# **ABSTRACTS OF ICCCC 2022 PAPERS**

# 2022 9TH INTERNATIONAL CONFERENCE ON COMPUTERS COMMUNICATIONS AND CONTROL ICCCC 2022

Felix & Oradea, Romania, May 16-20, 2022



# 2022 9<sup>th</sup> International Conference on Computers Communications and Control (ICCCC)

http://univagora.ro/en/icccc2022/

# Home

### Place: <u>Hotel President</u> (4 stars, aqua-park, spa), Băile Felix, Oradea, România Period: May 16-20, 2022

**Organizers:** Cercetare Dezvoltare Agora (Research & Development Center of Agora University), Agora University of Oradea under the aegis of the <u>Romanian Academy</u>- Information Science and Technology Section.

**Partners:** Springer (Advances in Intelligent Systems and Computing *Series*), Association Cluster of Scientific Research, Innovation and European Studies from Oradea.

### Dedication:

This edition is dedicated in memory of Prof. Univ. Dr. Habil. Dziţac Ioan – founder of the International Conference on Computers Communications and Control (ICCCC).

On this occasion, the Dziţac Family (wife Simona & daughter Domnica) will award the "Ioan Dziţac Prize" worth 500 EUR for the most appreciated scientific paper presented at ICCCC 2022 by a promising young researcher.



Photo Ioan Dziţac (14.02.1953 – 06.02.2021)

**Post Conference Proceedings** will be published by Springer ("Advances in Intelligent Systems and Computing" Series) - Intelligent Methods Systems and Applications in Computing, Communications and Control - 9<sup>th</sup> International Conference on Computers Communications and Control (ICCCC) 2022.

The editorial team of the International Journal of Computers Communications & Control (IJCCC) will award prizes (vouchers) consisting in the free publication in IJCCC of the most valuable 10% papers accepted / presented at ICCCC2022.

On the occasion of ICCCC 2022, the title of Doctor Honoris Causa of the Agora University of Oradea will be awarded to Professor Enrique Hererra - Viedma from the University of Granada, Spain, and the title of Professor Honoris Causa of the Agora University of Oradea will be awarded to Professor Gastón Lefranc H. from the Pontificia Universidad Católica de Valparaíso, Chile.

# Scope

**The International Conference on Computers Communications and Control (ICCCC)** has been founded in 2006 by <u>I. Dzitac, F.G. Filip</u> and <u>M.-J. Manolescu</u> and organized every even year by <u>Agora</u> <u>University of Oradea</u>, under the aegis of the <u>Information Science and Technology Section</u> of Romanian Academy.

The goal of this conference is to bring together international researchers, scientists in academia and industry to present and discuss in a friendly environment their latest research findings on a broad array of topics in computer networking and control.

The Program Committee is soliciting paper describing original, previously unpublished, completed research, not currently under review by another conference or journal, addressing stateof-the-art research and development in all areas related to computer networking and control.

Proceedings of ICCCC2022 will be published by Springer ("Advances in Intelligent Systems and Computing" Series) - Intelligent Methods Systems and Applications in Computing, Communications and Control - 9th International Conference on Computers Communications and Control (ICCCC) 2022, *Editors:* S. Dzitac, D. Dzitac, F.G. Filip, J. Kacprzyk, M.J. Manolescu, H. Oros.

# Topics

Chapter 1. Integrated Solutions in Computer-Based Control;

- Chapter 2. Advanced Control Systems Integrating Computers and Communications;
- Chapter 3. Soft Computing Including Fuzzy System Approach;
- Chapter 4. Decision Making and Support Systems;

Chapter 5. Trustworthy & Green Design.

# Chairs and Committees

# **General Chair**



Assoc. prof. Simona DZITAC - General Chair (Oradea, Romania) University of Oradea / Software System Engineer & Researcher at R&D Agora, simona@dzitac.ro, rd.agora@univagora.ro

**Dr. Simona Dzitac** is an Associate Professor at Energy Engineering Department, Faculty of Energy Engineering and Industrial Management, University of Oradea, Romania and Software System Engineer & Researcher at R&D Agora. She received her B.Sc. in Mathematics (2000), Energy Engineering (2005), Economic Informatics (2007) and PhD in Energy Engineering (2008). Her current research interests include different aspects of reliability, modelling, simulation, quality management, IT management. She has published 11 books/courses and materials for students and more than 120 scientific papers in journals and conferences proceedings. Her research activity includes participation in 42 grants/projects. The impact of her published works are over 370 citations and h-index 11 in ISI Web of Science.

# **Program Committee Chair**



Acad. Florin Gheorghe FILIP - Program Committee Chair (Bucuresti, Romania) President of "Information Science and Technology" Section of Romanian Academy, Romania, <u>ffilip@acad.ro</u>

**Acad. Florin Gheorghe Filip** was born in 1947 in Bucharest, Romania. He graduated in *Control Engineering* at Technical University of Bucharest in 1970 and received his PhD degree from the same university in 1982. He was elected as corresponding member of the Romanian Academy in 1991 and became full member of the Academy in 1999. During 2000-2010, he was vice-president of the Romanian Academy (elected in 2000, re-elected in 2004, and 2006). In 2010, he was elected president of the *Information Science and Technology* section of the Academy (re-elected in 2015, and 2019). He was the managing director of National Institute for R&D in Informatics-ICI Bucharest (1991-1997). He is honorary member of the Romanian Academy of Technical Sciences, and Academy of Sciences of Republic of Moldova. He was the chair of IFAC TC 5.4 (Large-scale Complex Systems) from 2002 to 2008. His main scientific interests include optimization and control of large-scale

complex/collaborative systems, decision support systems, technology management and foresight, and IT applications in the cultural sector. He authored/co-authored over 350 papers published in international journals (IFAC J Automatica, IFAC J Control Engineering Practice, Annual Reviews in Control, Computers in Industry, Large-Scale Systems, Technological and Economic Development of Economy, and so on) and contributed to volumes printed by international publishing houses (Pergamon Press, Elsevier, Kluwer, Chapman & Hall and so on). He is also the author/co-author of thirteen monographs (published by Editura Tehnică, Hermès-Lavoisier, J. Wiley & Sons, Springer) and editor/co-editor of 30 volumes of contributions (published by Editura Academiei Române, Pergamon Press, North Holland, Elsevier, IEEE Computer Society, and so on). He presented invited lectures in universities and research institutes, and plenary papers at scientific conferences in Brazil, Chile, China, France, Germany, Lithuania, Poland, Portugal, Republic of Moldova, Romania, Spain, Sweden, Tunisia, and UK. More details can be found at:

http://www.academiaromana.ro/sectii/sectia14\_informatica/sti\_FFilip.htm

# **Organizing Committee Chairs**



**Prof. Misu-Jan MANOLESCU - Organizing Committee Chair (Oradea, Romania)** President of Agora University of Oradea, Romania, <u>mmj@univagora.ro</u>

**Prof. Misu-Jan Manolescu** is a Professor of Risk Management and President of Administration Council of Agora University. He is an Engineer, PhD in Energy Engineering, PhD in Management, president of Agora Foundation, Founder of Agora University and co-founder and Managing Editor of International Journal of Computers Communications & Control and co-founder of International Conference Computers Communications & Control.

His publications and research results consist in 10 books, over 60 papers and 2 inventions.



Domnica DZITAC - Organizing Committee Chair (Abu Dhabi, UAE) Technical and Operational Coordinator of the <u>Social Science Experimental Laboratory</u> at <u>New York</u> <u>University Abu Dhabi</u>, <u>domnica.dzitac@nyu.edu</u>

**Domnica Dzitac** is a fresh graduate from New York University Abu Dhabi from where she obtained a degree in Computer Science with concentrations in Applied Mathematics and Political Science.

Domnica conducted meaningful research and studied in global locations such as Abu Dhabi (UAE), Paris (France), Washington D.C. (USA) and New York City (USA). Her research interests consist of applying computational tools to answer questions about human behavior, contributing to fields such as Computational Social Science, Natural Language Understanding, Machine Learning, Data Science and Behavioural Economics.

# **Publication Chairs**



Acad. Janusz KACPRZYK - Publication Chair, Poland Polish Academy of Sciences, Poland, <u>kacprzyk@ibspan.waw.pl</u>

Janusz Kacprzyk is Professor of Computer Science at the Systems Research Institute, Polish Academy of Sciences, WIT – Warsaw School of Information Technology, and Chongqing Three Gorges University, Wanzhou, Chongqing, China, and Professor of Automatic Control at PIAP – Industrial Institute of Automation and Measurements in Warsaw, Poland. He is Honorary Foreign Professor at the Department of Mathematics, Yli Normal University, Xinjiang, China. He is Full Member of the Polish Academy of Sciences, Member of Academia Europaea, European Academy of Sciences and Arts, European Academy of Sciences, Foreign Member of the: Bulgarian Academy of Sciences, Spanish Royal Academy of Economic and Financial Sciences (RACEF), Finnish Society of Sciences and Letters, Flemish Royal Academy of Belgium of Sciences and the Arts (KVAB), National Academy of Sciences of Ukraine and Lithuanian Academy of Sciences. He was awarded with 6 honorary doctorates. He is Fellow of IEEE, IET, IFSA, EurAI, IFIP, AAIA, I2CICC, and SMIA.

