ship's Synchronous Propulsion Motor

Nikolay Djagarov *Nikola Vaptsarov Naval Academy Varna, BG*
Zhivko Grozdev *Nikola Vaptsarov Naval Academy Varna, BG*

Abstract: More and more ships use electric propulsion. High drive power has led to the use of polyphase AC motors, which improves drive performance and increased fault toler-ance. Using the authors' mathematical model, various transient modes of operation were simulated. Some of the results obtained as a result of the simulations are shown and discussed.

Study of Operating Modes of a Synchronous Motor without Damper Winding

Nikolay Djagarov *Nikola Vaptsarov Naval Academy Varna, BG*
Zhivko Grozdev *Nikola Vaptsarov Naval Academy Varna, BG*

Abstract: Modern ship electric propulsion uses synchronous motors without a damping winding. The absence of a damping winding greatly affects the characteristics and control of electric propulsion. In the article, a model of a synchronous motor without a damping winding is proposed. Different normal and emergency modes of operation are simulated using the model. Different electric propulsion control approaches were used in the study.

Evaluating computer software model adequacy of electromagnetic processes

Marin Marinov *Technical University of Varna, BG*
Rosen Dimitrov *Technical University of Varna, BG*

Abstract: Electromagnetic processes are some of the most difficult to analyze without the use of computer models, since it's quite difficult to imagine how the magnetic flux will be distributed and what the magnetic flux density in the different parts of the magnetic circuit will be. Even more complex is analyzing the induced currents, induction heating and core loss. The purpose of this paper is to compare computer models created in some of the most popular analysis computer programs to an actual experiment. These programs are compared in terms of model adequacy, ease of use and accessibility. As it's important for future analysis, all selected

programs allow for Multiphysics (electromagnetic and thermal) analysis. The computer models are created in EM Works and ANSYS.

Supply Chain Logistics Marine Simulator

Bozhidar Dyakov — *Technical University of Varna, BG*
Milena Karova — *Technical University of Varna, BG*
Aneta Varbanova — *Technical University of Varna, BG*
Ivaylo Penev — *Technical University of Varna, BG*
Ivan Grigorov — *Technical University of Varna, BG*
Danail Dimitrov — *Technical University of Varna, BG*

Abstract: The paper presents an implementation of a supply chain logistics marine simulator, which realizes document flow for processing of loads, carried by marine transport. The simulator is intended to be used in the educational process in specialties Navigation and Logistics. The main stages of the logistic process are discussed. The architecture of the software system is explained. The essential parts of the process are presented with screenshots from the system.

Camera calibration for robotic lab setup

Zhivko Zhekov — *Technical University of Varna, BG*
Elena Vasileva — *Technical University of Varna, BG*

Abstract: The article deals with one main problem in setting up the work of any industrial robot using camera - calibration of the coordinate systems of the camera and the robot. Machine vision in industrial robotics implies the use of image recognition algorithms, whose accuracy and satisfactory result depend on the correct synchronization of the operation of the camera-robot system. Of interest to the present research is the use of neural networks in setting up the camera-robot coordinate systems.

SESSION B4 "ANALYSIS AND DESIGN OF ELECTRICAL AND ELECTRONIC DEVICES 1" — **Stream 2**

Chairman: Angel Marinov — Technical University of Varna, BG

Thursday, October 10th 15:30 – 17:00 — Online

Synthesis and Analysis of Low-Pass and High-Pass Voltage-Controlled Voltage Source Active Filters for Educational Purposes in the Communication Circuits Course

Adriana Borodzhieva — *University of Ruse "Angel Kanchev", BG*
Snezhinka Zaharieva — *University of Ruse "Angel Kanchev", BG*

Abstract: This paper delves into the synthesis and analysis of voltage-controlled voltage source active filters, tailored specifically for educational purposes within the realm of communication circuits. The methodology outlined encompasses the

intricate process of designing, sizing, and conducting simulation studies on both low-pass and high-pass active filters. Leveraging the computational power of MATLAB, MicroCAP, and NI Multisim, the synthesized filters undergo rigorous synthesis and analysis following the selection of standardized values of resistors and capacitors. This comprehensive material is curated for students enrolled in the Bachelor's program specializing in Internet and Mobile Communications. It introduces an innovative approach to understanding and implementing active filters in real-world scenarios, offering a hands-on learning experience that bridges theoretical knowledge with practical applications. By exploring the complexities and nuances of active filter design and operation, this educational resource aims to equip students with the necessary skills and insights to excel in the dynamic field of communication circuits.

A New Method for Synthesis of Complementary Pairs of Sequences and Mismatched Filters

Borislav Bedzhev *"Vasil Levski" National Military University, Veliko Tarnovo BG*
Dilyan Dimitrov *"Vasil Levski" National Military University, Veliko Tarnovo BG*

Abstract: Today radar sensor networks and remote control systems play a very significant role for the progress of the Forth Industrial Revolution and improvement of life-style of all people. The main performance characteristics of these systems could be significantly improved by exploitation of complementary pairs of phase manipulated signals and mismatched filters. Accounting this situation in the paper a new general method for synthesis of complementary pairs of phase manipulated signals and mismatched filters, is substantiated. The method could be useful in the development of radar sensor networks and remote control systems, which have to operate in hostile radio electronic environment.

Two Recursive Methods for Synthesis of Complementary Pairs and Quads of Sequences with Odd Lengths

Borislav Bedzhev *"Vasil Levski" National Military University, Veliko Tarnovo BG*
Dilyan Dimitrov *"Vasil Levski" National Military University, Veliko Tarnovo BG*

Abstract: Today the radar sensor networks and remote control systems are widely used in many areas such as smart vehicles, smart homes, smart factories and so on. The main performance characteristics of these systems could be significantly improved by exploitation of phase manipulated signals, which are complementary pairs or quads of sequences. Accounting this situation in the paper two new general recursive methods for synthesis of infinite families of complementary pairs and quads of sequences with odd lengths respectively, are substantiated. The methods could be useful in the development of radar sensor networks and remote control systems, which have to operate in hostile radio electronic environment.

Modeling a microprocessor with RISC architecture

Ilian Varbov *Technical University-Gabrovo BG*
Petar Minev *Technical University-Gabrovo BG*
Matyo Dinev *Technical University-Gabrovo BG*
Valentina Kukenska *Technical University-Gabrovo BG*

Abstract: Microprocessors with RISC architecture are widely used in various fields, including mobile devices, embedded systems, and high-performance computing. They are an essential component of computer systems. The selection of a suitable microprocessor architecture is required in the automated design and implementation of various computer configurations. This makes the development of various computer models of microprocessors relevant.

SESSION A5 "OPTIMIZATION OF COMMUNICATION SYSTEMS" **Stream 1**

Chairman: Ventsislav Nikolov Technical University of Varna, BG

Thursday, October 10th 17:30 – 19:00 Hall 109TV

Optimisation models and algorithms for wireless communications within an office building Optimisation models and algorithms for wireless communications within an office building

Zlatan Ganev *Technical University of Varna, BG*

Abstract: The primary objective of this article is to explore communication in an indoor setting within a single building and to present a suitable propagation model and algorithm that can be utilised in various environments with differing carrier frequencies, transmission powers, and distances. To achieve this goal, a radio propagation model is derived by means of a combination of analytical and empirical methods. The path loss (PL) of the signal, the path loss constant (n), and the standard deviation (σ) are first determined. Next, the Log-normal Shadowing Model, also known as the Path-loss Shadowing Model, is employed. This empirical model presents the measurement results in an analytical manner and has a Gaussian (normal) distribution with a distance-dependent mean, making it easy to account for the random effects of shadowing. Additional losses are primarily caused by propagation phenomena such as reflection, diffraction, scattering from the ground, and other obstacles. Finally, the received power (Pr) at a given distance (d) is estimated, and the likelihood of the received signal level being greater than a specified threshold γ (Pr[Pr(d) > γ]) is predicted. Additionally, the percentage of the area with a radius (r) where the received signal will be greater than the threshold γ (U(γ)) is determined.

Multi-hop transmission model for optimization of wireless communications and WSNs

Zlatan Ganev *Technical University of Varna, BG*

Abstract: In this paper, models for losses and multi-hop transmission between wireless nodes were presented with the aim of demonstrating that the information transmission between two end nodes can be significantly reduced by using intermediate repeaters. It was observed experimentally and through mathematical simulations that the losses are greatest in direct transmission and decrease with an increase in the number of hops (repeaters). The energy model presented in this study can also be successfully used for the optimisation of wireless communications and wireless sensor networks.

Spam Detection System Based on Hybrid Scorin

Stefka Popova *Technical University of Varna, BG*
Hristo Nenov *Technical University of Varna, BG*
Donika Stoyanova *Technical University of Varna, BG*

Abstract: Spam continues to be a serious problem for the vastly growing online communications. The is the reason for ongoing research and development of various solutions and systems for spam prevention and detection. This paper presents a spam detection system based on hybrid scoring which uses machine learning algorithms to analyze given email and classified as either spam or ham. Proposed system uses TF-IDF in the process of feature selection and works for emails written both in English and Bulgarian. Algorithms as Naïve Bayes, Support Vector Machines, Logistic Regression, Decision Tree, and Random Forest are implemented and tuned, and numerous experiments are conducted. Support Vector Machines and Random Forest models achieve best results in terms of classification accuracy, reducing classification error to less than 2%.

An Automatic Spam Detection System Based on Hybrid Scoring Models

Stefka Popova *Technical University of Varna, BG*
Hristo Nenov *Technical University of Varna, BG*
Velislav Kolesnichenko *Technical University of Varna, BG*

Abstract: Volume of spam everyone receives has significantly increased in the last years. Recognizing and clearing the spam manually by receiver become sometimes a challenging and time-consuming task. To solve this task automatic spam detection systems were developed using advanced machine learning algorithms. Such systems analyze each email at the time of its arrival thus preventing potential harm. The paper proposes an automatic system for spam detection based on three pre-trained models using Logistic Regression, Support Vector Machines and Random Forest algorithms. Each model estimates the email by content and header analysis. The final email classification is made by arbitrage of models' decisions. The estimation is triggered in periods of few

seconds processing different number of emails each time. Proposed system works for emails both in English and Bulgarian, and achieved very good accuracy of over 99.5% reducing classification error to less than 0.5%.

