The 21st International Conference on Informatics in Economy (IE 2022)

Education, Research & Business Technologies

Conference Program

Bucharest, Romania
May 26th, 2022

Conference Organizers

Bucharest University of
Economic Studies

Department of Economic
Informatics
and Cybernetics

INFOREC Association

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Preface

This year, the 21st International Conference on INFORMATICS in ECONOMY (IE 2022), Education, Research & Business Technologies, has been held in a hybrid format in Bucharest, Romania, on 26th May 2022. The Conference promoted research results in Business Informatics and related Computer Science topics:

- *Machine learning theory and applications*
- *Big data management, processing and analytics*
- *Smart cities and sustainable communities*
- *IoT management and integration with utilities*
- *Cloud, distributed and parallel computing*
- *Cybersecurity*
- *Mobile-embedded and multimedia solutions*
- *Quantitative Economics*
- *Enterprise & Business Solutions*
- *E-Society, E-Government & E-Education*

The Conference has represented a meeting point for participants from all over the world, both from academia and from industry.

The conference was first organized in 1993 in collaboration with researchers from Institut National des Sciences Appliquées de Lyon (INSA de Lion), France. From 1993 to 2011, the conference has been organized once every two years, publishing in ten editions high quality papers and bringing together specialists from around the world. Starting with 2012, the conference takes place annually, the 11th, 12th, 14th, 15th, and 16th edition volumes have been indexed by ISI Thomson Reuters in its ISI Proceedings directory. Also, the 20th edition volume have been indexed in Scopus and published in Springer.

The International Conference on Informatics in Economy is one of the first scientific events on this subject in Romania and during the last ten years has gained an international scientific recognition. At national level, remains one of the most important scientific events that gather the entire Romanian Economic Informatics community.

The conference has made partnerships with international journals like *Economic Computation and Economic Cybernetics Studies and Research, Informatica Economică, Economy Informatics, Database Systems Journal, Journal of Logistics, Informatics and Service Science, Journal of System and Management Sciences* to publish an extended format of the conference best papers.

A Conference such as this can only succeed as a team effort, so the Editors want to thank the International Scientific Committee and the Reviewers for their excellent work in reviewing the papers as well as their invaluable input and advice.

The Conference Team

Conference Important Events

Thursday, May 26th, 2022		
Time	**Event**	**Hall name**
10:00 – 10:30	**Registration & Coffee break**	**Entry hall Aula Magna**
10:30 – 11:00	**IE 2022 Opening Ceremony** Prof. Alina Mihaela **DIMA**, PhD Vice-Rector, Scientific Research, Development and Innovation Bucharest University of Economic Studies Acad. Florin Gheorghe **FILIP**, PhD Romanian Academy, Information Sciences and Technology Section Prof. Marian **DÂRDALĂ**, PhD Dean of the Faculty of Cybernetics, Statistics and Economic Informatics	**Aula Magna**
11:00 – 11:30	Prof. Fabrizio **MAROZZO**, PhD University of Calabria, Italy *"Improve In-Memory Execution of Data-Intensive Workflows Through Machine Learning Algorithms"*	**Aula Magna**
11:30 – 12:00	Prof. Fuad **ALESKEROV** National Research University Higher School of Economics, Moscow, Russia *"Models for an Analysis of Company's Transactions in the Large Commercial Bank of Russia"*	**Aula Magna**
12:00 – 12:30	Prof. Luiz Flavio **AUTRAN MONTEIRO GOMES**, PhD Ibmec University Center, Brazil *"Fundamentals of Multi-Criteria Decision Analysis: A Review"*	**Aula Magna**
12:30 – 14:30	**Lunch break**	
14:30 – 18:00	**Paper presentations**	Rooms available on each section

CONFERENCE PROGRAM

– SECTION 1 –

Cloud, Distributed and Parallel Computing
Mobile-Embedded and Multimedia Solutions

Thursday, 26th May, 14:30 – 18:00, Room: 2013B
Chairman: Gheorghe Cosmin SILAGHI; Paul POCATILU

1. **MICRO-SERVICES AS KEY ENABLER OF A CLOUD-NATIVE ARCHITECTURE** – Corneliu Barbulescu

2. **THE IMPORTANCE OF SECURITY AND SAFETY IN A SMART CITY** – Ana-Maria Tudor, Andreea-Geanina Vintilă, Răzvan-Alexandru Brătulescu, Robert-Ionuț Vătășoiu, Sorina-Andreea Mitroi, Mari-Anais Sachian

3. **CYBER RANGE TECHNOLOGY STACK REVIEW** – Ionut Lates, Catalin Boja

4. **IOT SECURITY CHALLENGES FOR SMART HOMES** – Nicolae-Gabriel Vasilescu, Paul Pocatilu, Mihai Doinea

5. **IMPACT OF MOBILE SOLUTION ON EDUCATION IN UNIVERSITIES** – Rares-Constantin Ciobanu

6. **AN OVERVIEW OF SECURITY ISSUES IN SMART CONTRACTS ON THE BLOCKCHAIN** – Silviu Ojog

7. **TOKENOMICS OF NFTS** – Felician Alecu, Lorena Bătăgan, Cristian Eugen Ciurea, Sergiu Capisizu

– SECTION 2 –

Enterprise & Business Solutions
Smart Cities and Sustainable Communities
E-Society, E-Government & E-Education

Thursday, 26th May, 14:30 – 18:00, Room: 2320
Chairman: Mihaela MUNTEAN; Bogdan GHILIC-MICU

1. **AGILE BUSINESS SYSTEMS DEVELOPMENT PARADIGMS – TECHNOLOGICAL AND HUMAN RESOURCE PERSPECTIVES** – Marian Stoica, Bogdan Ghilic-Micu, Marinela Mircea, Panagiotis Sinioros