His main research interests include the use of modern computation computational and artificial intelligence tools, notably fuzzy logic, in systems science, decision making, optimization, control, data analysis and data mining, with applications in mobile robotics, systems modeling, ICT etc.

He authored 7 books, (co)edited more than 150 volumes, (co)authored more than 650 papers, including ca. 150 in journals indexed by the WoS. He is listed in 2020 and 2021 "World's 2% Top Scientists" by Stanford University, Elsevier (Scopus) and ScieTech Strategies and published in PLOS Biology Journal.

He is the editor in chief of 8 book series at Springer, and of 2 journals, and is on the editorial boards of ca. 40 journals. He is President of the Polish Operational and Systems Research Society and Past President of International Fuzzy Systems Association.



Lecturer Horea OROS - Publication Chair (Oradea, Romania) University of Oradea, Romania, <u>horea.oros@gmail.com</u>

**Horea Oros** (b. August 22, 1977) received his PhD in Computer Science (2009) from "Babeş Bolyai" University of Cluj-Napoca, Romania. Since 2001 he is working within the Department of Mathematics

and Computer Science, Faculty of Informatics and Sciences, University of Oradea, Romania, where currently he is a lecturer. He also was a former lecturer at Agora University of Oradea for several years. He co-authored five books in the field of computer science and published twenty-one articles in several journals and proceedings of international conferences. His main research interest is in the field of cryptology and computer security.

# Keynote speakers at ICCCC 2022 (in alphabetical order)

- 1. Acad. Gintautas DZEMYDA (Vilnius, Lithuania),
- 2. Prof. Enrique HERERRA-VIEDMA (Granada, Spain),
- 3. Acad. Janusz KACPRZYK (Warsaw, Poland),
- 4. Prof. Gaston LEFRANC (Chile).

# **Invited speakers at ICCCC 2022 (in alphabetical order)**

- 1. Prof. Razvan ANDONIE (Ellensburg, USA),
- 2. Prof. Valentina BALAS (Arad, Romania),
- 3. Prof. Valeriu BEIU (Arad, Romania),
- 4. Prof. Alfred BRUCKSTEIN (Haifa, Israel),
- 5. Prof. Yezid DONOSO (Bogota, Colombia).

# **Program Committee**

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- Stephan OLARIU, Old Dominion University, USA
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- Radu-Emil PRECUP, Politehnica University of Timisoara, Romania (Senior Member of IEEE)
- Imre J. RUDAS, Óbuda University, Hungary (Member of IEEE)
- Yong SHI, University of Chinese Academy of Sciencies
- Milan STANOJEVIC, University of Belgrad, Serbia
- Codruța STOICA, "Aurel Vlaicu" University of Arad, Romania
- Athanasios D. STYLIADIS, Kavala Institute of Technology, Greece
- Ioan Alexandru ŞUCAN, Google [x] , USA
- Gheorghe TECUCI, George Mason University, USA (Full Member of Romanian Academy)
- Horia-Nicolai TEODORESCU, Technical Univ. Gh. Asachi Iasi, Romania (Full Member of Romanian Academy)
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# **ABSTRACTS OF KEYNOTE LECTURES**

### Keynote speaker

Gintautas DZEMYDA Lithuanian Academy of Sciences, Vilnius University, Lithuania



Enrique HERERRA-VIEDMA University of Granada, Spain



### Title & Abstract

Geometric Multidimensional Scaling: A New Approach for Data Dimensionality Reduction

Abstract: Real-life applications often deal with multidimensional data. Multidimensional scaling (MDS) is an often-used method to reduce the dimensionality of multidimensional data nonlinearly and to present the data visually. MDS minimizes some stress function which variables are coordinates of points in the projected lowerdimensional space. We have proposed to consider the stress function and multidimensional scaling, in general, from the geometric point of view, and the so-called Geometric MDS has been developed. It is proved that using ideas of Geometric MDS, it is possible to construct the iterative procedure of minimization of the stress where coordinates of a separate point of the projected space are moved to the new position defined analytically. In Geometric MDS, the step size and direction forward the minimum of the stress function are found analytically for a separate point or all the points at once in a projected space without reference to the analytical expression of the stress function, numerical evaluation of its derivatives and the linear search. It is proved theoretically that the direction coincides with the steepest descent direction, and the analytically found step size guarantees almost the optimal step in this direction. Despite the fact that the Geometric MDS uses the simplest (raw) stress function, there is no need for its normalization depending on the number of data points, the scales of features and proximities. These advantages allow the Geometric MDS to become the main realization of MDS. The obtained results allow us to extend the understanding of properties and ideas of Geometric MDS for the future development of a class of new both sequential and parallel algorithms, including global optimization. In addition to introducing Geometric MDS, the presentation also provides an overview of other strategies for multidimensional data visualisation. This research has received funding from the Research Council of Lithuania (LMTLT), agreement No S-MIP-20-19.

# On Fuzzy and Linguistic Decision-Making: Scenarios and Challenges (Reception Speech)

**Abstract:** This talk takes a brief tour through the main trends, studies, methodologies and models developed around the field of fuzzy decision-making in the last decades. Fuzzy decision making approaches allow to deal with real-world decision problems of varying complexity where humans exhibit vagueness and imprecision to assess information about decision alternatives, criteria, etc. Specifically, we address a triple goal in this talk. Firstly, we introduce the main representation paradigms that have arisen from fuzzy set theory to model assessment information at different levels of expressive richness and complexity.

Secondly, we examine three core scenarios around which fuzzy decision-making methods have been developed: multi-criteria decision-making, group (and consensus-driven) decision-making, and multi-person multi-criteria decision-making. Lastly, we discuss

Janusz KACPRZYK Polish Academy of Sciences, Poland



new complex decision-making scenarios that emerged in recent years where decisions should be guided by the "wisdom of the crowd", highlighting their challenges and reflecting on much needed key guidelines for future research in the field.

Al-enabled decision support systems: an effective and efficient solution for complex problems

**Abstract:** As the complexity of our world grows, decision making problems – which are the crux of virtually all human activities – get more and more complicated with more and more stakeholders, much uncertain, imprecise and lacking information, and an explict human centricity in the sense of a crucial role of the human being in the decision process. This implies that the inherent human decision making abilities alone are not enough to find a good decision.

A more effective and efficient setting, at least for the foreseeeable future, is to assume the human being to still be the decisive stakeholder in nontrivial decision processes though he/she should not be replaced but be aided or supported by some additional "units", humans (e.g. advisors) or "machines" (e.g. algorithms and computer systems). In this respect, the first obvious option is that the human decision maker, who knows about the domain of his activities but not necessarily about solution tools, be aided by a domain expert who knows solution tools but not necessarily the domain. This gives rise to, e.g., a judge-advisor type approaches. In their new versions they can be augmented by some AI (artificial intelligence) tools and techniques, notably machine learning models which can help find patterns and relationships in bigger and bigger data sets. A consistency of the AI models employed with some inherent human characteristics, notably the cognitive biases, is here crucial as is a collaborative partnership between the human being and AI models and systems.

An effective and efficient implementation of the above forms of decision making in complex environments is to combine the power of the computer and the power of the humans, notably by a powerful and widely employed concept of a decision support system (DSS), notably in its data or document driven forms which best suited for handling data intensive situations and for implementing data driven approaches.

New concepts, often termed the AI-enabled DSSs, are promising the essence of which is that they heavily use tools and techniques of AI (artificial intelligence) for the gathering and analysis of data and evidence, identification and diagnosis of problems, proposing courses of actions with their analyses, etc. More specifically, machine learning, analyses and handling of uncertainties, knowledge sharing, automated inference and reasoning, multiagent and autonomous systems, etc. are employed. Since, as already mentioned, the human being is assumed to be the main stakeholder, the AI based tools and techniques to be employed that could "mimic" human cognitive capabilities, observe some inherent human characteristic features, notably cognitive biases, provide comprehensive and trustworthy procedures and forms of results, and – in general - collaborate with the human during the derivation of a decision in a synergistic, human consistent way, with a llimitation of autonomy of the system.

*Some examples on supporting decision making in socio-economic planning will be presented.* 

Gaston LEFRANC H. Pontificia Universidad Católica de Valparaíso, Chile



### Review of Trends in Manufacturing Systems based on Industry 4.0: The Opportunities (Reception Speech)

**Abstract:** The paper presents a review of current trends in Manufacturing Systems that would give developed countries opportunities to improve their economy and create jobs. This would allow creating or improving companies that would have greater efficiency, flexibility, productivity and security of the processes. These companies would produce better quality products and more profitable production. Industry 4.0 criteria are used to accelerate manufacturing automation, giving rise to a completely new business model, which facilitates product diversification. Some opportunities are presented to integrate new technologies, to improve production, and achieve more benefits.