SESSION B5 "AI APPLICATION METHODS"	**Stream 2**
Chairman: Gancho Vachkov	BG
Thursday, October 10th 17:30 – 19:00	Online

Image compression-then-encryption model based on A1 attractor

Tsvetelina Ivanova — *University of Shumen, BG*
Dimitar Dobrev — *University of Shumen, BG*
Borislav Stoyanov — *University of Shumen, BG*
Plamen Ribarski — *University of Shumen, BG*

Abstract: Confidential data may be hacked in a number of ways, thus diversity protection strategies are needed to ensure the security of message transferred online. In order to increase date transmission confidentially, we will provide a secure image compression and encryption model in this study based on an A1 chaotic attractor. The procedure is put through several security checks. Robust examination demonstrates that the approach with enhanced features outperforms other comparable image encryption models.

Handwritten Alphabet Recognition Using Convolutional Neural Networks

Yasir Jamal — *GIK Institute of Engg. Sciences & Tech, PK*
Sakina Juzar Neemuchwala — *University of Europe for Applied Sciences, Potsdam, DE*
Rand Kouatly — *University of Europe for Applied Sciences, Potsdam, DE*
Ahmed Hassan — *Berlin School of Business and Innovation, DE*
Nafeesath Parappurath Puthiyapurayil — *University of Europe for Applied Sciences, Potsdam, DE*
Meerah Karunanithi — *University of Europe for Applied Sciences, Potsdam, DE*

Abstract: Instruction of hand-written alphabet recognition using an intelligent adaptive OCR system is one of the vital pattern recognition problems, which has a very broad spectrum of frequent applications in various fields, such as language comprehension and archival document investigation. Instruction Recognition has seen a lot of progress in the data recognition field but the handwritten alphabet recognition follows a separate track and computer with this can be a challenge due to the different styles and shapes of handwriting which are not marked. The project provides a room for further work in which we can train the CNN model for learn interpreting handwritten alphabet characters. In connection with the exact naming of the handwritten images in

A-Z collection, we apply the deep neural networks. AI images of the outcome duly corroborate the effectiveness and proper essence of the constructed CNN algorithm that precisely identifies the handwritten characters of the alphabet with an accuracy above 96-97 percent. Insights from this analysis are pivotal in making this research area a success and CNNs are a powerful tool that can be exploited for this purpose. The presentation seems to enjoy the fact that their results are useful in many areas which includes digitization of historical documents, automatic online form processing, as well as well as customized learning system.

Binarization via Local Gradient-like Differences in four Directions

Stefan Panov *University of Chemical Technology and Metallurgy, BG*

Svetlana Panova *University of Chemical Technology and Metallurgy, BG*

Abstract: Our research focuses on a binarization algorithm tailored for standard grayscale images. We propose an approach that computes intensity differences in four specific directions (horizontal, vertical, and two diagonal) for each pixel. These differences serve as localized gradient-like measurements, offer-ing insights into the intensity changes around each pixel. The image is segmented into small, uniform square blocks, with each block analyzed to determine a suitable binarization threshold based on the computed differences. If a reliable threshold cannot be established, the algorithm postpones binarization for that block. In the subsequent stage, the algorithm utilizes information from adjacent blocks to finalize the binarization, ensuring con-sistency and smooth transitions between blocks. Additionally, the algorithm incorporates parameters that fine-tune the threshold calculation, thereby improving the binarization outcome.

The Serbian Retrieval Augmented Generation System based on Hybrid Search

Aleksandar Cenić *University of Niš, RS*

Suzana Stojković *University of Niš, RS*

Matin Jovanović *University of Niš, RS*

Abstract: This paper presents a hybrid search based retrieval-augmented generation (RAG) system in the domain of history, in Serbian language. The system was implemented in Python programming language, and is based on Google BERT embedding model, OpenSearch hybrid search, OpenAI GPT 3.5 large language model, and two original Serbian datasets for augmentation and system evaluation. The system performance was evaluated using ROGUE-1, cosine similarity and human evaluation, and its performance was compared to the purely semantic search based version. The system performance was satisfactory in human measurement, but estimated as low in automated metrics. In both metrics the hybrid search showed significantly better performance.

SESSION A6 "SOCIAL ASPECT OF ENGINEERING"	**Stream 1**
Chairman: Milena Karova	Technical University of Varna, BG
Friday, October 11th 10:00 – 11:30	Hall 109TV

Conversational AI for Students with Hearing Disabilities: Approach to the Text Quality Evaluation

Radka Nacheva *University of Economics – Varna, BG*

Abstract: To achieve the UN's Sustainable Development Goals and provide opportunities for lifelong learning, digital accessibility is critical to the digital inclusion of individuals with special needs. At the global, European, and national levels, quite different institutions are working towards the integration of people with disabilities in public activities, providing funding, training, and employment programs. However, still, the challenges to policies for the inclusion of this target group need development, especially in the context of digital transformation. In this regard, the current paper aims to explore some of the tools used by hearing-impaired students to provide digital accessibility to the learning environment. In a practical aspect, the quality of generated text was analyzed with an artificial intelligence (AI) tool for reproducing text from speech. A limitation of this paper is related to the evaluation tools applied in the qualitative analysis. The metrics on which these evaluation tools are based are considered.

Social Engineering Threats in Cybersecurity: Risk Mitigation through Behavioral Insights

Ivaylo Tsanov *Technical University of Varna, BG*

Abstract: This study explores the critical intersection of social psychology and cybersecurity, with a focus on reducing social engineering threats using behavioral insights. Social engineering exploits human psychological vulnerabilities, making it a serious cyber threat. We propose effective cybersecurity resilience strategies that incorporate persuasion, cognitive biases, and behavioral economics principles. Simulation-based training, user-centric nudges, and the development of a cybersecurity-aware organizational culture are all important interventions. Case studies from Google and the NHS demonstrate the strategies' practical application and success. As social engineering tactics evolve in tandem with advances in AI and deepfake technology, this interdisciplinary approach provides a solid foundation for addressing emerging threats and improving overall digital security.

The Role of Social Psychology in the Creation of Ethical AI Systems

Ivaylo Tsanov *Technical University of Varna, BG*

Abstract: The goal of this paper is to develop ethical AI systems by investigating the relationship between social psychology and artificial intelligence (AI). It emphasizes the need for openness, justice, and data privacy while highlighting the revolutionary effects of AI in social work, criminal justice, healthcare, and education. Insights from social psychology into human behavior and decision-making are invaluable when developing AI systems that adhere to moral standards. While addressing issues like bias and regulatory gaps, the paper addresses future directions, including emotionally intelligent AI and AI applications in global challenges. We hope to guarantee that AI technologies advance society and preserve human values by incorporating ethical considerations and raising public awareness.

Evaluating the Accessibility of Electronic Educational Resources in PDF Format

Bonimir Penchev — *University of Economics – Varna, BG*
Latinka Todoranova — *University of Economics – Varna, BG*

Abstract: The successful inclusion of learners with disabilities, their active and full participation in the educational activities and the overall educational process, the widespread use of information and communication technologies in education, and the development of Learning Management Systems (LMSs) as supportive tools for traditional teaching, necessitate serious research on the accessibility of electronic educational resources. The goal of this study is to evaluate the accessibility of electronic educational resources in pdf format that are published on e-learning platform of the University of Economics – Varna. The results show what is the current state, possible ways to improve the PDF documents in order to make them more accessible and guidelines to make this process as convenient as possible for educators who face numerous challenges daily due to technological advancements.

SESSION B6 "COMPLEX INDUSTRIAL SYSTEMS CONTROL"	**Stream 2**
Chairman: Idilia Batchkova	University of Chemical Technology and Metallurgy, BG
Friday, October 11th 10:00 – 11:30	Online

Future Enterprise as a self-organizing Complex system

Simona Iuliana Caramihai — *University POLITEHNICA of Buchares, RO*
Dragos Constantin Popescu — *University POLITEHNICA of Buchares, RO*
Ioan Dumitrache — *University POLITEHNICA of Buchares, RO*

Abstract: The development of future enterprises with high autonomy and adaptability to business, technological and mar-ket conditions require new self-organizing and self-optimization architectures and appropriate design formalisms and method-ologies. In this work we address the problem of

designing such systems with the adoption of mechanisms inspired from biological cognitive and cortical processes.

Modelling of the Deployment of ERP Systems

Radoslav Hrischev — *Technical University of Sofia, Branch Plovdiv, BG*
Nikola Shakev — *Technical University of Sofia, Branch Plovdiv, BG*
Sevil Ahmed-Shieva — *Technical University of Sofia, Branch Plovdiv, BG*

Abstract: This paper applies simulation approach for investigation of the processes in deployment time of Enterprise Resource Planning (ERP) systems. An overview of the most frequently used methodologies for the implementation of integrated information systems, developed by the leading vendors of ERP systems - SAP and Oracle, is presented. A processes of deployment research model based on modeling software tool AnyLogic been developed.

Smart Manufacturing Integration of Heterogeneous Information Systems via OPC UA. A Case Study

Plamen Vasilev — *University of Chemical Technology and Metallurgy, BG*
Ani Boneva — *Institute of Information and Communication Technologies, BAS, BG*
Veronika Ivanova — *Institute of Robotics, BAS, BG*
Tsetso Tsvetanov — *University of Chemical Technology and Metallurgy, BG*

Abstract: Modern automation, digitalization, virtualization and intelligent production impose new criteria and approaches to process management. The operation and performance of any system and device depends on how it is managed. The article describes Smart Manufacturing Integration of Heterogeneous Information Systems via OPC UA. The main goal is the development of heterogeneous information systems with real application, with which reliable and up-to-date information can be exchanged between systems of different hierarchical levels. The goal was achieved with the following steps i) building the research infrastructure ii) analyzing the information compatibility and challenges in integrating systems from different hierarchical levels iii) implementing the integration by means of OPC-UA standard communication protocol. The setup has been tested under laboratory conditions. The obtained results are shown.

Risk and quality in the test production stage of the rapid prototyping process

Svilen Simeonov — *Technical university of Varna, BG*

Abstract: The article explores the possibility of risk management and ensuring stable quality in a test production process that is part of an RP (RP, Rapid Prototyping) process. For this purpose, Schuhart control charts were used. The results obtained from the study reveal the applicability of these charts in RP - the production of small test series. The results reveal an approximate minimum of the test units produced in regard to the achievement of minimum values characterizing the achievement of statistical manageability and stability of the ensured quality in test production.