2. **IDENTIFICATION OF QUALITATIVE WEAK SIGNALS COMING FROM ASSET MANAGEMENT WORKING PRACTICES TO FEED FORWARD-LOOKING INVESTMENT PENSIONS FUNDS MODELS** – Emmanuel Fragnière, Pierre Fischer, Jahja Rrustemi, Nils Tuchschmid, Olivier Guillot

3. **DIGITAL COMPETENCES IN THE PUBLIC SECTOR – CHALLENGES FOR UNIVERSITIES** – Margarita Bogdanova, Evelina Parashkevova-Velikova

4. **SOFTWARE TOOL FOR FAMILY DOCTORS. A PRACTICAL APPROACH** – Oana Vîrgolici

5. **RESEARCH ON INTELLECTUAL PROPERTY PROTECTION USING BLOCKCHAIN** – Petru Simon Mot

6. **TRANSPORT SYSTEM IN BUCHAREST** – Vlad-Alexandru Mihăilă

7. **GENERAL CHARACTERISTICS OF THE ASSISTED E-LEARNING SYSTEM IN COMPUTER SCIENCE** – Mădălina Pană, Alin Zamfiroiu

8. **E-LEARNING IN ROMANIA: AN OVERVIEW ON SOFTWARE SOLUTIONS FROM PRIVATE INITIATIVES** – Andreea-Cristina Stroe

– SECTION 3 –

Big Data Management, Processing and Analytics
Machine Learning Theory and Applications
Quantitative Economics

Thursday, 26th May, 14:30 – 18:00, Room: 2001D
Chairman: Florin FILIP; Adela BÂRA

1. **SUSTAINABLE COMMUNITIES WITH SMART METERS. A STATISTICAL MEASUREMENT MODEL TO COPE WITH ELECTRICITY CONSUMERS' BEHAVIOR** – Simona-Vasilica Oprea, Adela Bâra, Jin Xiaolong, Qian Meng, Lasse Berntzen

2. **THE ROLE OF BIG DATA ANALYTICS IN INCREASING COMPETITIVENESS** – Marian Pompiliu Cristescu, Raluca Andreea Nerisanu, Dumitru Alexandru Mara, Renate-Martina Polder, Albert-Attila Keresztesi

3. **BLOCKCHAIN AND SMART CONTRACTS FOR VOTING IN A UNIVERSITY** – Vlad Diaconita, Maria Georgiana Stoica

4. **USING TWITTER DATA AND LEXICON-BASED SENTIMENT ANALYSIS TO STUDY THE ATTITUDE TOWARDS CRYPTOCURRENCY MARKET AND BLOCKCHAIN TECHNOLOGY** – Denisa Elena Bala, Stelian Stancu

5. **APPLICATIONS THAT USE RECURRENT NEURAL NETWORKS (RNN) AND THEIR IMPACT ON PEOPLE'S LIVES** – Ionuț-Alexandru Cîmpeanu

6. **MODELLING THE PRICES VARIATION OF AGRICULTURAL PRODUCTS ON THE STOCK MARKET USING EVOLUTIONARY APPROACH** - Costin Radu Boldea, Bogdan Boldea

7. **THE TRENDS IN CYBERSECURITY MATURITY MODELS** – Aurelian Buzdugan, Gheorghe Capatana

8. **ORACLE MACHINE LEARNING – FEATURES AND USE CASES –** Dimitrie-Daniel Plăcintă

9. **CHALLENGES TO DEMOCRACY: ATTITUDES TOWARDS THE JANUARY 6TH EVENTS AT THE CAPITOL ON SOCIAL MEDIA** - Erik-Robert Kovacs, Liviu-Adrian Cotfas

10. **ISSUES IN PARTICIPATIVE HUMAN-CENTRED ALGORITHM DESIGN** – Marianne Cherrington, David Airehrour, Joan Lu, Samaneh Madanian

11. **WEB-BASED MACHINE LEARNING SYSTEM FOR ASSESSING CONSUMER BEHAVIOR** - Denis-Cătălin Arghir

– SECTION 4 –

Big Data Management, Processing and Analytics
Machine Learning Theory and Applications
Quantitative Economics

Thursday, 26th May, 14:30 – 18:00, Room: 2608
Chairman: Nora CHIRIȚĂ, Ionuț NICA

1. **FROM DIGITAL ECONOMY TO GLOBAL ECONOMY. A CYBERNETICS APPROACH** - Ionuț Nica, Nora Chiriță

2. **MODELS FOR IDENTIFYING PRICE BUBBLES IN THE FINANCIAL MARKET: THE SCIENCE OF BUYING CRYPTOCURRENCY** – Nicolae Spătaru, Ștefan Ionescu

3. **MULTIMODAL GLOBAL OPTIMIZATION, FUZZY ASA AND SPACE-FILLING CURVES** - Hime Aguiar e Oliveira, Luiz Flavio Autran Monteiro Gomes, Maria Augusta Soares Machado

4. **METRICS FOR EVALUATING CLASSIFICATION ALGORITHMS** – Mihaela Muntean, Florin-Daniel Militaru

5. **BIG DATA AND MACHINE LEARNING. DIFFERENT INDUSTRY CHALLENGES** – Andreea-Elena Ogrezeanu (Oprea), Georgiana Stănescu (Nicolaie), Andreea-Maria Copăceanu, Andreea-Alexandra Cîrnaru

6. **INTERCHANGING DATA JAVA-PYTHON WITH APPLICATIONS IN MACHINE LEARNING SOLUTIONS –** Titus Felix Furtună, Claudiu Vințe, Cosmin Proscanu