# **ABSTRACTS OF INVITED LECTURES**

### **Invited speakers**

Razvan ANDONIE Central Washington University, USA



Valentina E. BALAS "Aurel Vlaicu" University of Arad, Romania



### **Title & Abstract**

### **Computational Semiotics in Deep Learning**

**Abstract:** Semiotics is the study of signs and sign-using behavior. Computational semiotics is an interdisciplinary field which proposes a new kind of approach to intelligent systems, where an explicit account for the notion of sign is prominent. In our work, the definition of computational semiotics refers to the application of semiotics to artificial intelligence.

Our fundamental thesis is that information concentration processes appear in successive layers of deep learning models: each layer aggregates information from the previous layer of the network. In computational semiotics, this information concentration is known as superization, and it is accompanied by a decrease of entropy: signs are aggregated into supersign. Our interdisciplinary approach enables us to depict superization processes within deep learning models. This is a novel semantic interpretation of deep learning.

We use concepts from computational semiotics to explain decision processes in deep learning. In addition, we apply semiotic tools to optimize the architecture of deep neural networks. Explainability and architecture optimization of neural models are currently among the hottest topics in machine learning.

### **Advances in Soft Computing and Applications**

**Abstract:** The presentation is focusing on soft computing methodologies used in designing of complex systems.

Nowadays computers are doing many tasks on two-digit numbers which seeks precision, certainty, and rigor by following conventional rules. But there are tasks which require natural intelligence, that are best handled by human brains. While conventional computers are suitable for handling tasks sequentially, other tasks that required natural intelligence, past experience, self-improvements, probabilistic reasoning are best handled using parallel processing. Researchers are working to mimic human brains, so in the realm of artificial intelligence emerged the field of Soft Computing. This topic was introduced by Professor Lotfi Zadeh who showed that computation, reasoning, decision making should exploit the tolerance for imprecision and uncertainty and said that soft computing techniques uses the human brain as a role model. Professor Zadeh is a legend in fuzzy logic, known as a root of Artificial Intelligence.

Soft computing represents a collection of methodologies like fuzzy logic, neural networks, genetic algorithms, that exploit the tolerance for imprecision and uncertainty to achieve robustness and low-cost solutions. Fuzzy logic and expert systems are considered good approaches to solve control problems in many applications.

We introduced methodologies and some applications in the case of different complex systems, where we provided elements of deterministic knowledge about the processes and assisted the design with simulations.

*We will also introduce some recent regulations on Artificial Intelligence.* 

### Valeriu BEIU "Aurel Vlaicu" University of Arad, Romania







### **Reflective Optics from Stars to Dust**

Magic mirror on the wall, who is the flattest one of all? Paraphrasing from "Snow White and the Seven Dwarfs"

**Abstract:** This presentation will focus on a very particular application which, although off the beaten track, is perfectly fitting for several fields: optics & photonics, precision mechanics, electronics, control & automation, as well as IT (including AI). It achieves the lowest possible tolerances and outstandingly fine positioning. The first thoughts which might come to mind when thinking about ultimate reflective optical systems most probably lead towards cutting-edge mirrors like, e.g., the ones of the Extremely Large Telescope ELT (elt.eso.org & Extremely\_Large\_Telescope), aptly known as the world's biggest eye on the sky. Still, even better optical techniques and systems have been developed and put together, which also incorporate high-power lasers. In fact, if working in reverse, one might use these to hit a golf ball on the Moon with a laser ray. The question "What is it (this) good for?" naturally comes to mind, while the unexpected answer is that such techniques (and the machines/systems relying on them) are—and will be for some time a key ingredient for making the most advanced integrated circuits. This (key ingredient) is extreme ultraviolet lithography EUV or EUVL (Extreme ultraviolet lithography) which is at the heart of transforming dust (silicon) into the most advanced few-nanometer integrated circuits powering cloud and edge computing, AI, IoT, and most probably quantum computing as well. The presentation will mention the difficult technical problems faced, go over solutions which have been discovered over the last three decades (landing the German Future Prize in Fall 2020, news/11/11/44). All of these clearly make EUV a success, but also pinpoint to a monopolistic growth potential (in the context of the expected demise of Moore's law) revealing very stringent financial constraints.

Guiding Swarms with Pheromone Gradients or Broadcast Signals

**Abstract:** Several ideas for guiding many simple agents interacting in order to form a cohesive swarm while moving in a desired direction or toward a target location will be surveyed. The assumption is that the agents are all identical and anonymous and oblivious, disoriented and cannot explicitly communicate, however they can receive broadcast signals or sense pheromones locally. Hence they cannot be individually addressed, in the guidance process. The control signals for the guidance can only influence some of them, and the agents react to them locally and thereby modify their motion parameters in some preset way.

(This presentation will be based on joint work with Yotam Elor, Ariel Barel, Rotem Manor and Ilana Segall. )

Yezid DONOSO Universidad de los Andes, Colombia



Methodologies for Solving Complex Multi-Objective Combinatorial Problems in Engineering: An Evolutionary Approach Applied to Computer Networks

**Abstract:** In real problems in Engineering, solving a problem is not enough; the solution of the problem must be the best solution possible. In other words, it is necessary to find the optimal solution. The solution is the best possible solution because in the real world this problem may have certain constraints by which the solutions found may be feasible, that is, they can be implemented in practice and, unfeasible or that they cannot be implemented. Some of these problems in engineering can be MOP (Multi-Objective Optimization Problem). A general MOP includes a set of n parameters (decision variables), a set of k objective functions and a set of m restrictions. The objective and restriction functions are functions of the decision variables where is possible to obtain a set of optimal values. Then the MOP can be expressed as:

Optimize y = f(x) = (f1(x), f2(x), ... , fk(x)) Subject to e(x) = (e1(x), e2(x), ... , em(x)) 0 Where x = (x1, x2, ... , xn) X

 $y=(y1,\,y2,\,\ldots\,,\,yk)\;Y$ 

The method evolutionary algorithm (EA) refers to searching and optimization techniques based on the evolution model proposed by Charles Darwin. Genetic algorithms are used in several areas especially for searching and optimizations. In the real case the algorithm is implemented by choosing a coding for the possible solutions to the problem. The coding is done through chains of bits, numbers or characters that represent the chromosomes. The crossing and mutation operations are applied in a very simple way through functions of vector value manipulation. The EAs are interesting given the fact that at first glance they seem especially apt to deal with the difficulties presented by MOPs. The reason for this is that they can return an entire set of solutions after a simple run and they do not have any other of the limitations of traditional techniques. In addition, some researchers have suggested that the EAs would behave better than other blind searching techniques.

## **ABSTRACTS OF ACCEPTED PAPERS**

### Authors

Luiz Fernando Capretz<sup>1</sup>, Saad Harous<sup>2</sup>, Ali Bou Nassif<sup>3</sup> <sup>1</sup>Western University, Canada <sup>2</sup> UAE University, United Arab Emirates <sup>3</sup>University of Sharjah, United Arab Emirates

Emirates

Bogdana Stanojević<sup>1</sup>, Milan Stanojević<sup>2</sup> <sup>1</sup> Mathematical Institute of the Serbian Academy of Sciences and Arts, Serbia, <sup>2</sup>University of Belgrade, Serbia

### **Title & Abstract**

# What UAE Software Students Think about Software Testing: A Replicated Study

Abstract: Software testing is vital to improve software quality. However, software tester role is stigmatized, partly due to misperception and partly due to the treatment of the testing process within the software industry. The present study analyses this situation aiming to explore what might inhibit an individual from taking up a software testing career. In order to investigate this issue, we surveyed 132 senior students pursuing degrees in information systems, information and communication technology, computer science, computer engineering, software engineering, and other closely-related disciplines at three universities in the United Arab Emirates: two publicly funded and one top-notch private university. The students were asked to describe the PROs and CONs of taking up a career in software testing and to ponder the likelihood that they would take up the career themselves. The study identified 7 main PROs and 9 main CONSs for pursuing a testing career, and indicated that the role of software tester is perceived as a social role, which may require as many soft skills as technical prowess. The results also show that UAE softwarerelated students have a stronger negative attitude towards software testing compared to their counterparts in other countries where similar investigations have been carried out in the past three years.

Extension-principle-based approach to least square fuzzy linear regression

**Abstract:** The regression method is widely used in predictive analysis. Its role is to derive an analytic estimation of the outputs expected for given inputs based on observed input-output data. The objective function that is optimized within the regression model is generally the representation of the approximation error comparing to the observed data.