SESSION A7 "COMMUNICATION NETWORKS AND SYSTEMS CHAIR"	**Stream 1**
Chairman: Hristo Valchanov	Technical university of Varna, BG
Friday, October 11th 11:30 – 13:00	Hall 109TV

Behavior of Voice Codecs QoS Metrics in the IP Network Overload Zone

Vladimir Vichev — *Technical university of Varna, BG*

Todorka Georgieva — *Technical university of Varna, BG*

Abstract: Audio communications in IP-based networks have undergone a transformative shift with the advent of VoIP applications. The remarkable cost-efficiency of VoIP has cemented its role as the dominant communication method in the modern world, a trajectory that shows no signs of waning. VoIP performance is critically dependent on the efficiency of the audio codecs utilized in any given communication scenario, underscoring the importance of examining audio codec QoS parameters in IP networks. This paper delves into the performance analysis of several widely-used audio codecs, how each of the codecs QoS parameters reacts in the network congestion zone. How wide is this zone for each of them and how stable are its parameters before entering it.

IP Network Performance Analysis in VoIP Environment

Vladimir Vichev — *Technical university of Varna, BG*

Todorka Georgieva — *Technical university of Varna, BG*

Abstract: Innovation involves applying new solutions to address emerging requirements, unspoken needs, or existing market demands. In the realm of network performance analysis, new innovations are emerging that focus on converged networks (data, voice, and video). This paper aims to explore the concept of performance analysis broadly, with a particular emphasis on computer networks. We focused on the observation of packet loss, bandwidth, and packet inter-arrival time, also known as packet interval. In addition, we will emphasize the importance of packet inter-arrival time as a metric that provides a valuable and accurate indication of the IP network performance.

Technical overview & performance evaluation of Virtio-loopback

Timos Ampelikiotis *Virtual Open Systems SAS - Grenoble, FR*

Alvise Rigo *Virtual Open Systems SAS - Grenoble, FR*

Daniel Raho *Virtual Open Systems SAS - Grenoble, FR*

Abstract: The increasing complexity and proprietary nature of modern hardware solutions necessitate maintaining local forks of the Linux kernel with corresponding drivers, leading to significant maintainability challenges. User-space drivers have emerged as a promising solution, offering greater portability and reduced dependency on kernel revisions. However, these drivers also bring their own issues, such as vendor-specific APIs and lack of backward compatibility, which can increase the maintenance burden.

To address these challenges, a hardware abstraction layer (HAL) designed for non-hypervisor environments is necessary. Leveraging well-established virtio and vhost-user technologies, Virtio-loopback [6] provides a standardized interface that ensures compatibility and performance stability. This HAL aims to mitigate the issues associated with user-space drivers and support seamless application development without extensive modifica-tions.

The primary contribution of this paper is the technical overview and performance evaluation of Virtio-loopback tech-nology across various hardware architectures, including RISC-V, ARM64, and x86. Through this process, we evaluate Virtio-loopback's design against current standards and compare its performance with solutions like vDUSE. Our results indicate that Virtio-loopback meets contemporary performance standards, making it a viable candidate for operating as a HAL in non-hypervisor scenarios.

Implementing a High-Precision Boat Navigation System Using Raspberry Pi with RTK and GPS Integration via ESP32

Ivan Grigorov *Technical university of Varna, BG*

Nasko Atanasov *Technical university of Varna, BG*

Nikola Nikolov *Technical university of Varna, BG*

Dian Dzhibarov *Technical university of Varna, BG*

Abstract: This paper presents the development of a high-precision navigation system for small maritime vessels, utilizing a Raspberry Pi as the central processing unit, combined with Real-Time Kinematic (RTK) and Global Positioning System (GPS) technologies integrated via an ESP32 microcontroller. The system is designed to enhance navigation accuracy, leveraging RTK corrections to achieve centimeter-level precision. This cost-effective solution is ideal for small-scale maritime applications requiring reliable and accurate positioning. The system's performance is tested in various marine environments, demonstrating significant improvements over

conventional GPS-based navigation systems.

SESSION B7 "AI APPLICATION IN SOCIO-PROBLEMS"	**Stream 2**
Chairman: Gancho Vachkov	BG
Friday, October 11th 11:30 – 13:00	Online

Application of Machine Learning Agriculture Between Developing and Developed Countries: A Systematic Literature Review

Mario Leonardi — *Bina Nusantara University - Jakarta, ID*
Muhammad Resnandya Rafif — *Bina Nusantara University - Jakarta, ID*
Nicholaus Putra — *Bina Nusantara University - Jakarta, ID*
Ali Gunawan — *Bina Nusantara University - Jakarta, ID*

Abstract: The use of Machine Learning (ML) technology in the agricultural industry has evolved rapidly in the last few decades, especially in the 1990s-2000s era where it became important with the emergence of information and communication technology. These several things enable various countries that have adequate resources, such as developed countries, to develop ML technology and Internet of Things (IoT) components for the agricultural industry. The use of ML and IoT in the agricultural industry opens up new opportunities for data-intensive science as the amount of agricultural data collected increases, ML Agriculture algorithms are applied to further improve the intelligence and working functionality of applications. In recent years, various developing countries have also increasingly adopted agricultural technology to increase agricultural yields, reduce crop losses, and improve farmer welfare. The purpose of this literature review is to investigate the capabilities and impact of using ML in the Agriculture industry as well as the influence of the use and benefits received from implementing ML Agriculture in developed countries and the potential for application and further development for developing countries. Based on this literature review investigation, it was found that the method of implementing machine learning in developing and developed countries has different stages according to the capabilities of the resources and includes the role of supporting technology.

Neural Classifier of Honey Plants Pollen Using a Combination of Textural and Geometric Features

Lyubomir Zaykov — *University of Food Technologies - Plovdiv, BG*
Diana Tsankova — *University of Food Technologies - Plovdiv, BG*

Abstract: This study aims to develop a neural classifier of honey plants pollen. Microscope photos of pollen from black locust (acacia), linden, lavender, canola (rapeseed), and thistle were used. Pollen images were in polar and equatorial views, with rotations and small defects. A combination of textural (based on Gabor filter, gray level co-occurrence matrix, local binary patterns) and geometric features extracted from the pollen images were used. Six classifiers based on linear discriminant analysis and twelve - on an artificial neural network with a feedforward structure were built. Based on a comparative analysis, the most appropriate classifier for the purpose was determined. The best classification success rate obtained is 93.1%.

Supporting Digitization of a Cultural and Historical Heritage Platform

Iliya Nedelchev *University of Plovdiv "Paisii Hilendarski", BG*
Veneta Tabakova-Komsalov *University of Plovdiv "Paisii Hilendarski", BG*
Ivan Stoyanov *Institute of Information and Communication Technologies, BAS, BG*
Stanimir Stoyanov *University of Plovdiv "Paisii Hilendarski", BG*
Vanya Ivanova *University of Plovdiv "Paisii Hilendarski", BG*
Tsvetomira Kazashka *University of Plovdiv "Paisii Hilendarski", BG*

Abstract: The article introduces a platform designed for the storage and retrieval of digitized cultural and historical objects from Bulgaria. To enhance the plat-form's accessibility for tourists, a dedicated tourist guide has been created and implemented as a personalized assistant. The architecture, along with its distinct components, is thoroughly elucidated. The article provides an over-view of the current state of the platform, details the experiments conducted with the realized prototype, and outlines its future development, with a focus on integrating cultural and historical object ontologies. Additionally, a brief background of the platform is provided for context.

Adaptive Neuro-Fuzzy Inference System for Beverage Identification Based on VIS/NIR Spectral Analysis

Mariyana Sestrimska *University of Food Technologies - Plovdiv, BG*
Veselin Nachev *University of Food Technologies - Plovdiv, BG*
Tanya Titova *University of Food Technologies - Plovdiv, BG*
Plamen Nikovski *University of Food Technologies - Plovdiv, BG*

Abstract: In the present paper, a model of a hybrid neural-fuzzy system adapted to identify drinks with certain quality indicators, more specifically - tea blends with different ingredients, has been synthesized. Spectral characteristics of diffuse reflectance in the VIS/NIR range of the electromagnetic spectrum were used for sample classification. An analysis by the method of principal components (PCA) was applied to the obtained experimental database, with the aim of reducing the feature space, visual interpretation and evaluation of the

accumulated a priori information. The first five principal components resulting from PCA-analysis are selected as input vectors of neural fuzzy classifier. An overall classification accuracy of 97.6% was achieved (respectively, an error of 2.4%.

SESSION A8 "MODELING AND CONTROL IN INDUSTRY"	**Stream 1**
Chairman: Hristo Nenov	Technical university of Varna, BG
Friday, October 11th 14:00 – 15:30	Hall 109TV

Enabling SME Participation in Cross-Border Agricultural Futures: A Tokenized Pooling Model with OTC Clearing Integration

Deyan Paroushev *Sofia University St. Kliment Ohridski, BG*

Petko Ruskov *Sofia University St. Kliment Ohridski, BG*

Abstract: Small and medium-sized enterprises (SMEs) in agriculture face significant barriers to participating in institutional commodity trading, limiting their ability to manage risk and access global markets. This paper introduces a novel tokenized pooling mechanism that allows SMEs to collectively access over-the-counter (OTC) clearing services for agricultural futures. Leveraging blockchain technology, specifically Hyperledger Fabric, we create a transparent and efficient system for aggregating small-volume trades into standard-size contracts. Our model incorporates advanced pricing techniques that account for collateralization and cross-currency considerations. Implementation on Hyperledger Fabric demonstrates the feasibility of this approach in a real-world setting. Results indicate that this pooling mechanism can significantly reduce counterparty risk for SMEs while providing them access to institutional-grade risk management tools. This innovation has the potential to enhance market efficiency and promote more inclusive global agricultural trade.

Algorithmic model for complex assessment of the competitiveness of an industrial enterprise

Krasimira Dimitrova *Technical Univarsity of Varna, BG*

Abstract: In the modern world, the concepts of competitiveness and sustainable development are becoming more and more connected and interdependent. Sustainable development involves economic growth that takes place in a way that protects the environment and ensures social well-being. Competitiveness and sustainable development are inseparable aspects of modern business. Companies that successfully integrate sustainable practices into their competitiveness strategy not only contribute to a better future, but also strengthen their market position and long-term sustainability. The assessment of the competitiveness of any organization is important for its strategic planning, as it is the basis on which decisions are made to formulate strategies and priorities. Measured competitiveness provides information on the

investment potential of the organization, identifies problems, weaknesses and areas for improvement and allows comparison with competitors. The present publication represents an Algorithmic model for complex assessment of the competitiveness of an industrial enterprise, based on known techniques, but united in a new conceptual framework.

IoT system for AQI monitoring and control

Ivan Ganchev *University of Plovdiv "Paisii Hilendarski", BG*
Zhanlin Ji *University of Limerick,, IE*

Abstract: This paper* presents the horizontal approach for the development of Internet of Things (IoT) platforms, based on the example of a generic, multi-service, cloud-based IoT operational platform, called EMULSION, elaborated for the rapid development of mobile IoT systems and quick roll-out of corresponding IoT services. The successful use of the platform as a basis of various pilot systems, operating in different IoT areas, is show-cased on the example of 'smart environment' monitoring and control.