7. **PERSPECTIVES OF CRYPTOCURRENCY PRICE PREDICTION –** Crina Anina Bejan, Dominic Bucerzan, Mihaela Daciana Crăciun

8. **SENTIMENT ANALYSIS ON SHORT TEXTS: THE CASE OF THE ROMANIAN LANGUAGE –** Ioana Baghiut, Gheorghe Cosmin Silaghi

9. **CREDIBILISTIC VALUATION OF MERGER AND ACQUISITION TARGETS WITH FUZZY REAL OPTIONS** – Jani Kinnunen, Irina Georgescu

10. **A STUDY ON THE SYSTEMATIC IMPORTANCE OF MAJOR BANKS IN CHINA** – Du Xinyue, Ren Ying

ABSTRACTS

Cloud, Distributed and Parallel Computing
Mobile-Embedded and Multimedia Solutions

MICRO-SERVICES AS KEY ENABLER OF A CLOUD-NATIVE ARCHITECTURE

Corneliu BARBULESCU, *IBM Corporation*

Abstract: *This article discusses the Microservices and their key role in adoption of Cloud-Native ap-plication architectures. It starts by defining the Microservices concept, then identifies their key technical characteristics and business benefits they unlock, while proposing a parallel with 12-factor applications. Having these clarified, it answers 'Why Now' is the time to adopt Microservice Architecture in terms of business imperatives per industry and technological readiness. Everything is put in context, including evolution from SOA and what are the key differences between microservices and SOA. Having agreed on technical definition and characteristics, current article also highlights what is driving businesses to invest in Microservice-led transformations. Likewise, we apply a critical and pragmatic angle on limitations and avoiding 'purist' adoption of this modern architectural style.*

Keywords: Architectures, Microservices, Cloud, Applications, Services, 12-principles.

THE IMPORTANCE OF SECURITY AND SAFETY IN A SMART CITY

Ana-Maria TUDOR, *Beia Consult International*
Andreea-Geanina VINTILĂ, *Beia Consult International*
Răzvan-Alexandru BRĂTULESCU, *Beia Consult International*
Robert-Ionuț VĂTĂȘOIU, *Beia Consult International*
Sorina-Andreea MITROI, *Beia Consult International*
Mari-Anais SACHIAN, *Beia Consult International*

Abstract: *The main purpose of this paper is to explain the role of recently developed smart cities in the security and safety of its citizens, and how they will evolve in the future in most cities around the world. Today, most cities around the world are trying to become so-called smart cities. In*

this paper we aim to define the concept of Smart City, how it has evolved, the security and security that these types of cities bring and the evolution that smart cities will have in the future. Mainly, the term "smart city" is defined as the use of technological solutions to improve the quality of life of the citizens of these cities and to promote sustainable development. "Smart city" will be the term that will soon develop the most and will be on everyone's lips. Smart city implementation is frequently lauded as the answer to many urban difficulties, including transportation, waste management, and environmental protection. Security and crime prevention, on the other hand, are frequently overlooked.
Keywords: Smart City, Security, Safety, Cyber Security.

CYBER RANGE TECHNOLOGY STACK REVIEW

Ionuț LATEȘ, *Bucharest University of Economic Studies*
Cătălin Emilian BOJA, *Bucharest University of Economic Studies*

Abstract. *Recent studies on cybersecurity threats have revealed the complexity of the situation, both in terms of quantity, as the number of targeted IT/OT infrastructures, and in terms of the techniques and technologies used to carry out modern cyber-attacks. In this context, Cyber Range systems can tilt the scales in favor of cyber security prevention and preparedness. A cyber range is designed to simulate real-world circumstances for detecting and responding to simulated assaults, as well as allowing practitioners to test new technologies in the purpose of improving the existing cyber-security platforms. A Cyber Range system is meant to be a highly complex system, composed by multiple independent modules configured and managed through a master component. Existing known Cyber Range implementations use different technologies and deployment/management techniques. Considering these facts, a Cyber Range technology stack review may significantly contribute to the design and implementation improvement. The lack of CR implementation standardization represents a significant problem in terms of knowledge sharing between different cyber-security entities: companies, government institutions, research teams, etc. Detailed analysis of the technologies used in this area may lead to a standardization of the CR implementation and thus to a beneficial knowledge sharing system. One of the most important modules of a CR system is the virtualization component, which makes it possible to simulate / emulate the virtual infrastructures used in the process of cybersecurity scenarios development. As a first step, this paper presents*

the results of an in-depth analysis of the virtualization technologies used in the implementation of Cyber Range systems.

Keywords: Cyber Range, virtualization, network simulation, network emulation, cyber-security exercises.

IOT SECURITY CHALLENGES FOR SMART HOMES

Nicolae-Gabriel VASILESCU, *Bucharest University of Economic Studies*
Paul POCATILU, *Bucharest University of Economic Studies*
Mihai DOINEA, *Bucharest University of Economic Studies*

Abstract: *Nowadays, the emphasis is more and more on modernizing and ensuring the standard of living by using the intelligent IoT systems integrated in smart homes. These have some security breaches that can become vulnerable in the event of external attacks. Identifying these issues in advance increases people's confidence in using smart systems and moving from a mechanized to an automated way of life. Testing and finding solutions to prevent various types of attacks is a topic of interest today with a number of tools available to validate whether a home system is secure or not. This paper reviews the smart home applications, focusing on security aspects related to the IoT devices.*

Keywords: IoT, Smart home, Automation, Security, Vulnerability.