Nowadays, the uncertainty is commonly taken into consideration when modeling real systems, and vectorizing information is an important aspect of addressing big data in computer science. Consequently, finding pertinent fuzzy regression models is of great importance within mathematical modeling. In this paper we report our ndings related to thefull use of the extension principle in solving the optimization model comprised in a least square fuzzy linear regression methodology. We propose a solution approach based on mathematical programming to estimate the fuzzy outputs of the observed fuzzy data; and group our experiments in two categories with respect to the crispness of the observed input data.

The rst category uses crisp input data and is considered to better explain the advantage of using the extension principle within the solution approach; while the second category, having fuzzy both input and output observed data, is included to prove the relevance of the new approach compared to methodologies from the recent literature.

### Razvan Marcus, Cosmin Rus, Monica Leba, Marius Risteiu University of Petrosani, Romania

### Electric vehicles between recycling and sustainable development - @.ro

Abstract: Even if until now electric vehicles are not 100% clean, they are becoming an increasingly viable alternative to classic transport solutions, bringing in addition new innovations designed to help within the general concept of sustainable development, especially within large urban areas. In addition to the classic transport function, through new technologies (V2V, V2G), an electric vehicle can be successfully transformed into an active tool in achieving the goals of a Smart City. This paper presents several alternatives both as an effective part of control hardware for an electric vehicle and algorithms implemented on this hardware. The special characteristics that can be implemented in an electric vehicle are highlighted by presenting the achievements of such vehicles. The original note is the conversion of a vintage off-road vehicle from Romania into an electric vehicle. It is noteworthy that many of the hardware components used in the construction of various electric vehicles are recycled so it can be said that the first step in terms of the concept of sustainable development has already been achieved. All electric vehicles designed or converted at the University of Petrosani benefit from LoRa type communications (a communication network still little used in Romania but which has proven its reliability) and are intended for use inside an urban area and can successfully fulfil the role of the platform for monitoring the air quality parameters in a certain area precisely in view of the fact that it does not pollute directly.

Ionela Samuil, Andreea Ionica, Monica Leba University of Petrosani, Romania

Algorithmic Modeling to Individualize Touristic Experience in Petrila Theme Park

**Abstract:** The perception of tourism activity has changed a lot in recent years, as a result of the innovation of services, now accessible through the Internet and smart devices. The tourist offer is of an impressive variety and the tourist is looking for personalized services. In the light of this information, it is necessary to develop a tool for automatic planning of a tourist route based on the requirements defined by a tourist in order to increase his satisfaction. The personalized planning of the tour involves the selection, from the base of information related to the destination, of the elements that correspond to the requirements of the tourist, and the configuration of the tourist route according to the selected elements. In order to achieve this goal, in this article, the personalized planning of the tourist route in the context of the industrial tourism within the proposed Petrila Theme Park, is modeled on the basis of the knapsack problem, the discreet form. Gamification elements are also introduced in the analysis to enhance the result. Thus, in the case under study, the tourist represents the knapsack, the elements to be introduced in the knapsack are represented by the characteristics that define each type of player and the constraint is given by the time that allows the player to explore the destination by buying the ticket.

Maria Georgiana Stoica Bucharest University of Economic Studies, Romania

# Smart contracts: A valuable technology in ERP e-commerce systems and for customer experience

Abstract: In the past few years, more and more e-commerce companies are progressively looking for business opportunities and ways to evolve in terms of their informatic system in such a crowded market and gain a unique customer experience to earn the client's trust. This need is exacerbated, taking into account the competition generated by the major market leaders, by constantly introducing innovations in planning the business resources, and by the results-oriented for stimulating the competition. This study theoretically systematizes how blockchain technology and smart contracts are slowly becoming a necessity in the ERP systems from the big companies that offer online shopping services, whether B2B or B2C, providing extra security for its clients. The models defined in this study highlight the technical efficiency in a resource system planning of three companies, market leaders in Romania, in terms of supply-chain, secure payments, and forecast, for comparing the costs of the change when using blockchain technology. Moreover, for a better shopping experience in online stores, the efficiency and effectiveness scores of applying these technologies to the customer review section, so that frauds are analyzed and can be significantly reduced by making in this way a secured and more reliable system. The study analysis of these aspects shows that the efficiency of minimizing frauds and improving the technology of ERP development by creating a safe and stable environment varies substantially between models and leads to a new era in ecommerce that is so needed nowadays.

German A. Montoya, Carlos Lozano-Garzon, Yezid Donoso Universidad de Los Andes, Colombia

A Stochastic Mobility Prediction Algorithm for finding Delay and Energy Efficient Routing Paths considering Movement Patterns in Mobile IoT Networks

Abstract: In Mobile IoT Networks, the network nodes are constantly moving in a field, causing interruptions in the communication paths and, thus, generating long delays at the time of building a communication path from a source IoT node to the gateway (destination node). Communication interruptions affect the delay performance in delay-sensitive applications such as health and military scenarios. In addition, these IoT nodes are equipped with batteries, whereby it is also necessary to accomplish energy consumption requirements. In summary, a gateway node should not receive messages or packets coming from the IoT nodes with undesired delays, whereby it is pertinent to propose new algorithms or techniques for minimizing the delay and energy consumption experimented in the IoT network. Due to IoT nodes are attached to humans, animals or objects, they present a specific movement pattern that can be analyzed to improve the path-building with the aim of reducing the end-to-end delay. Therefore, we propose the usage of a mobility prediction technique based on a Stochastic Model to predict nodes' positions in order to obtain minimum cost paths in terms of energy consumption and delay in mobile IoT networks. Our stochastic model is tunned and evaluated under the Markov-Gauss mobility model, considering different levels of movement randomness in order to test how the capability prediction of our proposal can impact the delay and energy consumption in mobile IoT networks in comparison with others routing algorithms.

Smaranda Belciug,
Renato Constantin
Ivanescu
University of Craiova,
Romania

# Non-parametric rank correlation trained single-hidden layer feedforward neural networks for medical data

Abstract: Massive amounts of medical data led to a faster, more accurate diagnosis and course of treatment for cancer. Machine learning (ML) algorithms have been developed increasingly in order to process medical data. By embedding knowledge from data into the algorithm's architecture we customize MLs to provide personalized diagnosis and personalized treatment plan. The goal of this study is to statistically analyze non-parametric correlation coefficients for initializing the inputhidden weight matrix of three single hidden layer feedforward neural networks (SLFNs). A SLFN is able to approximate a continuous function given a training dataset as input for a desired output. Using different nonparametric correlation coefficients,  $\rho$ ,  $\tau$ , , and  $\Upsilon$ , we developed three novel SLFNs that have their input hidden layer weight matrix initialized using the above-mentioned correlation coefficients computed between the input and the output. The matrix that contains the hidden output weights is computed in just one step, using the Moore-Penrose pseudoinverse matrix. A statistical analysis is performed for assessing the models' results when applied on three medical datasets that regard differentiating lung, breast, and liver cancer. The statistical benchmarking showed that the p-SLFN is superior to the other two. All three models were overall competitive to other state-of-the-art algorithms.

Fuad Aleskerov<sup>1,2</sup>, Sergey Demin<sup>1,2</sup>, Alexey Myachin<sup>1,2</sup>, Vyacheslav Yakuba<sup>1,2</sup> <sup>1</sup> HSE University, <sup>2</sup> Institute of Control Science of Russian Academy of Science, Russia

Victorita Radulescu University Politehnica of Bucharest, Romania Short-Term Covid-19 Incidence Prediction in Countries Using Clustering and Regression Analysis

**Abstract:** As of February 07, 2022, more than 395 million cases of COVID-19 had been identified in the world, with 5.74 million deaths. The paper considers methodology for predicting the number of cases in the short term using a prelim-inary assessment of countries based on three indicators: expert assessments of the law-abiding population, the level of education and restrictive measures taken in the country. The description and composition of the groups obtained are given. An assessment of the accuracy of the forecast results is made. A comparison of the considered models of 2020 with 2022 is given.

Fuzzy Logic Applied in Hierarchical Secondary Regulation Voltage-Reactive Power

**Abstract:** Hierarchical regulation between voltage and reactive power in electricity supply systems is proposed, in the current conditions of the liberalization of the internal energy market and of the permanent international trades. In Romania there are several electricity transmission and distribution companies, usually zonal, each with a specific approach to this regulation.