Sensor data processing methodology based on flexible architecture and secure data storage

Valentin Mollov *Technical University of Sofia, BG*
Panayot Petrov *Technical University of Sofia, BG*

Abstract: Here, we present a general methodology for logging, processing and storage of long-time data streams from various type of sensors. The measured digital values are introduced via high speed serial interface. Measured data are processed with a digital system that holds the required processing algorithms implemented over FPGA device with a flexible architecture. A special attention is paid on the general option to send the measured sensor values outside the target device only as encrypted data, thus keeping highest level of data security.

SESSION B8 "COMMUNICATION AND CYBER SECURITY 2" **Stream 2**

Chairman: Miroslav Markov Technical University of Varna BG

Friday, October 11th 14:00 – 15:30 Online

Android Agile Test-Driven Development

Manish Kaushik *University of Europe for Applied Sciences-Berlin, DE*
Rand Kouatly *University of Europe for Applied Sciences-Berlin, DE*
Mohammed Nazeh Alimam *University of Europe for Applied Sciences-Berlin, DE*

Abstract: In today's technological world, one of the industries that are growing the fastest is the market for mobile apps. The things that mobile apps need to do change all the time, so software developers need to be able to adapt. After many failed attempts to overcome problems with mobile computer programming, it was decided that the agile project process was the best way to make an application for various devices. This project report goes into detail about how Agile methodologies within Kotlin programming language that is utilized to deal with the many problems that come up when making mobile software. As a way to deal with these problems, agile methods have been suggested as the guidelines for making mobile apps. The principal objective of this study is to find out more about the agile approach and how it can be used to make mobile apps. For this study, the researcher would search the published research and other databases for relevant papers to utilize as secondary research. As a group struggles to create and keep software that works, they will go through these steps of the DevOps entire life cycle over and over again. TDD can also help to make software quickly. The findings/results of this research are to consider through several testing like unit, UI, Instrumentation, and non-functional along with knowing about the developer's viewpoint on the findings by underpinning Kotlin programming language. The main limitation of this research is that TDD cuts down on the time spent fixing insects and recreating work.

A comparative analysis of Jenkins as a data pipeline tool in relation to dedicated data pipeline frameworks

Angel Georgiev *University of Plovdiv "Paisii Hilendarski", BG*

Vladimir Valkanov *University of Plovdiv "Paisii Hilendarski", BG*

Penyo Georgiev *University of Plovdiv "Paisii Hilendarski", BG*

Abstract: This paper presents a comparative analysis of Jenkins as a data pipeline tool in comparison to other dedicated frameworks, including Apache Airflow and Prefect. Jenkins is an open-source tool that is employed for the implementation of continuous integration and delivery (CI/CD) pipelines. It is a highly popular tool that offers robust automation capabilities and a comprehensive range of plugins. Nevertheless, the software is deficient in certain features that would be more pertinent to data engineering, encompassing activities pertaining to data pipelines, monitoring, error handling, and scaling. Some of the tools, such as Apache Airflow and Prefect, are specifically designed for the implementation of data pipelines. The software supports the ingestion, transformation, and loading (ETL) of data natively, which is an appropriate naming convention for this feature. Such tools possess additional functionalities that are designed to address potential errors in order to maintain data integrity and productivity. This study compares and contrasts the

functionalities, integration, performance, and community aspects of Jenkins and other specialized data pipeline tools. It aims to determine whether Jenkins can be effectively utilized to address data pipeline tasks or if there are specific end-to-end tools that may offer superior performance. The findings of this study will be invaluable for data engineers and decision-makers seeking to identify the optimal tool for their data pipeline-related tasks.

SESSION A9 "OPTIMIZATION AND COMPANY PRESENTATIONS"	**Stream 1**
Chairman: Mariela Alexandrova	Technical University of Varna, BG
Friday, October 11th 15:30 – 17:00	Online

Evaluation of Energy Efficiency of Si and GaN FET for Power Electronic Converters

Angel Marinov — *Technical University of Varna, BG*
Kristiyan Mihalev — *Technical University of Varna, BG*
Firgan Feraodv — *Technical University of Varna, BG*
Svetlozar Zahariev — *Technical University of Varna, BG*

Abstract: Energy efficiency and energy efficient design are of key significance for every contemporary electronic device. The conducted study presents a comparative evaluation of the efficiency of field-effect transistors (FET) based on Si and GaN technologies. Approaches for the increase of electrical efficiency of power electronic converters by substituting Si MOSFET with GaN transistors are examined for cases where the benefits of higher switching frequencies are not immediately apparent. For that purpose, a specialized computational approach based on Particle Swarm Optimization (PSO) is developed, which allows the performance of converters to be compared in close to optimal conditions. The evaluation in the presented study is conducted using a Single-Ended Primary Inductor Converter (SEPIC) topology. The results of the comparison between designs using GaN and Si transistors obtained from the developed algorithm are presented.

Minimum Complete Pareto Front of a Biobjective Minimum Spanning Trees Problem

Lasko Laskov — *New Bulgarian University, BG*
Marin Marinov — *New Bulgarian University, BG*

Abstract: We propose an exact method that finds a minimum complete Pareto front of the biobjective minimum length mini-mum risk spanning trees problem. The method consists in two algorithms. The first algorithm finds a single minimum length spanning tree that has minimum risk in running time complexity O(m + n lg n). The second algorithm calculates a minimum complete Pareto front

with an algorithm that has a pseudo-polynomial complexity.
We present the mathematical theorems that proof the correct-ness of both algorithms, and we show their computational com-plexity. Also, we describe numerical experiments that illustrate their implementation.

Senseye – AI Based Predictive Maintenance by Siemens

Nikola Petkov *Siemens EOOD, Digital Industries, BG*
Anton Naumov *Siemens EOOD, Digital Industries, BG*

Abstract: Megatrends are bringing nowadays new challenges to discrete and process industries. Globalization, digitalization, lack of skilled working force, are setting new requirement to different manufacturers. The keyword in digitalization of product lifecycle processes is data availability. It requires different multi-connections starting from the field sensors, trough the control systems, to MOM/MES, ERP, and cloud systems. The interoperated data exchange at different levels leads to new challenges in the OT (Operational Technologies) world. Currently the major one of them is the highly increased number of cyberthreats and both IT (Information Technology) and OT are at risk.

Rittal's digitalization – customer-oriented

Alexander Georgiev *Rittal EOOD – Bulgaria, part of FLG, BG*

Abstract: The end products we use in our daily lives are becoming increasingly complex and high-tech. For their production, the industry needs increasingly complex and efficient production processes. This is associated with a high degree of automation and production control, which is achieved with the use of a large number of sensors and actuators. In the process of design, construction and operation of such systems, a huge volume of documentation is created and used, which is generally found on paper (locally at the system) and/or in digital format at the designers' premises.

SESSION B9 "COMPUTING 1"	**Stream 2**
Chairman: Sevinç Gülseçen	Istanbul University, TR
Friday, October 6th 15:30 – 17:00	Online

IoT Continuum for Energy Management

Simeon Tsvetanov *Sofia University St. Kliment Ohridski, BG, BG*
Dimitar Chalamov *Sofia University St. Kliment Ohridski, BG, BG*
Stela Ruseva *Sofia University St. Kliment Ohridski, BG, BG*

Abstract: This paper introduces a suite of innovative methods and technologies aimed at enhancing energy efficiency in buildings by leveraging advanced meta operating system (OS) principles for optimizing resources in a distributed

environment. This allows the domestic appliances to dynamically adjust their energy consumption patterns to meet overarching goals, such as reducing the power usage and increasing the share of renewable energy, while maintaining a seamless user experience. The development process is particularly challenging, incorporating cutting-edge technologies for data processing and security to ensure robust and efficient implementation. Experimental results demonstrate that the proposed methods can lead to significant reductions in energy consumption. Moreover, the solution holds the potential for scalability, extending beyond individual households to smart cities and potentially being applied in other sectors, contributing to broader energy conservation efforts.

Laboratory set-up for the research of roller conveyors for logistics warehouses

Vladimir Hristov *Technical University of Sofia, BG*

Ivan Chekurov *Technical University of Sofia, BG*

Abstract: In this research paper, a laboratory setup for the study of roller conveyors for logistics warehouses is presented. The conveyors were designed and implemented in a teaching laboratory that is relatively small, but the conveyor manufacturer was able to fabricate them in such a way as to retain full functionality and enable different control algorithms and strategies to be explored by tuning the parameters and time constants of the drives used in the conveyors. The ability of the conveyors to be controlled by PlC and the specific software used to control the modules will allow other peripherals to be quickly integrated to recreate a real logistics park environment in a sufficiently small space.

A Systematic Review on Detection of Aortic Dissection by Utilizing Deep Learning

Hatice Koç *Istanbul University, TR*

Nilgün Bozbuğa *Istanbul University, TR*

Sevinç Gülseçen *Istanbul University, TR*

Abstract: Aortic dissection is a cardiovascular disease-causing mortality. It is vital to detect timely for earlier interventions and healing prognosis of aortic dissection. Computer-aided diagnosis and detection systems assist physicians and radiologists to identify a disease as a second opinion during decision-making for treatment. These systems provide early detection as well as save time and low cost when increasing accuracy in diagnosis. The systems utilize deep learning techniques to discover the localization of disease, and lesions by examining medical data. Thus, the purpose of this study is to perform systematic literature reviews in order to discover the studies that focus on aortic dissection detection by using deep learning. For this, Web of Science has been searched by combining specific keywords. Although 66 publications have been retrieved on the electronic database, only 53 publications have been examined due to the inclusion criteria.

The findings presents that there is a tendency on improving a segmentation application to detect aortic dissection by employing deep learning techniques. This study will help to explore trends for new studies focusing on aortic dissection detection with deep learning technique.

SWOT Analysis Of The Possibility Of Using AI For Education

Nikolay Yanev *Library Studies and Information Technologies university, BG*
Iglika Getova *Library Studies and Information Technologies university, BG*
Teodora Hristova *Library Studies and Information Technologies university, BG*
Iva Kostadinova *Library Studies and Information Technologies university, BG*
Georgi Dimitrov *Library Studies and Information Technologies university, BG*
Elizabet Mihaylova *Library Studies and Information Technologies university, BG*

Abstract: The purpose of the article is to make a SWOT analysis of the possibility of using generative algorithms in the education of students. The research was done on the basis of different groups of students who filled out a survey about knowledge and desire to use this cutting-edge technology. Economics, engineering and computer science students took part in the study. After analysis, the strengths and weaknesses, as well as the opportunities and prospects for the development of social skills for using digital technologies in education, were determined. This will provide guidance to overcome the difficulties and weaknesses and strengthen the opportunities to use this innovative tool.