IMPACT OF MOBILE SOLUTIONS ON EDUCATION IN UNIVERSITIES

Rareș-Constantin CIOBANU, *Bucharest University of Economic Studies*

Abstract: *Thanks to the technological progress and due to the need to digitalize the educational system, the higher education institutions focused on developing mobile solutions that would bring alternatives to the classic study methods to improve the university experience by providing instant access to educational re-sources and easy educational system management. The objective of this paper is to analyze the existing mobile learning solutions, by evaluating their functionalities and user experience. Furthermore, the research targets the impact of educational mobile applications on students' academic experience based on their results, productivity, engagement, and social activity. In this paper, the methodological approach is focused on gathering statistical data on the use of mobile solutions in the academic field. The paper presents an in-*

crease of the use of mobile solutions at university level due to portability and fast access to resources and information. Also, the impact on students and professors can be observed both from a didactic and social point of view, facilitating communication and student-professor interaction.
Keywords: Mobile solutions, University, Learning.

AN OVERVIEW OF SECURITY ISSUES IN SMART CONTRACTS ON THE BLOCKCHAIN

Silviu OJOG, *Bucharest University of Economic Studies*

Abstract: *Blockchain technology is a factor of disruption for the current state of the internet, and it has the potential to solve many of its security, centralization, and trust issues. The second generation of blockchain appeared in 2013, with the launch of Ethereum and introduced smart contracts, as a way of building applications on top of the blockchain. Nevertheless, smart contracts raise particular security challenges due to their immutability, attack surface, and economic implications. This paper aims to present the most common security vulnerabilities and possible exploits in smart contracts and the best practices for combating them.*
Keywords: Blockchain, Smart contract, Security, Ethereum, Exploit, Immutability, Solidity.

TOKENOMICS OF NFTS

Felician ALECU, *Bucharest University of Economic Studies*
Lorena BĂTĂGAN, *Bucharest University of Economic Studies*
Cristian Eugen CIUREA, *Bucharest University of Economic Studies*
Sergiu CAPISIZU, *Bucharest Bar Association*

Abstract: *An NFT (Non-fungible token) can represent any digital asset from artworks to real estate properties, so any digital item can be easily turned into an NFT with the help of the blockchain technology. NFT is basically a proof of ownership in the form of metadata. The process of creating an NFT is called minting and it generates a permanent link between the digital work and its creator. The tokenomics (economics of tokens) is explaining the factors affecting the supply and the demand of the crypto assets on the market. Studies are showing a powerful few*

people control the NFT market and a small group of privileged users are actually taking the largest part of the profit coming out of the NFT trading. Since there is quite simple to right click and save a digital file, anyone can create a copy of an expensive NFT for free but the proof of the ownership belongs only to the NFT owner who can later sell the digital asset for a large profit. Unlike what most of the users think about, the subject of any NFT trade is the metadata, not the work itself. Copyright disputes may appear when the metadata of an NFT traded on the market is pointing to a digital asset that is in fact protected by the copyright legislation. Most of the time, the infringement situations are solved by removing from the trading platforms the NFTs having copyright issues.

Keywords: Blockchain, Token, NFT, Tokenomics, Copyright.

AGILE BUSINESS SYSTEMS DEVELOPMENT PARADIGMS - TECHNOLOGICAL AND HUMAN RESOURCE PERSPECTIVES

Marian STOICA, *Bucharest University of Economic Studies*
Bogdan GHILIC-MICU, *Bucharest University of Economic Studies*
Marinela MIRCEA, *Bucharest University of Economic Studies*
Panagiotis SINIOROS, *University of West Attic*

Abstract: *Today's society is significantly contaminated in all its dimensions by the techno-logical revolution of recent decades. Technology, in one form or another, has penetrated all corners of human existence and directly contributes to spectacular metamorphoses in individual-behavioral, professional, and societal aspects. Going through higher stages of development and dangerously approaching a maximum limit of evolution, society today experiences the emotions of an organization based almost exclusively on information and knowledge. Information has re-gained the status of an indispensable factor for business, and knowledge is the natural result of the logical processing of this information. Business prospects have stimulated the economy to invest heavily in information gathering, transmission and processing infrastructure. This has led to an intensification of research in the field of information technology and telecommunications, further increasing the impact of technology on human society. Thus, a significant attribute of con-temporary society is the development of scientific interface disciplines, which seeks an answer to the increasing complexity of economic and social realities, which requires interactive and multidisciplinary approaches. The importance of the information dimension of the business is no longer as vehemently challenged as it was 20-30 years ago, and the development of agile business information systems has long been just a fad. Agility thus becomes a sine qua non of eco-nomic success. Coupled with technology, it translates into flexibility of methods, techniques and tools embedded in software products dedicated to modern business. In a realistic approach, the adaptability offered by agility must be met throughout the systems development lifecycle, regardless of the methodology approached - constructive or ameliorative. In this paper, the authors propose an analysis of how the individual is impacted by information and communication technology in*

the context of modern business, given that human resources and technology are the main "culprits" for the evolution of today's society, in general. The technological dimension of the business is approached from the systems development lifecycle perspective and the main agile paradigms for the development of business information systems.

Keywords: Agile system and business development, Technology and human re-source, System development life cycle - SDLC, Information and communication technology - ICT, Agile tooling, DevOps.