There is also a problem with the overloaded power lines in different areas, for certain distribution nodes, especially in the transition zones from one company to another. The regulation between voltage and reactive power is absolutely necessary both in normal operation but especially in emergency mode, when it is necessary to ensure the supply of as many consumers as possible, in a short time. The focus is on secondary regulation, using Fuzzy Logic by managing complex control space in a modern way. This adjustment allows to change the voltage of the generators in the control zone, when there is a variation of the voltage in

	the pilot node, as a result of the variation of the reactive power consumption in that area. The Fuzzy model is numerically tested for the monofilament diagrams of the developed Power Test line. Some of the numerical results obtained are finally presented.
Claudio J. Macuada, Astrid M. Oddershede Luis F	Decision support model for raw water availability for purification in a region in Chile
Quezada, Pedro I. Palominos University of Santiago of Chile, Chile	<b>Abstract:</b> This article proposes a decision model to identify the most sustainable solution(s) to ensure the availability of raw water to be subsequently treated to be converted into drinking water as a consequence of the climate change scenario, particularly the drought currently experienced by the Metropolitan Region in Chile, derived from the technical and regulatory requirements associated with the availability of water resources from its capture to its drinkability to meet the fu-ture demand of the region. From the perspective of drought, the solution must provide security levels that guarantee the availability of raw water is one of the main concerns of the stakeholders. In turn, the need to adapt current regulations regarding raw water sources, as well as community acceptance of some proposals for converting raw water into potable water and climate dependency, involve qualitative as well as technical aspects that may affect the investment and operating costs of the different solutions required to ensure raw water availability. Therefore, through a multi-criteria approach, it is possible to incorporate quantifiable and intangible aspects and to address conflicting objectives. Through a case study, we present a decision model based on the Analytic Hierarchy Process to define and evaluate the most sustainable solution(s) to secure raw water for drinking. This study proposes to integrate technical and qualitative attributes to identify the challenging criteria and the associated linkage to the problem of selecting proposals for the most sustainable solution(s) to secure raw water, being a guide to decide the
	implementation of the most appropriate solution.
Alexandra-Iulia	Linear and nonlinear observers developed for direct current electric
Radu-Emil Precup.	urve systems
Raul-Cristian Roman	Abstract: act. This paper suggests four estimation approaches, namely
Politehnica University	two linear and two nonlinear ones: Extended Luenberger State Observer
of Timisoara, Romania	(ELSO), Kalman Filter Observer (KFO), Extended Kalman Filter Observer (EKFO) and Sliding Mode Observer (SMO), for electric drive systems (EDSs) with direct current (DC) motor. The application considered in this paper is a simple mechanism, a mechatronic system that does not require complex hardware and also exhibits attractive features such as high efficiency, low manufacturing cost, simple construction and operation and linear torque- speed characteristics. The performance and the efficiency of the four estimation approaches are validated through results obtained by digital simulation. To better highlight the performance, a comparative study of all four estimation approaches is performed considering the values for the mean square error (MSE) regarding two simulation scenarios – step reference input and staircase reference input – obtained for two state variables. The results show that all these estimation approaches work efficiently for such types of processes.

Radulescu, Marius Provider selection	
Radulescu, Radu	
Boncea Abstract: In the last decades multi-criteria methods have	known an
National Institute for important development and their area of application was	significantly
Research and enlarged. Multi-criteria methods are used for making de	cisions that
Development in involve multiple and conflicting criteria. These methods consi	der a set of
Informatics, alternatives and a set of criteria. Each alternative is evaluate	d according
Romania to each criterion. As a result, a best alternative or an alternat	ives ranking
is obtained. The selection of the appropriate multi-criteria m	ethod, for a
decision, is an important problem. Two classical multi-criteria r	nethods are
TOPSIS and VIKOR, which have been proven effective throu	ugh a large
number of applications. Sometimes the two methods give	ve different
solutions regarding the alternatives ranking when they are st	arting from
the same input data. In this paper we propose a new method	od that is a
combination of these two methods. The combined VIKOR-TOP	SIS method,
is applied to evaluate and ranking a set of CSP (Cloud Service F	Provider) for
selecting a best CSP, taking into account the user require	ements and
Quality of Service (QoS) criteria.	
Victorita Radulescu Modeling with Fuzzy Logic the Impact of Power Line	es on the
University Politehnica Environment	
of Bucharest,	
Romania Abstract: Recently in Romania, due to the development of	new power
plants based on renewable sources, there is the problem of	developing
surface power grids. In their realization, an increasing importa	nce is given
on the impact induced by them on the environment, bio	logical and
economical life. The ground electric field, the induced of	urrent, the
magnetic field and the noise produced affect the area over	quite large
distances. The effect on the environment produced by the	power lines
cannot be separated from the economic aspect regarding th	ie alstances
required in their realization associated with the costs of maint	
two major aspects, of economic and environmental nature.	ween these
two mujor uspects, of economic und environmental impact i	maget over
agriculture, visual impact, accupied grads for new reads of	inpuct over
constructions, population health, land animal life, migrator	, hird flight
routes TV and radio recention signals, etc. A multi-sriteria mo	al based on
some Fuzzy inequalities is used to solve the problem. The value	er buseu on
the electric and magnetic field are compared with the values	ohtained hv
numerical modeling and the fuzzy parameters are corrected	obtained by
Study is presented a network from the Project 138- Black S	ea Corridor
400 kV suspended nower lines - LEA Smardan – Gutinas. The L	itilization of
this method allows a higher degree of flexibility than the class	ic solutions.
easier to adapt in different concrete cases.	,
Oianli Zhou <sup>1</sup> . Fuzzy Fractal: An Information Entropy View <sup>*</sup>	
Chenhui Qiang <sup>1,2</sup> ,	
Yong Deng <sup>1,3,4,5</sup> Abstract: We model intuitionistic fuzzy sets (IFS) by Dem	oster-Shafer
<sup>1</sup> Institute of theory, and use belief entropy to give a new intuitionistic fuz.	zy measure.
Fundamental and Combining the Shannon entropy measure of fuzzy sets (F	S) and the
Frontier Science, proposed IFS measure, we explore the fractal features of FS a	nd IFS from
University of the perspective of information entropy. Besides, we give	e the fuzzy
Electronic Science information fractal dimension according to the growth rate of	normalized
and information entropy of the joint distributions.	

Technology of China, <sup>2</sup> Yingcai Honors	
College, University of	
Electronic Science	
and Technoloav of	
China China	
<sup>3</sup> School of Education	
School of Luucution	
Shaanxi Normai	
University,	
* School of	
Knowledge Science,	
Japan	
<sup>5</sup> ETH Zurich,	
Switzerland	
Jixiang Deng <sup>1</sup> , Yong	IV-FEC: Information Volume-Based Fuzzy Evidential Classifier *
Deng <sup>1,2,3,4</sup>	
<sup>1</sup> Institute of	Abstract: Classification based on fuzzy set theory and evidence theory has
Fundamental and	attracted much attention. However, traditional fuzzy classifiers and
Frontier Science	evidential classifiers may encounter two issues when facina data with high
University of	uncertainty. For one thing, the knowledge represented by the classifier
Electronic Science	may be in conflict, making classification difficult. For the other thing, most
and	classifiers only consider one type of uncertainty. Hence, in this namer
Tachnology of Ching	information volume-based fuzzy evidential classifier (IV-FEC) is proposed
China	by considering both the fuzziness and the total uncertainty (TII) of the
25 chool of Education	classification problem IV-EEC incorporates fuzzy information volume (EIV)
School of Education	and ovidential information volume (EIV) for conflict management under
Shaanxi Normai	the different types of uncertainty. EN/ and EN/ respectively estimate the
University,	the dijjerent types of uncertainty. Fix and Eix respectively estimate the
School of Knowledge	juzziness of the Gaussian membership degree of the samples and the To
Science, Japan	Jor each altribute. An Fiv and Eiv-based alscounting technique is utilized
* ETH Zurich,	to moalfy the mass functions in order to manage conflicts in evidence
Switzerland	combination and improve classification performance. The proposed IV-FEC
	is applied in target classification and verified based on several
	experiments. The results show that IV-FEC has a better classification
	accuracy compared with the existing models.
Sergey Shvydun	The Impact of COVID-19 on the Air Transportation Network
<sup>1</sup> National Research	
University Higher	Abstract: The COVID-19 pandemic have changed our lives and caused
School of Economics,	severe social, economic and environmental disruption worldwide. This
Russia,	paper examines the impact of coronavirus outbreak and subsequent wave
<sup>2</sup> V.A. Trapeznikov	of lockdowns and travel restrictions on air transportation from the
Institute of Control	network perspective. Using the air traffic data from 2019 to 2021, we
Sciences of Russian	examine how the structure of the network has changed both globally and
Academy of Science.	locally. We quantify the similarity of air transportation network for
Russia	adjacent years and compare it to the pre-pandemic period. The
	connectivity configuration of countries is also considered. Finally, we
	identify the most important participants of the air transportation industry
	and reveal countries with the largest change of centrality during the
	pandemic.
Eabián Barralos <sup>1</sup>	Elevibility in Organizational Design A Desision Making Guida
Claudia Duran <sup>2</sup> Diogo	HEADING IN Organizational Design A Decision Making Guide
Euontoolbo <sup>3</sup> and David	Abstract: Global changes have influenced organizations generating
	uncertainty in economic, social, environmental and technological
	decisionmakina. To face this situation, it has been necessary to
-Oniversidad de	incorporate increasingly the concept of flexibility in the organizational