SESSION A10 "ADVANCED ROBOTIC APPLICATION" **Stream 1**

Chairman: Nikola Shakev Technical University Sofia Branch Plovdiv, BG

Friday, October 11th 17:30 – 19:00 Online

Prospects of Intelligent Techniques for Energy Efficient Control of Drying Process

Desislava Delicheva *Technical University of Sofia, BG*
Snejana Yordanova *Technical University of Sofia, BG*

Abstract: Drying is one of the widely spread in industry great energy consuming processes. The plant is inertial, nonlinear and with model uncertainties. To reduce the energy required special methods are developed for its control. In the present research a Sugeno model-free PI fuzzy logic controllers (FLC) are designed for the control of the internal temperature of a laboratory dryer for fruits. Besides tackling with the plant nonlinearity and the lack of a plant model the FLC ensures system stability, good performance and energy safety. System simulations prove that the FLC systems outperform other energy efficient control systems designed using classical open loop approaches or a linear plant model.

Modeling and Analysis of a Real Residential Heating System

Nikolay Komitov *University of Food Technologies, Plovdiv,, BG*

Margarita Terziyska *University of Food Technologies, Plovdiv,, BG*

Abstract: This paper presents a model of a real-world heating and water heating installation in a residential building, consisting of a biofuel boiler, a tank, solar vacuum tubes, and radiators. The model was developed using MATLAB® and Simulink®, utilizing the recorded transient characteristics of the individual system components for identification. The solar vacuum tubes are connected to the system year-round; however, this study focuses on the system's operation during the winter season, and they are not considered part of the thermal system. The obtained model demonstrates high accuracy and can be used to improve the management and efficiency of the real system. Additionally, the proposed identification and modeling approach can be used for student training, providing valuable practical experience.

Smart IoT-Based Home Automation System

Nikolay Komitov *University of Food Technologies, Plovdiv,, BG*

Margarita Terziyska *University of Food Technologies, Plovdiv,, BG*

Abstract: The aim of this study is to propose an intelligent system to monitor key indicators and reduce energy consumption in an existing heating installation, thereby improving the comfort of households living in a family house. The system achieves this by monitoring temperature, lighting, smoke levels and home security and allowing control over these factors. Rather than using off–the–shelf commercial products, this research seeks to show how such a system could be built from scratch. The proposed system integrates various smart sensors and actuators, all controlled by an Arduino–based central hub. This hub collects real–time data from the sensors and communicates with a cloud platform via a Wi–Fi module. The system uses this data to make decisions about reducing energy consumption (eg at night). In this way, this work demonstrates the practical application of IoT technologies to increase energy efficiency in residential environments and lays the foundation for transforming the home into a "green home".

Implementation of ESD in automatic temperature, pressure and level control system in raw gypsum calcination plant

Viktor Tsolov *Technical University of Varna, BG*

Nikola Nikolov *Technical University of Varna, BG*

Abstract: The purpose of this paper is to present the implementation of an emergency shutdown in automatic temperature, pressure and level control systems in raw gypsum calcination plants, for achieving optimum levels of health and safety during work in order to protect workers and employees working in

such enterprises, as well as to preserve work equipment in the event of emergency situations.

SESSION B10 "ANALYSIS AND DESIGN OF ELECTRICAL AND ELECTRONIC DEVICES 2"	**Stream 2**
Chairman: Yasen Gorbunov	New Bulgarian University, BG
Friday, October 11th 17:30 – 19:00	Online

Program module for spectral analysis of continuous periodic signals

Radoslava Gabrova — *University of Food Technologies Plovdiv, BG*
Hristina Andreeva — *University of Food Technologies Plovdiv, BG*
Kamen Toromanov — *University of Food Technologies Plovdiv, BG*

Abstract: In this paper, we present a program module designed for the spectral analysis of continuous periodic signals with a rectangular shape of the elementary pulse. Spectral analysis is a tool in numerous scientific and engineering fields, enabling the decomposition of signals into their constituent frequencies to facilitate detailed examination and interpretation. This makes training in this field particularly important for electrical and computer engineers who play a crucial role in the development of technology, economies and public welfare in the modern world. The main goal of the developed application is to study the frequency content of unipolar and bipolar pulse train with possibilities to set all their parameters through a visual and interactive approach. It enables a detailed understanding of the spectral characteristics of the investigated signals, which is fundamental to many practical and scientific endeavors. The application is implemented through an simple, convenient and easy graphical user interface, which makes it especially suitable for training students of the new generation. The application is based on the mathematical foundations of the Fourier series for continuous periodic signals and accurately determines the spectral components of the investigated signals. Tests made with different data sets for both types of signals show stable performance in implementing the intended functionalities.

A modular approach of PV-systems modelling using real meteorological data

Svetlozar Zahariev — *Technical University of Varna, BG*

Abstract: This article focuses on presenting an algorithm of the modular approach for modeling, configuring, reconfiguring and investigating photovoltaic systems using meteorological data. It outlines a methodology for determining the solar model, solar radiation, time correction, solar azimuth, Incidence angles, Total Diffuse (GDI), Direct Solar Radiation (DBI), Clear Sky Models, frequency indices, Internal temperature of the photovoltaic cell and others. An automatic analysis of the simulation results has been implemented. The development is part of the activities of the Technical University of Varna to construct a modular open

instrument in Matlab Simulink for modeling and research of photovoltaic systems by processing meteorological data.

Algorithm for Maritime Target Detection

Ivan Garvanov — *University of Library Studies and Information Technologies, BG*

Magdalena Garvanova — *University of Library Studies and Information Technologies, BG*

Abstract: In this paper, an algorithm for detecting small marine boats using forward scattering radar (FSR) is proposed. It is suitable for guarding maritime borders and objects from unregulated maritime traffic. The detection of moving objects is performed in the time domain of the signal and the estimation of the object parameters is performed in both the time and frequency domains.

Development and Practical Application of a Small Laser Engraving Machine

Stanislav Simeonov — *Technical University of Sofia, BG*

Marin Zhilevski — *Technical University of Sofia, BG*

Mikho Mikhov — *Technical University of Sofia, BG*

Abstract: This paper is about the development and practical implementation of a low-cost small laser engraving machine. Based on formulated requirements the main device components are presented. Models of the individual elements and the whole machine are developed using a specialized software. Hybrid stepping motors are selected to drive the coordinate axes, which are controlled in microstepping mode of operation. The practical implementation is illustrated with pictures of the developed laser engraving machine and a processed workpiece. The research carried out and the results obtained can be used in the development and using of such type of laser engraving devices.

SESSION A11 "INTELLIGENT ROBOTICS" **Stream 1**

Chairman: Yasen Gorbunov — New Bulgarian University, BG

Saturday, October 12th 09:00 – 10:30 — Online

Generative AI-Driven Personnel Training in Industrial Robotics through Intelligent HXM

Stela Stoykova — *Technical University of Sofia, Plovdiv Branch, BG*

Nikola Shakev — *Technical University of Sofia, Plovdiv Branch, BG*

Abstract: The aim of this paper is to present a developed solution for integrating an AI digital assistant as a service on one of the most widely used ERP platforms – SAP. The digital assistant is based on a popular large language model GPT-2 and has been trained locally on manuals and technical documentation for a Mitsubishi industrial robot as well as a command database for the programming

language MELFA Basic V. The main task of the digital assistant is to contribute to the workforce on-boarding and training process as a human experience management tool. The developed digital assistant service is made freely available via web-browser access to students in its testing stage.

Distributed 3D camera distance measurement system for intelligent mobile robots

Radoslav Vasilev — *Institute of Information and Communication Tehnologies, BG*
Nayden Chivarov — *Institute of Information and Communication Tehnologies, BG*
Maya Staikova — *Institute of Information and Communication Tehnologies, BG*

Abstract: he present paper presents a distributed system for measuring distance to objects using a 3D camera, which comple-ments the functionality of an existing program (program model) for scene analysis created by the authors. The program integrates ob-ject recognition, color classification and QR code decoding. Meas-uring distance and determining the physical dimensions of recog-nized objects is a new functionality discussed in this article. This functionality adds new hardware and software components, mak-ing the overall system distributed. The main goal of the system is the coordinated interaction between devices and programs to en-sure effective processing and analysis of information from the 3D camera in real time. The preservation of structured information about recognized objects will be addressed in future research, as this will create prerequisites for logical reasoning and decision-making by a mobile robot in which the presented distributed system is integrated.

Cascade Control of PMDC Motor on FANUC M-430iA/4FH Robot

Vesela Karlova-Sergieva — *Technical University of Sofia, BG*
Nina Nikolova — *Technical University of Sofia, BG*

Abstract: In this study, the possibility of cascade robust control of the electric drive of the FANUC M-430iA/4FH robot is examined. Classical and robust control algorithms have been synthesized.

Automated control of a stand for determining the critical angles of static stability of agricultural robots

Veselin Mengov — *University of Plovdiv "Paisii Hilendarski", BG*
Vladimir Kotev — *Institute of Mechanics, BAS, BG*
Georgi Komitov — *Agricultural University – Plovdiv, BG*
Evgeni Kehayov — *Agricultural University – Plovdiv, BG*

Abstract: During its movement, the agricultural robot encounters various obstacles such as lumps of earth or stones, various slopes on the terrain, puddles and others. They change the coefficient of friction of the tire with the terrain. To work in this variable environment, the robot speeds up or slows down its movement. At the same time, all this time, a variety of equipment was installed

on its structure, with which he worked in the field. Performing its work operations, the wheeled robot together with the work equipment is subjected to significant dynamic forces. The design of the wheeled agricultural robot must be designed in such a way that it is able to withstand variable loads with a large amplitude.

SESSION B11 "COMMUNICATION AND CYBER SECURITY 3"	**Stream 2**
Chairman: Willian Dimitrov	University of Library Studies and Information Technologies, BG
Saturday, October 12th 09:00 – 10:30	Online

Some Cybersecurity Issues in Artifical Intelligence Systems

Vassil Sgurev — *Institute of Information and Communication Technologies, BAS, BG*

Lyubka Doukovska — *Institute of Information and Communication Technologies, BAS, BG*

Abstract: The significant spread of information technology (IT) has led to the emergence of artificial intelligence (AI) systems important to society. Their importance will grow. Along with this, attempts to destroy these systems have appeared and greatly increased. This in turn has led to the development of systems to resist cyber attacks. A new scientific and applied direction - cyber security - was formed. In the present work, some issues of cyber security are considered and discussed in order to ensure a sufficiently high degree of protection of AI systems throughout their life cycle. The main requirements for cyber security systems, their effective construction and operation are discussed. The paths for future development of cyber security systems - in research and applied aspects - are also indicated. It is proposed to build a society responsible for continuous improvement of cyber security systems.