IDENTIFICATION OF QUALITATIVE WEAK SIGNALS COMING FROM ASSET MANAGEMENT WORKING PRACTICES TO FEED FORWARD-LOOKING INVESTMENT PENSION FUNDS MODELS

Emmanuel FRAGNIÈRE, *University of Applied Sciences Western Switzerland*
Pierre FISCHER, *Grammont Finance, Financial Engineering and Trading, Lutry, Switzerland*
Jahja RRUSTEMI, *University of Applied Sciences Western Switzerland*
Nils TUCHSCHMID, *University of Applied Sciences Western Switzerland*
Olivier GUILLOT, *Grammont Finance, Financial Engineering and Trading, Lutry, Switzerland*

Abstract: *Because of their overreliance on benchmark tracking, pension funds in Switzerland tend to take a passive and short-term approach to portfolio investment and management. This leads to mismatched and sterile strategy styles in relation to their mandate's perspective and needs. Pension funds have a long-term perspective which nevertheless could benefit from more adaptive approaches (for example in seeking to temper the negative effects of the paradigm shift to near-zero interest rates which has plagued performance for several years now). In this study, we aim to explore and understand alternative approaches used by successful market participants. The inductive methodology used is a qualitative survey based on the collection of narratives through semi-structured interviews. We conducted 9 semi-structured interviews with experts in the field to explore this question and develop research proposals. Then a synthesis is made based on a categorization by theme. Thanks to this synthesis, research hypotheses are generated and compared with the scientific literature. The key findings are that talented finance professionals look for weak signals that herald change and they*

can exploit them successfully. We aim to see if there are benefits to incorporating qualitative weak signals into a forward-looking risk management tool to better hedge the portfolios of pension funds that typically rely on more backward-looking approaches. The objective of this research is therefore to apply the concepts of cybernetics to the case of a business investment portfolio solution. These results will be introduced in further research in our quantitative and digitized forward-looking portfolio management models.

Keywords: Feedforward Iterative Controller, Investor's Behavior, Weak Signals.

DIGITAL COMPETENCES IN THE PUBLIC SECTOR - CHALLENGES FOR UNIVERSITIES

Margarita BOGDANOVA, *Tsenov" Academy of Economics, Svishtov, Bulgaria*
Evelina PARASHKEVOVA-VELIKOVA, *Tsenov" Academy of Economics, Svishtov, Bulgaria*

Abstract: *The purpose of the paper is to identify the key competencies in the public sector in the digital age and to analyze the main challenges facing higher education in the process of training students and practitioners. The issues of the necessary competencies are addressed in a broad framework of interaction between different stakeholders in the process of transition to e-government. The methodology includes: a review of secondary sources - strategic and regulatory documents related to digital transformation in the country, scientific publications on digital transformation, comparative studies of practices of different countries, etc.; interviews with representatives of leading institutions - Institute of Public Administration and State Agency for e-Government; observations of the work of administrations in the public sector in the study of the Index of Administrative Capacity in Bulgaria; questionnaire survey of students' attitudes (N = 118) for distance learning through digital means. Among the conclusions drawn is the need for broad stakeholder involvement (the government in cooperation with universities, the private sector, and the administrations themselves) in determining the necessary digital competencies; creativity and flexible approach in developing curricula in higher education; non-formal learning to complement the formal ones provided by universities.*

Keywords: Digital competencies, Public sector, Universities

SOFTWARE TOOL FOR FAMILY DOCTORS. A PRACTICAL APPROACH

Oana VÎRGOLICI, *Bucharest University of Economic Studies*

Abstract: *The main objective of this paper was to propose a software tool that could assist family doctors in better diagnosis and prevention of common diseases. A simplified prototype, which implement a selection of algorithms and medical calculators is presented, a solution that would be very useful for family doctors, but not only. These algorithms are not meant to replace the doctor's work, but act like alarm signals in the prevention and treatment of diseases. Based on these algorithms, doctors can recommend a change in lifestyle, a new medication, hospitalization or even surgery.*

Keywords: Software tool, Medical alert, Medical calculator.

RESEARCH ON INTELLECTUAL PROPERTY PROTECTION USING BLOCKCHAIN

Petru Simon MOT, *Bucharest University of Economic Studies*

Abstract: *Blockchain technology has received a lot of attention in the past years for its ability to power a trusted system in a trustless environment, where asset ownership can be established and transferred between participants. While the financial applications attracted most of this attention, several other industries recognized the potential and started exploring blockchain-based solutions for systems where the decentralization, immutability and traceability are key characteristics. Intellectual property organizations - both international such as WIPO or EPO and national such as USPTO or IP Australia - have been evaluating blockchain technologies for a few years and recently started implementing solutions for IP rights management. This paper reviews the current developments at several known IP offices and provides a solution for secure document exchange between institutions based on the popular, open source, Hyperledger blockchain.*

Keywords: IP, Patents, Trademarks, Blockchain, Data protection, Document management, WIPO, EPO, IP rights, Law.

TRANSPORT SYSTEM IN BUCHAREST

Vlad-Alexandru MIHĂILĂ, Bucharest University of Economic Studies

Abstract: *Smart mobility is one of the 6 domains that define a smart city. Traffic is a global problem that some large cities in Europe have managed to resolve and meet the criteria that classify them as smart cities. Bucharest still has a lot to learn from other European cities, in terms of how the transport takes place inside the city. With the help of data on public transport and the level of satisfaction we can better understand where Bucharest ranks in terms of smart mobility.*

Keywords: Traffic, Intelligent transport systems, Technologies, Public transport

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GENERAL CHARACTERISTICS OF THE ASSISTED E-LEARNING SYSTEM IN COMPUTER SCIENCE

Madalina PANĂ, *Bucharest University of Economic Studies*
Alin ZAMFIROIU, *Bucharest University of Economic Studies*

Abstract. *Taking into consideration all the restrictions applied worldwide due to the Covid-19 pandemic in the recent couple of years, it is completely understandable why the educational system as well had to adapt and move all its activities online. Even though this kind of approach has turned out to have many advantages, there are certainly still things that could be improved and explored. The main objective of this paper is to highlight the importance and benefits of online learning tools which could assist students during their educational process, even under normal circumstances. Hence, we will analyse the characteristics of the current eLearning applications and what each one proposes for the automation of computer-assisted learning using the computer science field.*