Santiago de Chile, Chile <sup>2</sup> Universidad Tecnológica Metropolitana, Chile <sup>3</sup> Universidad Tecnológica Metropolitana, Chile <sup>4</sup> Universidad de Las Americas, Santiago Chile	structure of companies. In the present work through a review of the scientific literature of the last 30 years, the key factors related to the new trends, models and areas of application showing as evolved the design and organizational structure is evolved. Successful cases are studied, results and conclusions are delivered.
Nadaban Sorin, Deac Dan "Aurel Vlaicu" University of Arad, Romania	Nonstandard Fuzzy Sets : A General View Abstract: Nonstandard fuzzy sets are extensions, generalizations of fuzzy sets introduced by Zadeh. They represent a research domain of great interest due to the multiple applications in ambiguity situations and in problems with incomplete information. We make a systematic review of these types of fuzzy sets in order to provide a framework for new research in this field, to strengthen the available theoretical results, to establish the relations among them as well as their various applications
Francisco Sepúlveda-	Boosting data management using artificial neural networks
Ortiz <sup>1</sup> , Claudia Duran <sup>1</sup> , Diego Fuentealba <sup>1</sup> , Manuel Vargas <sup>2</sup> ,Raúl Carrasco <sup>3</sup> <sup>1</sup> Universidad Tecnológica Metropolitana, Chile <sup>2</sup> Universidad de Santiago de Chile, <sup>3</sup> Universidad de Las Américas, Santiago, Chile	<b>Abstract:</b> The present work promotes the study of artificial neural networks (ANN) in the management of data from logistics chains. The main aspects and advantages of applying this technology to business are reviewed. Through a literature review, the business domains, models, algorithms and benefits of ANN forecasting are determined. A case study is generated with historical data to predict with ANN the flow of cargo moving by land and sea transport during the year 2020. The results are analyzed and when compared with the company's actual data and the least squares method, they show greater efficiency when using ANN.Finally, conclusions are drawn on the advantages of incorporating this technology in a public company and the need to generate more research in this area to reduce costs, increase process efficiency and improve decision making.
Attila Simo <sup>1</sup> , Simona Dzitac <sup>2</sup> <sup>1</sup> Politehnica University Timisoara, <sup>2</sup> University of Oradea, Romania	<b>Energy-Efficient Wireless Sensor Networks for Greenhouse Management</b> <b>Abstract:</b> Agriculture plays a crucial role in the economy of the country. The agricultural industry is getting more data-centric and requires precise, more advanced data and technologies than before, despite being familiar with agricultural processes. The agriculture industry is being advanced by various information and advanced communication technologies, such as the Internet of Things (IoT). Development and deployment of sensing technologies is one of the main steps in achieving sustainability in crop production through precision agriculture. The energy crisis will further accelerate this digitization process. The energy crisis will accelerate this digitization process even more, but at the same time it will help farmers consume energy more responsibly. To optimize electrical energy consumption, farmers need monitoring devices. In this paper the authors propose a low-cost, low-power, long range monitoring device development. The results obtained show the usefulness of such a monitoring device.

Simona Dzitac<sup>1</sup>, Adrian Cheregi<sup>1</sup>, Daniel Alexuță<sup>2</sup>, Attila Simo<sup>3</sup>, Badea Gabriela Elena<sup>1</sup> <sup>1</sup> University of Oradea, Romania <sup>2</sup>"Aurel Vlaicu" University of Arad, Romania <sup>3</sup> Politehnica University Timisoara, Romania

Víctor Lomas-Barrie<sup>1</sup>, Mario Peña-Cabrera<sup>1</sup>, Mauricio Reyes-Castillo<sup>1</sup>, T. Alcantara-Concepcion<sup>1</sup>, Gaston Lefranc<sup>2</sup> <sup>1</sup>Universidad Nacional Autonoma de México, México <sup>2</sup> Pontificia Universidad Católica de Valparaiso, Chile

Valente Váguez-Velazquez<sup>1</sup>, Mario Mario Peña-Cabrera<sup>1</sup>, Víctor Lomas-Barrié<sup>1</sup> and Gaston Lefranc<sup>2</sup> <sup>1</sup> Instituto de Investigaciones en Matemáticas Aplicadas y en Sistemas (IIMAS), Universidad Nacional Autónoma de México, México <sup>2</sup> Pontificia Universidad Católica de Valparaiso, Chile

# Digitization of the characteristic parameters of a greenhouse in order to streamline energy consumption

**Abstract:** Smart agriculture represents a management concept focused on industrial agriculture that already has the infrastructure to use advanced technologies like big data, cloud and Internet of Things (IoT) in order to supervise, automatize and analyze operations. It is known as well as precise agriculture, smart agriculture is driven by software and supervised by sensors. The importance of smart agriculture is constantly growing as it needs to use natural resources as efficiently as possible. In present paper we will consider supervising and controlling a greenhouse through sensors and software for its energy efficiency. In a first phase, the architecture of the sensor network and of the possible equipment that will control the temperature, the humidity of the greenhouse in order to make the production as efficient and the consumption of energy are established. Based on some measurements, solutions will be found to reduce the consumption of electrical energy. The conclusions present the advantages of smart agriculture, the stages of energy efficiency of a greenhouse by adding sensors and software control.

# A nursing mobile robot for COVID19 patients using a RPI and mobile device

**Abstract:** The article shows the design and implementation of a caterpillar structure mobile platform, which includes integrated electronic communication and control devices, as well as 3D printed parts for custom mechanical and additive manufacturing. The objective is to help in the care of patients with COVID19 within the restricted areas of the hospital. PWM technique is used for motion control due to its proven use of robust and reliable performance for service robot applications. The implementation is done with a commercial mechanical caterpillar platform with the architecture and electronic components manufactured by 3D printing are described in order to show the scope and technique used to control the operation. The article aims to test the efficiency and reliable performance of a mobile platform using PWM control techniques and Wi-Fi communication implemented in a RaspBerry Pi hardware electronic device as an auxiliary nursing robotic system in hospital areas restricted by COVID19. Assisted remote control is web-based, so any mobile device can perform actions. MQTT WebSocket is used to send and receive commands and telemetry.

Conversion of a Hybrid Flexible Manufacturing Cell to Industry 4.0

**Abstract:** A flexible manufacturing cell implemented in a hybrid way is presented, that is, integrating a real physical part with a simulated one. The cell is made up of a Kuka robotic manipulator, a vision system, sensors and containers for parts and products. The simulation part is fully connected to the real part and vice versa. The cell is converted using industry 4.0 criteria, which is implemented with a wireless communications system, and is controlled through a hierarchical system. The cell is tested by way of a picking and placing parts task on a conveyor belt.

Catalin Dimon,
Marius Teme,
Dumitru Popescu,
University Politehnica
of Bucharest,
Romania

Bogdan Alexandru Radulescu, Victorita Radulescu University Politehnica of Bucharest, Romania

### Francisco Javier Cabrerizo1, Enrique Herrera-Viedma<sup>2;1</sup>, Juan Antonio Morente-Molinera<sup>1</sup> <sup>1</sup>University of Granada, Spain. <sup>2</sup> School of Business Administration, University of Finance and Economics,

Yangxue Li<sup>1</sup>,

Chengdu, China

### Optimization of road traffic using intelligent traffic light systems

**Abstract:** If we consider road traffic in urban areas, one of its major problems encountered nowadays is that of traffic congestion. The paper aims to provide an improvement, in terms of reducing traffic congestion, by analyzing different traffic light cycles. A traffic light cycle is determined by the red and green duration of the traffic lights. Traditionally these two have a fixed duration and controlling road traffic can be achieved by modifying it, resulting in a congestion reduction. We present a comparison between the fixed and an improved fixed situation, as well as a QL algorithm to further reduce the congestion at an intersection. Urban traffic can thus be optimized, in terms of reducing congestion, on an existing traffic light system.

A study case validates the results, based on road traffic data obtained from the city of Bucharest.

Artificial intelligence, solution in planning the electricity transactions

**Abstract:** In Romania, starting with 2018, the electricity supply market has been liberalized. Starting with 2021, the gas supply market has also been liberalized. We are currently facing a global energy crisis, with an unprecedented rise in the price of electricity and gas. The correct substantiation of the portfolio framework contracts concluded between the electricity producers, suppliers and consumers represents an essential condition from the financial point of view regarding the electricity supply services. They must provide a benefit to the producers, within reasonable limits, so that the consumer price is not artificially increased. This process becomes optimal if a forecast based on artificial intelligence, made over an average of one year, is used. It must reflect domestic consumption associated with the international trade to be made. The forecast must be realized in the form of load curves with hourly levels for each day of the selected period. The adopted solution uses a hybrid model, optimized statisticneuronal, built on the basis of selected preliminary data. The calculation model and modeling used in the daily task graphs are presented, using self-organizing processes. The results obtained by forecasting the data recorded for the minimum, average and maximum consumption scenario for each form of estimating the average daily and monthly consumption is compared with the values of the consumption recorded in the months selected as a model. The errors obtained are in the range of 1.8-5.4%

### A Modified Uncertainty Measure of Z-numbers

**Abstract:** The Z-number is a more adequate construct for describing reallife information. While considering the uncertainty of the information, it also models the partial reliability of the information. It is a combination of probabilistric restriction and possibilistric restriction. In this paper, we modified the uncertainty measurement of the discrete Z-number and proposed the uncertainty measurement of the continuous Z-number. Some numerical examples are used to illustrate the calculation processes and advantages of the proposed method. An application of journey vehicle selection shows the effectiveness of the proposed uncertainty measurement in determining the weights of criteria.