Preserving Privacy and Security in Online Assessment Process: Exploration and Analysis

Iskra Trifonova — *Technical University of Sofia, BG*

Malinka Ivanova — *Technical University of Sofia, BG*

Abstract: The assessment process is an important part of students' learning because it provides an opportunity to see what knowledge has been acquired and what skills have been obtained. When assessment is carried out in an online environment, which is currently becoming increasingly intelligent, integrating various predictive and analytical functions, the learner's behavior is tracked, the collected data is processed and analyzed. There emerge the issues of how secure the data is and whether its privacy can be maintained. This paper aims to summarize and analyze current scientific publications on how secure and data privacy-based are online assessment environments and to develop a conceptual

model showing the possibility for realization of a trust-based assessment. To achieve this, a bibliometric approach and in-depth exploration of the content of relevant scientific articles is applied. The results show that an online assessment environment should be characterized by mechanisms for e-authentication, verification of students' authorship, implementation of integrated approaches to data security in their life cycle, as well as the realization of appropriate methods for covering General Data Protection Regulation (GDPR) principles.

Using Reed-Solomon codes to securely transmit data over radio frequencies using broadband communications

Alla Levina *"LETI" University, St. Petersburg, RU*

Nikita Galkin *"LETI" University, St. Petersburg, RU*

Abstract: The purpose of the research work is to analyze the energy gain and reliability improvement in data trans-mission using Reed-Solomon codes in a noisy channel of broadband communication.

The paper analyzes the applicability of Reed-Solomon codes for secure information transmission. The model of integrity assessment of transmitted data on the basis of methods of noise-proof coding with the help of cyclic block Reed-Solomon codes is developed. According to the results of the model study the en-ergy gain and reliability improvement in data transmis-sion using Reed-Solomon codes in the noisy channel of broadband communication are analyzed.

Performance and Accuracy Assessment of Detecting Network Intrusions with eSOM-Based Techniques

Dimitrios Simeonidis *University of Economics - Varna, BG*

Pavel Petrov *University of Economics - Varna, BG*

Georgi Penchev *University of Economics - Varna, BG*

Stefka Petrova *College of Tourism Varna, BG*

George Dimitrov *University of Library Studies and Information Technologies, BG*

Volodymyr Petrivskyi *Taras Shevchenko National University of Kyiv, UA*

Abstract: This study evaluates the Emergent Self-Organizing Map (eSOM)-based Intrusion Detection System (IDS) in a simulated wireless network environment. The experiment assessed the system's proficiency in detecting various network intrusions, including DoS, Probe, R2L, and U2R attacks. The findings indicated that DoS (95%) and Probe (88%) assaults had the highest detection rates, while R2L (75%) and U2R (70%) attacks had the lowest rates. The IDS demonstrated a low false positive rate of 5% and quick response times for overt attacks (2 seconds), though response times increased for covert attacks (4 seconds). The number of resources used was substantial; the average memory and CPU utilization was 70% and 80%, respectively. These results show the promise of eSOM-based intrusion detection systems (IDSs) in network security, but they also point to the need for additional optimization in order to identify more

sophisticated threats.

SESSION A12 "COMPUTING 2"	**Stream 1**
Chairman: Ivaylo Penev	Technical University of Varna, BG
Saturday, October 12th 10:30 – 12:00	Online

Hardware implementation of lightweight cryptographic algorithms: An overview

Dilyana Dimitrova *Nikola Vaptsarov Naval Academy, Varna, BG*

Ivaylo Dimitrov *Engineering Department Blu11 Ltd., Varna, BG*

Abstract: The main aim of the paper is to evaluate and compare the hardware implementation of three lightweight cryptographic algorithms - SKINNY, ForkAE, and Romulus to determine their efficiency and suitability for IoT environments. Methods used: theoretical analysis and summary. The study indicates that SKINNY shows good results in round-based implementations but is less efficient in serial modes, while ForkAE offers better performance for small message encryption with minimal latency. Romulus is noted for its compact hardware footprint and efficient serial mode operation, making it suitable for low-power applications. These findings underscore the importance of selecting appropriate cryptographic solutions to balance security, performance, and resource constraints in IoT systems.

Exploring Web3 Challenges: Implications for Investigative Techniques and Evidence Acquisition in Digital Forensics

Blerim Krasniqi *Sofia University St. Kl. Ohridski, BG*

Eliza Petrova Stefanova *Sofia University St. Kl. Ohridski, BG*

Abstract: The emergence of Web3 technologies presents new challenges and implications for investigative techniques and evidence acquisition in the field of digital forensics. This research paper delves into the intricate landscape of Web3 and its impact on the investigative processes involved in digital forensics. By examining the unique characteristics of Web3, such as decentralized networks, blockchain technology, and smart contracts, this study aims to highlight the complexities that digital forensic investigators face in this rapidly evolving environment.

Through a comprehensive review of existing literature, this paper identifies key challenges in conducting digital investigations within Web3 ecosystems. These challenges include issues related to data integrity, privacy concerns, jurisdictional boundaries, and the authentication of digital evidence. Furthermore, the implications of these challenges on traditional investigative techniques are discussed, emphasizing the need for adaptation and innovation in digital forensic practices.

Overall, this research sheds light on the evolving nature of digital forensics in the

context of Web3 technologies, providing insights for forensic practitioners, law enforcement agencies, and policymakers to better navigate and address the complexities of investigating digital crimes in decentralized and blockchain-based environments.

Text Mining Student Comments for Teaching Performance Evaluation using VADER and Latent Dirichlet Allocation Algorithm

Jenny Resuello *Cebu Institute of Technology University, PH*

Larmie Feliscuzo *Cebu Institute of Technology University, PH*

Cheryl Pantaleon *Cebu Institute of Technology University, PH*

Abstract: This study, which analyzed student feedback on teacher performance from University of Eastern Philippines evaluations using VADER and the Latent Dirichlet Allocation (LDA) algorithm, presents significant findings to the institution. The results indicate that students are generally satisfied with their instruction but have concerns about class scheduling and management. The neutral tone of the student feedback reflects a balanced assessment of strengths and areas for improvement, underscoring the fairness and comprehensiveness of the study. The analysis identified several key areas: clarity, accessibility, interactive aspects, advanced instruction, online resources, a supportive learning environment, and assessments. The analysis also offers valuable recommendations for improvement, such as the importance of in-person instruction, engaging student-teacher relationships, and advanced instructional strategies. These findings have significant implications for faculty development, suggesting that it should prioritize improving teaching methods, supporting student-centered learning, strengthening teacher-student interactions, motivating faculty, and incorporating technology to enhance the educational experience at the University of Eastern Philippines.

Features of FDM printing of test specimens

Miglena Paneva *Institute of Information and Communication Technologies, BAS, BG*

Peter Panev *Institute of Information and Communication Technologies, BAS, BG*

Abstract: The presented article describes the process of 3D printing using FDM technology and its advantages over the conventional plastic manufacturing technique, as well as the need to study the characteristics of the created 3D models. The technology allows the use of a wide variety of materials that have different mechanical characteristics and resistance to atmospheric influences: PLA, PLA Wood, PETG, PC, CPE, PA and Filaflex. A classification of printing parameters, namely fill percentage and pattern, was made depending on the printed 3D model and printing orientation. The most basic parameters such as printing temperature, heating of the bed, printing speed and cooling are in accordance with the technical characteristics indicated by the manufacturer of the materials and based on analyzes in the literature. CAD models of test specimens

were designed for testing tensile strength at normal and elevated temperature, impact and shear resistance. The dimensions of the test bodies are in accordance with European quality standards. The Ultimaker Cura software program was used to prepare the printing programs of the test. A Geroid pattern and a fill density of 30% were used for all test bodies. These parameters are chosen to be applicable to small, standard and functional 3D printed objects.

SESSION B12 "PROCESS MEASUREMENT AND CONTROL"	**Stream 2**
Chairman: Plamen Daskalov	University of Ruse "Angel Kanchev", BG
Saturday, October 12th 10:30 – 12:00	Online

Switching Multi-regulator Control of Electro-Hydraulic Servo System

Georgi Mihalev — *Technical University of Gabrovo, BG*
Stanimir Yordanov — *Technical University of Gabrovo, BG*
Krasimir Ormandzhiev — *Technical University of Gabrovo, BG*

Abstract: The paper proposes a switching multi-regulator control for an electro-hydraulic servo system with throttle regulation. The architecture of the multi-regulator control, composed of three conventional regulators (PID1, PI2, PI3) for different regions of the setpoint signal variation and switching logic, is discussed. The main issues arising from the use of such control are considered, and an analysis of the stability of the closed-loop system is conducted. Some mathematical formulas and descriptions are presented. Using a universal measurement and control module, graphical results for the quality of the designed control are obtained. The advantages of this type of control and the emergence of additional robust qualities of the system are experimentally proven

Application of a Modified Multiparametric PID Controller for Control of an Electrohydraulic Servo System

Stanimir Yordanov — *Technical University of Gabrovo, BG*
Georgi Mihalev — *Technical University of Gabrovo, BG*
Krasimir Ormandzhiev — *Technical University of Gabrovo, BG*
Stefan Ivanov — *Technical University of Gabrovo, BG*

Abstract: The paper proposes a switching multiparametric control for an electrohydraulic servo system with throttle regulation. The architecture of a MISO (Multiple Input Single Output) control is considered, consisting of a conventional PID controller operating in the deviation control channel and a fuzzy PID controller operating in the disturbance channel. The main issues arising from the use of this type of control are discussed, and an analysis of the stability of the closed-loop system is conducted. Graphic results for the control quality of the designed system are obtained using a universal measurement and control module. The advantages of this type of control and the manifestation of additional robust

qualities of the system are experimentally demonstrated

Single-channel ultrahigh frequency moisture meter with direct measurement of moisture content of bulk materials

Palvan Kalandarov — *National Research University Tashkent, UZ*
Shakhnoza Ubaydullayeva — *National Research University Tashkent, UZ*
Nikola Nikolov — *Technical University of Varna, BG*
Mariela Alexandrova — *Technical University of Varna, BG*

Abstract: The article discusses the theoretical foundations of the design of a single-channel ultrahigh frequency moisture meter with direct measurement of the moisture content of bulk materials. In accordance with the requirements of the methodology for selecting efficiency criteria, it is necessary to develop structural diagrams of measuring devices. For these purposes, the standard deviation of the random error is determined, characterizing the accuracy. It includes the main components: sensitivity error, zero error and additive component. Mathematical models of structures are constructed and the standard deviation of random errors, which are caused by certain parameters and additive fluctuations, is calculated. A single-parameter ultrahigh-frequency method for determining the moisture content is proposed. This method provides high accuracy of a single-channel ultrahigh frequency moisture meter with direct measurement of the moisture content of bulk materials. The measuring device can be used in the agricultural industry, where humidity is one of the important parameters, starting with harvesting and ending with the release of finished products.