Keywords: Assisted, eLearning, characteristics, automation

E-LEARNING IN ROMANIA: AN OVERVIEW ON SOFTWARE SOLUTIONS FROM PRIVATE INITIATIVES

Andreea-Cristina STROE, *Bucharest University of Economic Studies*

Abstract: *The purpose of this paper is to present an overview on the software solutions that contribute to the development of the e-learning in the Romanian undergraduate education system. This research relies on a study of the solutions provided by the Romanian private companies that dominate the market of the e-learning platforms. The software providers considered for the paper include SIVECO, Ascendia S.A., Timsoft or InsideMedia. The platforms will be analyzed in terms of functionalities and characteristics. After the analysis, a series of common features will be identified, as well as the benefits and the drawbacks of each of the solutions. Based on the results, a profile of an adequate e-learning plat- form for the Romanian undergraduate education system will be drawn. Overall, this paper contributes to the literature by identifying the existing and already integrated e-learning software solutions in the system at the present moment. Moreover, a comparison between them will be provided, leaving room for future directions the field of e-learning platforms in Romania can benefit from.*

Keywords: E-learning, E-learning platform, Digitalization, Romanian education, Digital education, Information technology.

SUSTAINABLE COMMUNITIES WITH SMART METERS. A STATISTICAL MEASUREMENT MODEL TO COPE WITH ELECTRICITY CONSUMERS' BEHAVIOR

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Adela BÂRA, *Bucharest University of Economic Studies*
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Lasse BERNTZEN, *University of South-Eastern Norway*

Abstract: *The mentality of electricity consumers is one of the most important entities that needs to be addressed when coping with balancing issues in operating the power systems. Consumers are used to being completely passive and just plugging in their appliances. Still, recently these things have changed as significant progress of Information and Communication Technologies (ICTs) and Internet of Things (IoT) gain momentum. In this paper, we propose a statistical measurement model using covariance structure, specifically a first-order Confirmatory Factor Analyses (CFA), to identify the factors that might contribute to the change of attitude. Furthermore, this research identifies la-tent constructs and indicates which observed variables load on or measure each latent construct. For simulation, two real complex data sets of questionnaires created by the Irish Commission for Energy Regulation (CER) are analyzed, demonstrating the influence of some exogenous variables on the items of the questionnaires. The results reveal a relevant relationship between the social-economic and behavioral factors and observed variables. Furthermore, models provide an excellent fit to data as measured by the performance indicators.*

Keywords: Confirmatory Factor Analysis, Consumer Perception, Smart Meter

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THE ROLE OF BIG DATA ANALYTICS IN INCREASING COMPETITIVENESS

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Raluca Andreea NERISANU, *Lucian Blaga University of Sibiu*
Dumitru Alexandru MARA, *Lucian Blaga University of Sibiu*
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Abstract: *The purpose of this article is to present the way in which big data analysis in-fluences competitiveness and the impact of analysis on competitiveness. Its importance is significant because it can help the readers understand how using big data analysis may influence the competitiveness of a country and the companies within it. This article also highlights the advantages of analyzing big data in relation to competitiveness. We analyzed the relationship between the evolution of the percentage of companies that do big data analysis and the competitiveness of businesses inside countries from the European Union, as evaluated by the Global Competitiveness Index 4.0. We selected all companies without the financial sector that had more than 10 employees. Global Competitiveness Index (GCI) values were collected for the period 2017-2019, the percentage of companies using big data analysis covers insignificant years for the case study. In this situation we had to make an average for years of the lack of percentage of companies that use big data analysis. The results obtained from the analysis show the level of competitiveness versus the use of big data analysis for the years 2018-2020 and the strong correlation between the percentage of companies that use big data analysis and the competitiveness index. Thus, in countries where the percentage of big data usage is lower, it has a low level of competitiveness index, and in countries with a higher level of use of big data in enterprises, a higher level of competitiveness index is presented.*

Keywords: Competitiveness, Big Data Analysis, Big Data, Performance, Europe.

BLOCKCHAIN AND SMART CONTRACTS FOR VOTING IN A UNIVERSITY

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Maria Georgiana STOICA, *Bucharest University of Economic Studies*

Abstract: *In this article, we will begin by presenting a comparison between various platforms for the development of smart contracts. The goal is to find that technology that offers various facilities to the developer and multiple functionalities and performance in the development of smart contracts. We will analyze the 3 top platforms and highlight the advantages and disadvantages encountered, which architecture is used by each model, and which are more reliable for developing smart contracts. We will propose a voting solution that can be used in a university-based on an ERC20 token.*

Keywords: Blockchain, smart contracts, education, voting

USING TWITTER DATA AND LEXICON-BASED SENTIMENT ANALYSIS TO STUDY THE ATTITUDE TOWARDS CRYPTOCURRENCY MARKET AND BLOCKCHAIN TECHNOLOGY

Denisa Elena BALA, *Bucharest University of Economic Studies*
Stelian STANCU, *Bucharest University of Economic Studies*

Abstract: *The use of messages and posts in the online environment has become increasingly popular when it comes to identifying public opinion on various phenomena. A reliable way to explore these attitudes is to collect short messages shared on the Twitter platform, recognized as tweets. This article aims to conduct a sentiment analysis of the cryptocurrency market and Blockchain technology using a series of 5,000 such messages and a lexicon-based approach. A comparison of the sentiment extracted with the help of three of the most popular lexicons (NRC, Bing and Loughran) will be also exposed.*

Keywords: Sentiment analysis, NLP, cryptocurrency market, blockchain, lexicons

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APPLICATIONS THAT USE RECURRENT NEURAL NETWORKS (RNN) AND THEIR IMPACT ON PEOPLE'S LIVES