Stefano Bonnini,	Two-sample permutation test for comparing marginal probabilities of
Michela Borghesi	multivariate Bernoulli distributions
University of Ferrara, Italy J. M. Tapia <sup>1</sup> , F.	<b>Abstract:</b> The contribution of this paper is both methodological and applicative. A combined permutation test for two independent samples is proposed for comparing the vectors of marginal probabilities of two multivariate Bernoulli distributions. The power behavior of the test is analyzed through a Monte Carlo simulation study. The application of the method to real data concerning the propensity towards circular economy of small Italian companies in the sector of metal, contributes to the debates on the effect of firm size to the "circularity" of companies. <b>Measuring Consensus in Group Decision-Making Problems through an</b>
Chiclana <sup>2</sup> , M. J. del	inequality measure
Moral <sup>1</sup> , E. Herrera– Viedma <sup>1</sup> <sup>1</sup> University of Granada, Spain, <sup>2</sup> De Montfort University, UK	<b>Abstract:</b> Gini index, a measure of statistical dispersion intending to represent inequality within a group, used mainly in economics, becomes in this paper a tool to introduce a new index to measure the level of consensus in Group Decision Making problems. An empirical study reveals that the levels of consensus obtained by this index are similar to those derived through the use of a distance function when fuzzy preference relations are considered. The results obtained suggest that this new index can be satisfactorily used to measure the degree of consensus in this framework.
Dan Noje, Radu	Automatic system based on Riesz MV-algebras, for predictive
Tarca, Nicolae Pop,	maintenance of bearings of industrial equipment using temperature
Alin Moldovan,	sensors
Ovidiu Moldovan	Abstract: Predictive maintenance systems take a more and more
University of Oradea, Romania Bogdan Alexandru	important place in increasing the reliability of industrial equipment, of productivity and reducing production costs. There's a constant focus to develop new system architectures and in using the latest numerical methods and algorithms in developing more and more reliable predictive maintenance systems. Based on recent results in using Shepard local approximation operators defined in Riesz MV-Algebras for IoT devices signals processing, in this article we propose a new architecture for a predictive maintenance system by adding an extra layer (denoted Data Validation Layer). This new layer is processing the acquired signals by sensors such that to provide to the predictive algorithms a complete and validated data set. The proposed architecture was validated by implementing and testing a predictive maintenance system that is monitoring the bearings of industrial equipment using temperature sensors.
Radulescu, Victorita	Convolutional Architecture
Radulescu	Abstract: Recognition of human actions is a tonical issue due to its
University Politehnica of Bucharest, Romania	<b>ADSUTACL:</b> Recognition of human actions is a topical issue due to its applicability in many different domains such as medicine, security, behavioral analysis, education, etc. The development of the computer processing power, as well as human motion capture equipment, has increased the accessibility to larger data sets. In this way the performances of the elaborated programs are improved. Convolutional neural networks represent the starting point for solving the analysis of human gestures or human faces. By their nature, they can recognize spatio-temporal features ideal for processing TGB images and sequences
	of RGB images. The proposed model with 3D Kernel is useful in certain

situations where gestures are very different between them, necessary to be recognized by the system that must react quickly at a high speed (urgent situations, critical cases, etc.). The main objective of this paper is to build a reliable and easy human gesture recognition classifier. It must be able to easily classify large number of images so that it can operate in real time, processing at least 30 frames per second. This is possible by using other hardware of a shelf computer connected to a normal CCTV infrastructure. Selection of gesture class should not be related to the environment, person, background, appearance, or viewing angle. The decision must be related only to the person to whom the gesture is attributed and to the context in which he reacts.

Maria Vişan<sup>1</sup>, Sorin Lenus Negrea<sup>2</sup> <sup>1</sup> School of Advanced Studies of the Romanian Academy, <sup>2</sup> Romanian Association for Smart City and Mobility, Romania Decision support systems for integrated land management and transport infrastructure in support of climate change mitigation and pandemic

**Abstract:** The third sector is important in the climate change race for the "reduction of carbon emission effects", severely affected by the pandemic and under pressure to implement drastic measures, the transportation from urban agglomerations (UA) requires a sustainable transformation solution. An important point in this major effort is the understanding of the cognitive, institutional, strategic and regulatory barriers that may hinder the achievement of the objectives set by international climatic changes agreements. An integrated territory and infrastructure management centre equipped with decision support systems is a solution for this challenge. Dynamic spatial planning contributes through the regulatory framework to the operationalization of this solution in the "new normality" after the pandemic. But no matter how agile the adoption of technologies could be at the UA level (through the collaboration of all actors involved in the process, namely public administration, business environment, citizens), in a society where the "new normal" is disruption, the key to change remains the vision and how the transformation is conducted. However, the challenge remains the integrated management of the territory and operation under hybrid roles, and the development of collaborative workflows between all actors involved in the workflows processes, between organizations and the development of the relationship with civil society and the public or private business environment.

Some Trends in Fuzzy Decision Making

Abstract: Decision making is a line of research that has been consolidating since its beginnings in the 1960s. The aim of this paper is to show the evolution and future challenges of this line of research, focusing especially on its evaluation and information methods. For this purpose, some issues and trends of the fuzzy decision system are presented. By doing so, it is possible to show which trend fuzzy decision systems will follow and the challenges that may arise.

Valeriu Beiu<sup>1</sup>, Sorin-Horatiu Hoara<sup>2</sup>, Roxana-Mariana Beiu<sup>1</sup> <sup>1</sup>"Aurel Vlaicu" University of Arad, <sup>2</sup> Politehnica

J.R. Trillo<sup>1</sup>, F.J.

Cabrerizo<sup>1</sup>, F.

Viedma<sup>1</sup>

UK

Chiclana<sup>2</sup>, M.A.

<sup>1</sup> University of

Granada, Spain,

Martinez<sup>1</sup>, E.Herrera-

<sup>2</sup> Montfort University,

Bridging Reliability to Efficiency Consecutive Elegant and Simple Design

**Abstract:** An acute problem when moving into the few nanometers highly advanced CMOS technologies is represented by the inexorable cost-yield balance, lately clearly tilted by the hefty costs. Amongst the options worth investigating (for reducing costs), designing for (enhanced) reliability has still not gained traction, as implicitly considered a power-/energy-hungry solution (due to redundancy), as well as a complex design alternative

University of Timisoara Romania	(hence risky). From the biological side, neurons are prime examples of highly efficient designs reaching outstanding communication and computation reliabilities, although relying on random devices (known as ion channels or, more appropriately, single ion transistors). In this paper, bridging from biology to circuits, we will show how kind of overlooked mathematical results (about consecutive systems) together with novel Binet-equivalent formulas (for Fibonnaci numbers of higher orders) can be pieced together for completely avoiding reliability calculations for consecutive systems. Finally, using such results, in combination with freshly defined cost functions (for reliability), we are able to present a trivial design scheme for consecutive systems which is balancing reliability and efficiency.
Marilena Jianu <sup>1</sup> , Leonard Daus <sup>1</sup> , Mariana Nagy <sup>2</sup> , Roxana-Mariana Beiu <sup>2</sup> <sup>1</sup> Technical University of Civil Engineering Bucharest, <sup>2</sup> "Aurel Vlaicu" University of Arad, Romania	Approximating the Level Curves on Pascal's Surface Abstract: It is well-known that in general algorithms for determining all the coefficients of the reliability polynomial associated to a two-terminal network are computationally demanding, and even just bounding them can be taxing. Still, reliability polynomials can be expressed in Bernstein form, hence the coefficients of such polynomials are always fractions of the binomial coefficients. That is why we have very recently proposed an extension of the classical discrete Pascal's triangle (which comprises all the binomial coefficients) to a continuous version/surface. The fact that this continuous Pascal's surface has values in between the binomial coefficients of all the reliability polynomials (which are integers, as resulting from counting processes), and even more (i.e., infinitely many real values). This means that the coefficients of any reliability polynomial represent discrete steps (integer values) on geodesics on this surface. Unfortunately, we were not able to find closed forms for the level curves on the Pascal's surface. That is why in this paper we are going to approach the level curves problem on Pascal's surface using approximations, and we will show that approximations for the level curves can be both accurate and computationally simple. Besides theoretical results we are also going
Minai Tacne <sup>2,2</sup> , Sorin-Horatiu Hoara <sup>1</sup> , VF. Drăgoi <sup>2</sup> , Roxana-Mariana Beiu <sup>2</sup> <sup>1</sup> University Politehnica of Bucharest, <sup>2</sup> Aurel Vlaicu" University of Arad, Romania	<b>Abstract:</b> Early on, communications (theorized by Shannon) and computations (abstracted by Turing and von Neumann) have relied on reliability augmenting schemes: one proposed by von Neumann and the other one introduced by Moore and Shannon. For computations the gate- level method of von Neumann was embraced, while the device-level scheme crafted by Moore and Shannon founded network reliability, and was employed for communications. Since those early days, steady advances towards single digit nanometer transistors have been constant. Lately, advanced technologies are in high demand for supporting the growing computational needs on which AI, IoT and G5 are blooming. As
	advance CMOS are sensitive to variations, it seems normal to analyze networks for identifying optimal ones, and the Moore and Shannon concept is a perfect fit for transistors/devices built and organized as arrays: FinFET, MBCFET, GAAFET, etc. Still, defining optimality in this context is a non-trivial task, as the conflicting power consumption and reliability requirements need to be optimized simultaneously. For a clear understanding we decided to perform very detailed simulations of 3×3 resistor/transistor networks including variations (using ASAP7 PDK). We