In-Situ Optical Emission Spectroscopy for Process Monitoring and Material Identification in Laser Powder Bed Fusion

Ema Vasileska — *Ss. Cyril and Methodius University in Skopje, MK*
Mite Tomov — *Ss. Cyril and Methodius University in Skopje, MK*
Xiaoshuan Zhang — *China Agricultural University Beijing, CN*
Valentina Gecevska — *Ss. Cyril and Methodius University in Skopje, MK*

Abstract: Laser Powder Bed Fusion (LPBF) additive manufacturing has significantly advanced in fabricating multi-material structures with tailored properties. However, challenges persist due to the varying melting behaviors of different materials under identical laser energy inputs or because of critical part designs, leading to incomplete or excessive melting. Identifying the material being printed and understanding the energy intensity in the laser-material interaction zone is important for gaining insight into the process and enabling automatic parameter selection and control to optimize the printing process for multi-material applications. This study explores the integration of a coaxial spectrometer for laser-induced optical emission spectroscopy (OES) monitoring in LPBF, as it allows for the identification of both the processed material and the

energy intensity using a single sensor. The spectral emission signals generated by the laser's interaction with the material are analyzed using Principal Component Analysis (PCA). Experiments with varying laser power and laser exposure time were conducted on AISI316L and Ti-6Al- 4V to assess the model's ability to detect materials under diverse processing conditions and to assess different energy inputs. The results demonstrate accurate identification of the two metal alloys and three energy processing ranges during LPBF, highlighting a promising approach for improving process control and product quality in multi-material LPBF additive manufacturing.

SESSION A13 "ADVANCED METHODS IN LEARNING AND TEACHING 1"	**Stream 1**
Chairman: Ts. Vasilev	BG
Saturday, October 12th 14:00 – 15:30	Online

A Comparative Analysis of Generative AI Models for Improving Learning Process in Higher Education

Nurassyl Kerimbayev — *Al-Farabi Kazakh National University Almaty City, KZ*
Zhanbota Menlibay — *Al-Farabi Kazakh National University Almaty City, KZ*
Magdalena Garvanova — *University of Library Studies and Information Technologies, BG*
Saltanat Djaparova — *K. Tynystanov Issyk-Kul State University Karakol City, KG*
Vladimir Jotsov — *University of Library Studies and Information Technologies, BG*

Abstract: This study comprehensively analyses ten advanced generative AI models including GPT-4, Llama 3.1, Microsoft Copilot, Gemini and others to assess their applicability in higher education for computer science students. The study uses a mixed-method approach involving qualitative and quantitative analyses to evaluate these models across four key groups: architecture, content quality, adaptability, and performance. The results show that while each model has certain strengths - such as GPT-4's content creation capabilities and Pi's adaptability - none is the optimal choice across all clusters. The study emphasises the importance of aligning the choice of AI tool with specific educational goals and needs. It also emphasises the need for continuous evaluation of AI technologies to ensure their effectiveness in dynamic educational environments. The study contributes to the growing discourse on AI in education by offering a sound framework for evaluating AI models and guiding their implementation in educational environments.

Effective management of educational resources – Automated scheduling of lectures

Boris Stoykov — *Bulgarian Air Force Academy Dolna Mitropoliya, BG*
Mariyan Apostolov — *ANM-Solutions Ltd Sofia, BG*

Simeon Arnaudov *Bulgarian Air Force Academy Dolna Mitropoliya, BG*
Nikolay Nichev *Bulgarian Air Force Academy Dolna Mitropoliya, BG*

Abstract: The implementation of innovative technologies to support the management of educational resources has become a key driver in the development of universities. This is a critical factor in reducing the administrative burden in communication between different departments within the university. The introduction of internal university electronic services is a new trend, and in this article, we will describe the components necessary for creating an effective web-based service for academic calendar planning. This article presents the experience we have gained in developing an electronic service to support the management of educational services at the Bulgarian Air Force Academy "Georgi Benkovski".

Review Using AI Learning Models to Develop E-Learning Platforms

Lyazzat Zhaidakbayeva *M.Auezov South kazakhstan University, KZ*
Makpal Dildabayeva *M.Auezov South kazakhstan University, KZ*
Raushan Sambetova *M.Auezov South kazakhstan University, KZ*

Abstract: This study concentrates on the essential elements needed to develop an AI learning model for developing learning platforms. AI enables learning and instruction tailor to each student's specific requirements and skill set. Learning is therefore customize based on the interests, learning preferences, and skill level of each learner. This technique makes reading more motivating and facilitates better content absorption. The purpose of this study is to investigate how AI integrates teacher, platform, and student data into an e-learning environment on learning outcomes through a systematic assessment of the literature. Experts assert that e-learning is a dynamic domain with a range of benefits and challenges. We can keep enhancing e-learning's efficiency and accessibility and watch as it transforms education in the future by implementing appropriate educational standards, utilizing cutting-edge technology, and tackling moral concerns.
This study aims to investigate how e-learning may be enhanced by integrating AI instructor, student, and platform data into e-learning.

The Impact of a Web Platform with Motivational Elements on Student Engagement in the Learning Process

Nikolay Nikolov *University of Economics Varna, BG*

Abstract: This study examines the impact of a web-based learning platform with motivational elements on student engagement. Conducted over three years (2022-2024) with students from the same specialty, the research analyzes assignment submission rates and student motivation. The platform features a credit system, resource unlocking, progress tracking, and real-time instructor interaction to enhance learning. Results show a significant increase in completed assignments

and student engagement in 2024 compared to previous years. Surveys indicate that students found the platform motivational, particularly appreciating the credit system. The findings suggest that such platforms can effectively boost student engagement and motivation. The study highlights the need for modern educational methods to improve academic outcomes.

SESSION B13 "AI APPLICATION IN HEALTH CARE"	**Stream 2**
Chairman: Tanya Pencheva	Institute of Biophysics and Biomedical Engineering BG
Saturday, October 12th 14:00 – 15:30	Online

Methods and Applications of Artificial Intelligence In Mental Health Care

Vitali Atias — *University of Plovdiv "Paisii Hilendarski", BG*

Katerina Atias — *University of Plovdiv "Paisii Hilendarski", BG*

Abstract: Mental disorders affect one in eight individuals globally, but access to professional assistance and necessary information is often limited. Artificial intelligence (AI) technology has the potential to revolutionize mental health care. This paper aims to provide a theoretical overview of the recent application of AI in the field of mental health. A non-systematic review of studies from the last decade, focusing on recent findings, was conducted. The paper summarizes the commonly used machine learning (ML) techniques include Support Vector Machines (SVMs), followed by Random Forest (RF), Naïve Bayes (NB), Logistic Regression (LR), and K-nearest neighbors (KNN) for prediction and diagnosis, research, and classification. Among Deep learning (DL) techniques, the most frequently applied are Convolutional Neural Network (CNN), Recurrent Neural Networks (RNN), and hybrid DL models for prediction, diagnosis, screening, and research. Natural Language Processing (NLP), wearable artificial intelligence, and AI-based Virtual Reality (VR) are also applied for monitoring, treatment, prediction, and research. Most of the current attention is centered around depression, anxiety, and mental health problems in general. Although AI-based applications claim to improve wellbeing, limited research currently supports these claims Furthermore, the paper explores the responsible implementation of AI in mental health care, considering technical, clinical, and ethical perspectives. The need for a regulatory framework for all AI solutions in mental health care is emphasized, and further research is called for to evaluate their reliability and risks. In conclusion AI application in mental health care is a delicate balancing act between optimism and caution.

Enhancing Model Robustness Using Differential Debugging in Jupyter Notebooks: A Case Study with Noisy Breast Cancer Data

Martin Vassilev — *University of Plovdiv "Paisii Hilendarski", BG*

Alexander Penev — *University of Plovdiv "Paisii Hilendarski", BG*

Abstract: Differential debugging is a powerful technique used to identify and resolve discrepancies in software behavior by comparing multiple execution traces. Jupyter Notebook, an open-source web application, has gained prominence in various fields for its interactive and user-friendly interface. Its interactive nature and ability to combine code, visualizations, and narrative text have made it a preferred tool for exploratory data analysis, machine learning, and research. This paper explores the potential of Jupyter Notebook as a platform for differential debugging for comparing the behavior of a program under different inputs or conditions to identify errors. We discuss the inherent advantages of Jupyter Notebook for differential debugging, including its interactive environment, rich visualization capabilities, and support for multiple programming languages.

Malaria Cell Classification Using CNN: A Deep Learning Approach

Nafeesath Parappurath Puthiyapurayil — *GIK Institute of Engg. Sciences &Tech, PK*
Meerah Karunanithi — *University of Europe for Applied Sciences Potsdam, DE*
Muhammad Qasim Ali — *University of Europe for Applied Sciences Potsdam, DE*
Rand Kouatly — *Berlin School of Business and Innovation, DE*
Ali Vaisifard — *University of Europe for Applied Sciences Potsdam, DE*
Ahmed Hassan — *University of Europe for Applied Sciences Potsdam, DE*

Abstract: Plasmodium malaria is a parasitic protozoan that causes malaria in humans. Computer-aided detection of Plasmodium is a research area attracting great interest. In the current paper, we speculate the results of different machine learning, neural network, and deep learning approaches to evaluate them on cell images from digital microscopy concerning the identification of Plasmodium. We use a publicly available data set that contains 27,558 individual images, half of these images contain Plasmodium and the remaining it consist of uninfected cells. Through the random split of dataset into 80-20% groups of training and testing the process was used. We perform color normalization and spatially reshape all images to a predefined size that will match chosen architecture configurations. We develop a fast CNN model to classify cells in particular cell images. Classification and ranking of algorithms for transfer learning are additionally done via the application of the existing networks, for example, AlexNet, ResNet, VGG-16 and DenseNet. On top of the bag-of-features model performance checking, we also evaluate the model with a Support Vector Machine for classification. A generalized probability trait of an image is assigned only after thoroughly evaluating the probability values given by each CNN model developed for this purpose in this paper. We have developed the algorithm with an accuracy of 96.7 % overall on the test dataset.