Ionuț-Alexandru CÎMPEANU, *Bucharest University of Economic Studies*

Abstract: *Human intelligence has no limits and constantly impresses with innovative solutions that increase in complexity, applicability, efficiency. Over time, a lot of smart applications have been substantially improved by including artificial neural networks. Thus, they came to perform tasks that only humans could accomplish. Other smart applications made decades ago are the starting point for other more complex smart solutions in which researchers have in-vested time, money, courage, patience, desire for progress and knowledge, research. In this paper we highlighted the importance of using recurrent neural networks, we exemplified the use of recurring neural networks in two applications in different fields of activity, we listed the benefits that can be obtained by using applications, the limits of artificial neural networks, the need for human intervention to obtain desired results. My work is inspired by the recent development in neural translation using the attention mechanism in order to learn long sequences and improve the performance of translation from one language to another. Using this approach, I set out to provide arguments to highlight the effectiveness of implementing solutions based on artificial neural networks, but also the fact that in all intelligent solutions based on this network and which have been created so far, the human factor is indispensable.*

Keywords: Recurrent neural networks, sequence-to-sequence, google neuronal machine translation, long short-term memory.

MODELLING THE PRICES VARIATION OF AGRICULTURAL PRODUCTS ON THE STOCK MARKET USING EVOLUTIONARY APPROACH

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Bogdan BOLDEA, *West University of Timisoara*

Abstract: *The dynamics of the Stock market can be affected by many factors that include the adaptive reaction of the sales agents. In this context, the application of adaptive algorithms inspired by nature can help to identify patterns and business strategies that increase the real benefits of the main suppliers of consumer goods. The paper proposes a new method to*

simulate the variation of the prices of agricultural products on the Stock market, using an evolutionary adaptive model of concurrent sales strategies. The results of the simulation show that the greatest real benefits are obtained in the short term using low mutation / innovation rates and rather combinations of the successful sales strategies of competing companies.
Keywords: Evolutionary algorithms, Co-web models, Stock market

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THE TRENDS IN CYBERSECURITY MATURITY MODELS

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Abstract: *Requirements in cyber security for organizations from critical infrastructures or specific domains are not a novelty. Industrialized and developed countries enforce strict cyber security controls for institutions from financial, healthcare or defense domains. Theoretical or practical models that support the evaluation process for cyber security stance, as well as compliance with national or organizational controls, are becoming more common. The use of models can be driven by a number of factors, ranging from national regulations, economic benefits, up to the efficiency and standardizations aspects. From a practical standpoint it is much more efficient to use a publicly vali-dated model developed rather that develop individually a new model. In this paper we review current models that are used for evaluating cyber security controls in organizations that are part of the critical infrastructure domain. Via a comparative analysis we identify the peculiarity of publicly available models. We compare the results against a model that we have proposed for assessing cybersecurity maturity in critical infrastructures. We highlight the differences and common factors between these models, as well as identify current trends in the development of such models.*
Keywords: Cybersecurity, Maturity Model, Critical Infrastructure, Comparative Study.

ORACLE MACHINE LEARNING – FEATURES AND USE CASES

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Abstract: *This paper introduces the impact of Oracle machine learning on competitive business environments and continues with an overview of Oracle Machine Learning (OML) features. I described the benefits and importance of OML notebooks for data scientists and data analysts and continued with the automatic processes offered by the AutoML feature. For the OML for SQL(OML4SQL) section I emphasize the importance of OML Scratchpad (tool for SQL and PL/SQL query manipulation), the presence of execution plans, keyboard shortcuts, and SQL options (query cancelation, coloring the SQL code). Within the OML for Python (OM4Python) paragraphs I have exposed the in-database machine learning algorithms, the included Python libraries in the OCI platform. In the use case section, I have built a classification model using the OML4SQL and AutoML features and observed that the results are very similar for both scenarios, and this result will give me confidence to further use the OML features*

Keywords: Oracle Machine Learning, features AutoML, OML4SQL, OML4Py, uses case, classification.

CHALLENGES TO DEMOCRACY: ATTITUDES TOWARDS THE JANUARY 6TH EVENTS AT THE CAPITOL ON SOCIAL MEDIA

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Abstract: *On January 6th, 2021, a group of protesters contesting the results of the 2020 US Presidential election laid siege to the US Capitol Building in Washington, D.C., resulting in several deaths, hundreds of injuries, property dam-age, the temporary interruption of the certification of Electoral College votes by Congress, and, ultimately, in the second impeachment of former US Pres-ident Donald Trump. Users on social media platforms have reacted by posting messages expressing their feelings towards these events, supporting or rejecting the actions of the protesters. The present paper aims to analyze the opinions the public posted on social media with respect to the incident, and their evolution over time. For this purpose, we gathered a dataset containing*

50,618 English-language tweets posted during two periods: January 2021, when the original events took place, and January 2022, when the incident's first anniversary prompted renewed interest on social media and among wider society. We train several machine learning and deep learning algorithms and use the best-performing model, RoBERTa, to carry out stance analysis on the dataset, classifying each tweet as neutral, in favor, or against the actions of the Capitol rioters. We then use the NRCLex emotion lexicon to identify emotions expressed for each class, comparing the evolution of opinions over the two periods. The results we present can be useful for social media stakeholders, government regulators, and the general public in order to better understand the relationship between social media communication and the political system, as well as highlight the threat posed to democracy by in-creasing political partisanship and polarization.

Keywords: social media analysis, stance analysis, natural language processing, machine learning, Capitol riot.