are reporting and discussing those simulations here. Their statistical processing will reveal subtle and unexpected links between classical Kirchhoff theorems (pertaining to power consumption) and Moore and Shannon theoretical reliability concepts, which will need plenty of additional investigations. Still, the main conclusion (based on our preliminary simulations) is that optimal networks for low-power reliable CMOS designs (for computations) are conceivable.

### On the roots of certain reliability polynomials

Leonard Daus<sup>1</sup>, Vlad-Florin Dragoi<sup>2</sup>, Dominic Bucerzan<sup>2</sup>, Valeriu Beiu<sup>2</sup> <sup>1</sup>Technical University of Civil Engineering Bucharest, <sup>2</sup> Aurel Vlaicu" University of Arad, Romania

Marilena Jianu<sup>1</sup>, Leonard Daus<sup>1</sup>, Sorin-Horatiu Hoara<sup>2</sup>, Valeriu Beiu<sup>3</sup> <sup>1</sup>Technical University of Civil Engineering Bucharest, <sup>2</sup>Politehnica University of Timisoara, <sup>3</sup>Aurel Vlaicu" University of Arad, Romania **Abstract:** In this paper we assume that a network is a probabilistic graph where the vertices do not fail while the edges do, being independently functional with probability p. The two most common probabilistic models of network reliability are the all-terminal and the two-terminal reliability. For each of these two models, the reliability of a network is represented by a polynomial in p. While the roots of all-terminal reliability polynomials have been extensively studied, only a small number of papers have investigated the roots of two-terminal reliability polynomials. One particular two-terminal network was introduced in 1956 by Moore and Shannon when establishing the concepts of network reliability. They argued that for improving the reliability of a network when doing computations one should replace the unreliable devices (relays, transistors, etc.) by particular regular networks of such devices, called hammock networks. Although hammock networks were introduced more than sixty years ago, no general formula for their two-terminal reliability polynomials have been reported yet. Additionally, the roots associated to the reliability polynomials of hammock networks have not been mentioned and investigated, a fact which is unexpected and a bit oddespecially when taking into account the optimality suggestions of Moore and Shannon. In this paper, we are going to correct this omission by enumerating and studying the roots of the two-terminal reliability polynomials associated to the 29 hammock networks presented by Moore and Shannon in their original paper. These will lead to several conjectures and also suggest further directions for research.

Using Delta-Wye Transformations For Estimating Networks' Reliability

**Abstract:** It is well-known that finding the exact reliability polynomial of a given two-terminal network in general is a highly demanding computational task (belonging to the #P-complete class of problems), while for particular networks this process might get to be significantly simpler (e.g., of polynomial complexity). This statement is especially true in the case of (very) large networks which cannot be reduced to compositions of simpler (e.g., series and parallel) networks, and contain complex bridge type sub-networks. An interesting, and not much explored approach, is to borrow concepts and methods from electrical circuits, in particular the delta-wye transformation which has long been established and used for computing exactly the equivalent resistance of a resistor network. We shall review how such concepts (from electronics) should be adapted and applied to reliability evaluations, showing that (as opposed to the case of electrical circuits) these are not always exact, hence sometimes leading to reliability estimates. We shall exemplify approximations of the reliability polynomials when using delta-wye transformations, and show that this approach is able to significantly reduce complexity. Finally, we will apply the delta-wye transformation method to the Moore-Shannon hammock networks (for the first time

Yi Song, Dan Chang	ever), and show how hammock networks can be transformed into ladder networks/graphs whose reliability can be easily computed by a recurrence formula. A few illustrative examples revealing the accuracy of this type of approximation will also be presented. Research on Early-Warning of Financial Risks of Logistics Enterprises
Beijing Jiaotong University, China	<b>Abstract</b> :The logistics industry is a composite service industry integrating transportation, warehousing, freight forwarding, and information industries. It is an important part of the national economy. Therefore, the research on the early-warning of the financial risks of logistics enterprises and whether they can be developed continuously are also necessary. Through the study of enterprise risk early-warning, doing a good job in financial risk management and control is the most important issue that must be solved to thoroughly evaluate, prevent, and resolve the financial risks of logistics companies so that they can develop in a sound and orderly manner. This paper builds 22 financial early-warning indicators from the six aspects of each share index, growth capability index, profitability index, etc., using PCA to reduce and optimize the latitude, and build a logistics enterprise Financial Risk Early-warning Model, which is based on BP neutral network.
Chunxiang Sun, Dan	Research on the storage of integrated pipe corridor monitoring data
Beijing Jiaotong University, China	Abstract: As an emerging urban underground life line in China, the integrated pipeline corridor has received extensive attention from many scholars, and the operation and maintenance management about the integrated pipeline corridor is gradually developing towards intelligent management with the maturity of digital technology. This paper proposes a monitoring data storage scheme based on the alliance chain to further realize the intelligent management of the integrated pipe corridor. In this paper, the data storage federated chain model is constructed by using various monitoring hosts of the integrated pipeline corridor as preselected nodes of the federated chain. In addition, the paper also adopts a dual-chain storage model with "on-chain" storage of key data information and "off-chain" storage of complete monitoring data to avoid the problem of communication jams among nodes caused by too much data on the federated chain. Finally, the proposed storage scheme is analyzed and discussed in terms of security performance, and the advantages of the model are demonstrated. The storage scheme proposed in this paper can safely and reliably store the monitoring data in the integrated pipe corridor, which provides a theoretical reference for further construction of an intelligent platform for integrated pipe corridor management, and to a certain extent promotes the development of intelligent management of integrated pipe corridors.
Nicolaie Popescu- Bodorin <sup>1</sup> , Mariana Nagy <sup>2</sup> <sup>1</sup> Spiru Haret University, Bucharest	A new way of controlling traffic jams inside a Smart City based on IoT devices and communication protocols designed for preserving perfect anonymity Abstract: In the IoT communication based on the OSI model, by the nature
<sup>2</sup> "Aurel Vlaicu" University <u>of Arad,</u>	of the used protocols, one can find out who is using what device, under what IP address, in what location, at what time - and this is what we

Romania	ironically still call privacy today, when in fact, it is exactly the lack of that. In various situation, mainly connected to the "smart city" concept, the data should be collected while preserving the anonymity of its source device. Such a situation is aggregating and processing data for modelling and controlling the traffic flow. We search here for new IoT communication protocols and technologies in the context of avoiding traffic jams in Smart cities, aiming to exemplify traffic data as IoT data that can be collected and transmitted without necessarily bounding it with an identity of a person or of a device, hence without creating any room for users' and devices' privacy to be compromised. For this, we will descend along the OSI model up to the point where perfect anonymity is achievable - eventually by changing a transmission protocol, and also the structure and functionality of the IoT devices accordingly to preserving anonymity at any moment.
Florentin	Extension of HyperAlgebra to SuperHyperAlgebra and Neutrosophic
Smarandache, University of New	SuperHyperAlge-bra (revisited)
Mexico, USA	<b>Abstract:</b> This is a review paper. The nth-Powerset of a Set, and the concepts built on it such as SuperHyperOperation, SuperHyperAxiom, SuperHyperAlgebra, and their corresponding Neutrosophic SuperHyperOperation, Neutrosophic Su-perHyperAxiom and Neutrosophic SuperHyperAlgebra are recalled and then prolonged to the Neutrosophic SuperHyperStructures {or more accurately Neutrosophic (m,n)-SuperHyperStructures}.





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