Classifying Human Emotions through EEG data with Machine Learning

Gaganjot Kaur *Engineering, Chandigarh University, Punjab, IN*
Meenu Gupta *Engineering, Chandigarh University, Punjab, IN*
Rakesh Kumar *Engineering, Chandigarh University, Punjab, IN*

Abstract: The Psychological and neurobiological phenomenon is called an emotion. Nowadays, using emotional engineering for the prediction of human emotions is one of the major attempts of Machine Learning (ML). However, the capability of human beings to present different expressions clashes with the emotional state of mind. Therefore, by observing physical appearance it is challenging to be able to identify a human's real emotional state. In this study, the objective is to examine the usage of machine learning techniques for an efficient emotion prediction that relies on Electroencephalography (EEG) signals. Using the Kaggle dataset that was collected through a Muse headband, five distinct ML methods are applied to classify emotions. To differentiate between different classification techniques performance metrics such as precision, recall, F1 score, support, and accuracy are used, Random Forest turned out to be the best method due to its high accuracy. Three emotions are predicted based on the results of performance metrics. This study is beneficial for mental health monitoring, neurofeedback therapy, stress management, human-computer interaction, etc. This study lays the groundwork for exploration into this field and helps in the development of more sophisticated control systems in the future.

SESSION A14 "ADVANCED MEASUREMENT APPLICATION 2" **Stream 1**

Chairman: Stanimir Stoyanov University of Plovdiv „Paisii Hilendarski", BG

Saturday, October 12th 15:30 – 17:00 Online

Emerging technologies: focus on distance learning

Boris Stoykov *Bulgarian Air Force Academy, BG*
Mariyan Apostolov *ANM-Solutions Ltd Sofia, BG*
Simeon Arnaudov *Bulgarian Air Force Academy, BG*
Nikolay Nichev *Bulgarian Air Force Academy, BG*

Abstract: Each university individually determines which technologies to use in providing educational services in a distance learning format. While the scientific literature extensively explores the topic of digitizing universities and distance education, less attention has been given to the technologies that implement various administrative services complementing distance learning in a web environment. This paper aims to examine the different services offered by universities in a distance learning format and categorize them. The results will be useful to the academic community and to the industry that provides technologies for delivering educational services in a distance learning format.

Streamlining Feedback Processes in Virtual Educational Systems

Nurassyl Kerimbayev *Al-Farabi Kazakh National University Almaty, KZ*
Aliya Akramova *Al-Farabi Kazakh National University Almaty, KZ*
Zhanat Umirzakova *Al-Farabi Kazakh National University Almaty, KZ*
Karlygash Adamova *Al-Farabi Kazakh National University Almaty, KZ*

Abstract: Currently, virtual learning is becoming more and more popular and is widely used in educational institutions. One of the important aspects of virtual learning is feedback, which plays a key role in improving the effectiveness of the educational process and supporting students. In this article, we explore various forms of feedback organization in the virtual learning system and their impact on students' academic achievements. The paper discusses written comments, evaluations, discussion forums and videoconferences as the main forms of feedback. The authors analyze the advantages and limitations of each form and discuss their impact on student motivation, engagement, and learning outcomes. The results of the study allow us to determine the most effective forms of feedback in the context of virtual learning and offer recommendations for teachers and developers of educational platforms on the effective use of feedback in order to improve the quality of the educational process in a virtual environment.

Exploring the Impact of Educational Serious Game in a Gamified LMS

Milen Sotirov *Nikola Vaptsarov Naval Academy Varna, BG*
Valentina Petrova *Nikola Vaptsarov Naval Academy Varna, BG*
Donika Nikolova-Sotirova *Nikola Vaptsarov Naval Academy Varna, BG*

Abstract: This study explores the impact of integrating gamification into Learning Management Systems (LMS) and developing educational serious games to enhance student engagement, motivation, and academic performance. By implementing game elements such as points, badges, levels, storylines, and interactive challenges within Moodle LMS and the "World of Mindcraft" educational serious game, the research aims to create a dynamic and motivating educational environment for first-year cybersecurity students at Nikola Vaptsarov Naval Academy. The findings indicate significant improvements in student motivation, engagement, and academic performance, demonstrating the potential of gamification and educational serious games to support and enhance traditional educational methods.

Learning through Gamification: A Case Study on the Development and Integration of a University Educational Serious Game

Milen Sotirov *Nikola Vaptsarov Naval Academy Varna, BG*
Valentina Petrova *Nikola Vaptsarov Naval Academy Varna, BG*

Donika Nikolova-Sotirova *Nikola Vaptsarov Naval Academy Varna, BG*

Abstract: The paper presents an approach for developing an educational serious game to enhance learning through gamification, specifically implemented for the cybersecurity students and cadets at the Nikola Vaptsarov Naval Academy. The approach involves integrating educational content with engaging, interactive elements to increase student motivation and attain significant improvements in academic performance. The authors develop and implement "World of Mindcraft" (WoM), an educational serious game that incorporates various tools, quizzes and interactive learning within a gamified Moodle LMS course. The survey indicates positive reception, engagement and learning material retention, highlighting the successful outcomes of gamified learning in higher education.

SESSION B14 "PROCESS CONTROL" **Stream 2**

Chairman: Nikola Nikolov Technical University of Varna BG

Saturday, October 12th 15:30 – 17:00 Online

Design and Development of a 3D printed gripper

Damjan Pecioski *Ss. Cyril and Methodius University of Skopje, MK*

Albion Shaipi *Ss. Cyril and Methodius University of Skopje, MK*

Dejan Shishkovski *Ss. Cyril and Methodius University of Skopje, MK*

Abstract: Robotic manipulators are essential components in industrial automation systems. The working body of the manipulator or the gripper is an indispensable manipulator component when it comes to performing tasks with precision speed and reliability. The gripper may be incorporated into the robot's overall design or added to its fundamental framework. The working environment conditions as well as the tasks that need to be completed and the objects that need to be manipulated dictate the design of the robot gripper. In this paper the authors present a low cost 3D printed robotic gripper. The gripper is designed with a detachable mount which allows for use with different robots. Having an easily fabricable and exchangeable working element allows for flexibility and adaptability in the working process.

Comparative analysis of different forms of grinding bodies and media, including innovative ones in ball mill

Miglena Paneva *Institute of Information and Communication Technologies, BG*

Peter Panev *Institute of Information and Communication Technologies, BG*

Nikolay Stoimenov *Institute of Information and Communication Technologies, BG*

Abstract: In the present work, a survey of authors on the use of different forms of grinding bodies and their scope of application is presented. Attention was paid to the innovative shape - spheroidal tetrahedron, and experiments were conducted with a laboratory ball mill with dimensions: outer diameter of the drum - 0.269 m, inner diameter of the liner - 0.228 m and length of the mill - 0.013 m. Research has been done on the interaction of grinding media - without lifters, with innovative, rectangular and trapezoidal lifters and grinding bodies - spheroidal tetrahedron at 20% filling of the ball mill. All parts of the laboratory mill and grinding bodies are made by 3D printer from Polylactic acid (PLA) material. Data from studies of already performed experiments on the same grinding media in interaction with grinding bodies-spheres at 20% and 30% filling of the mill are presented. In operation of the mill without lifters, the parameters were analyzed at critical speed and 70%, 75% and 80% of Vcr. The parameters when working with tetrahedrons and the three types of lifters were determined: the critical speeds, the shoulder angles and toe angles at two speeds - the resulting %Vcr and at the same optimal operating speed when operating the mill with spheres. A comparative analysis was made of the operating speeds (rpm) when using the two forms of grinding bodies. The data shows that when the mill is operated with a spheroidal tetrahedron, there is greater efficiency and less electricity consumption.

Methodology for Predicting and Optimizing Process Parameters and Accuracy Indicators of Complex Plastic Parts Through Virtual Prototypes

Todor Todorov — *Technical University of Sofia, BG*

Georgi Todorov — *Technical University of Sofia, BG*

Yavor Sofronov — *Technical University of Sofia, BG*

Abstract: The work presented demonstrate a methodology for workflow from concept to prototype and timely production of a product which typically involves three main stages: product design and development, processing and construction of tooling, and validation of the virtual prototype with a physical one. The focus of this study will be on the second stage of product development. The aim of the study is to emphasize the integration of virtual prototyping in creating complex plastic parts, which improves the injection molding filling analysis. Simulating the mold filling process in injection molding, particularly for creating complex plastic products with minimal defect rates, presents significant challenges. Although CAE software offers a wide range of options for optimization and filling analysis in injection molding, the complexity of the process means that a clear and well-defined methodology for studying it or for predicting and optimizing process parameters is lacking.

Rapid prototyping of process-driven applications using low-code development platforms: A case study from the Greek public sector

Marios Konstantinos Gialitakis *University of Macedonia Thessaloniki, GR*
Nikolaos Nousias *University of Macedonia Thessaloniki, GR*
George Tsakalidis *University of Macedonia Thessaloniki, GR*
Kostas Vergidis *University of Macedonia Thessaloniki, GR*

Abstract: This paper investigates the feasibility of rapid prototyping for process-driven applications using Low-Code Development Platforms (LCDPs). The authors analyze various LCDPs and their key features such as drag-and-drop UI development, process modeling with BPMN, and data manipulation capabilities. The paper proposes a development methodology that leverages BPMN for process modeling and integrates it with a LCDP for rapid application development. The process models are used to guide the development process including the database creation, UI development, and code writing (PL/SQL). To demonstrate the effectiveness of the approach, the authors implement a real-world public service application. The selected process involves a citizen submitting a request and supporting documents, followed by validation and potential compensation by a government agency. The proposed approach details the conversion of the public service process to an executable BPMN model and its subsequent implementation, including database design, webpage development, and code writing. The results suggest that LCDPs with BPMN support can enable rapid development of process-driven applications compared to traditional coding methods. Additionally, using BPMN for process modeling streamlines the design phase and facilitates parallel development and testing. While acknowledging limitations like the need for further development process refinement, the authors conclude that the proposed methodology offers a promising approach for rapid prototyping of process-driven applications using LCDPs.

Letter codes of the countries

where ICAI 2024 participants are from:

BG - Bulgaria
CN - China
DE - Germany
FR - France
GR - Greece
IE - Ireland
ID - Indonesia
IN - India
KG - Kyrgyzstan
KZ - Kazakhstan
MK - North Macedonia
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