ISSUES IN PARTICIPATIVE HUMAN-CENTRED ALGORITHM DESIGN

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Abstract: *Human-centred Algorithm Design (HCAD) holds the potential to improve machine learning outcomes and interpretation by including human and social considerations throughout the algorithmic design process. The purpose is to mitigate unintended, negative social biases that algorithms have been shown to generate, ever more important in situations using automated algorithms or black box models. HCAD suggests designers 'slow down, to speed up' and consider more than just performance metric refinement as a measure of success. In particular, participatory methods can support improved outcomes, via diverse perspectives and domain expertise inculcated into design processes. This paper explores the benefits of participatory HCAD, as well as several practical issues encountered when developing algorithms with unique social interpretations. It adds to the cache of knowledge in embryonic HCAD by interpreting the theory of participatory methods in an applied setting. The paper is novel as well as original, in that an Aotearoa New Zealand perspective was used. We find that participatory*

HCAD leads to pre-processing conversations data scientists must undertake to hone their skills and build capabilities that are truly needed, so that algorithms may create outcomes that are human-centred and more beneficial.
Keywords: Human-centred Algorithm Design, Participatory, Social Bias

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WEB-BASED MACHINE LEARNING SYSTEM FOR ASSESSING CONSUMER BEAHVIOR

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Abstract: *This paper introduces a new web-based system to automate the use of ma-chine learning techniques to support decision makers in identifying and assessing consumer's behavior. Customer retention is one of the main pillars of business development in the competitive market, and the timely identification of factors that influence customer opinions is a topic of real interest for both business and academia. Seven machine learning classification methods were applied and evaluated on an established dataset aimed at understanding the behavior of the consumer of banking services. A new web application was developed to automatize the assessment of implemented techniques and reveal the optimum one, in terms of performance, by fine-tuning the parameters of the selected models. This solution can be successfully applied on other datasets gathered to better target the marketing campaign and prioritize the promotion to customers who have a high potential to hire a new service or purchase a particular product.*

Keywords: Machine Learning, Consumer Behavior, Telemarketing, Web Application.

FROM DIGITAL ECONOMY TO GLOBAL ECONOMY. A CYBERNETICS APPROACH

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Nora CHIRIȚĂ, *Bucharest University of Economic Studies*

Abstract: *The Digital Economy is a new form of economy that has grown rapidly in recent years, becoming a real oxymoron for more and more specialists. In this research we aimed to make a systematic review of the existing literature in the field, to present the differences between digitization, digitalization, and digital transformation and to defining the Global Economy as a Cybernetics System in the Digital Age. Moreover, we will investigate what was the role of the COVID-19 pandemic in accelerating the digitalization of the Digital Economy and what could be the future post-Covid-19 actions of the digital transformation.*

Keywords: Digital Economy, Global Economy, Cybernetics System

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MODELS FOR IDENTIFYING PRICE BUBBLES IN THE FINANCIAL MARKET: THE SCIENCE OF BUYING CRYPTOCURRENCY

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Ștefan IONESCU, *Bucharest University of Economic Studies*

Abstract: *Because virtual currencies are regarded as a speculative means, the purpose of the paper is to investigate methods and algorithms in order to test hypotheses of price bubbles existence on this market because investors are very interested to know key moments of buying and selling these currencies, which are very important to obtain a desired return. The investment strategy depends on these two moments because in the cryptocurrency market, the price bubbles on this market are common and the moment of their development dictates whether or not an investor should buy. Daily data of prices covered the period January 2019 – January 2022. Using the Exponential Curve Fitting (EXCF) method and the Generalized Supremum Augmented Dickey-Fuller (GSADF) test, we have shown that a rising price trend for all 3*

currencies does not exist at the moment of the analysis, indicating a possible decrease in price in the following period. Also, the value at risk have been exceeded in the last period of the analysis for all currencies, which may have indicated a suboptimal investment period. Using Game Theory, the Nash equilibrium for the (short term) investment strategy is formed when both the investor and the market are optimistic about the value of cryptocurrencies. Optimizing the conditional value at risk (expected shortfall), a portfolio was found that consists only of Binance coin. The mathematical method found that Bitcoin was not necessary the most profitable investment from the data studied, despite of the level of maturity of this currency.

Keywords: Cryptocurrencies, EXCF, GSADF, Investment Strategy, Cybernetics Theory

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MULTIMODAL GLOBAL OPTIMIZATION, FUZZY ASA AND SPACE-FILLING CURVES

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Luiz Flavio AUTRAN MONTEIRO GOMES, *Ibmec, Brazil*
Maria Augusta SOARES MACHADO, *Fuzzy Consulting Ltd, Brazil*

Abstract: *In this paper the general problem of multimodal global optimization of numerical functions defined on subsets of Rn is investigated, and a new approach for its solution is proposed through a multistart version of Fuzzy Adaptive Simulated Annealing. It is shown that it is possible to obtain even better results by using deterministic initialization with space-filling curves by launching several independent threads of optimization based on the selected method, departing from points obtained in the preliminary phase. As it is shown from the numerical results from various simulations with different test functions, the proposed method performed very well in comparison to two other algorithms of current use, indicating a potential opportunity to boost the performance of other computational paradigms. The final set of results produced by this procedure proves to be very effective, representing an attractive alternative to population-based approaches, with the outstanding feature that the framework corresponding to simultaneous execution of Adaptive Simulated Annealing-based optimization threads is easy to implement, not demanding a large programming effort, in terms of the synchronization apparatus.*

Keywords: Fuzzy Adaptive Simulated Annealing; Space-filling curves; Multimodal optimization; Ergodic Theory; Computational intelligence.

METRICS FOR EVALUATING CLASSIFICATION ALGORITHMS

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Florin-Daniel MILITARU, *West University of Timisoara*

Abstract: *One of the most important topics in machine learning is how to evaluate the models, that means to measure how accurately they predict the expected outcome. In addition to accuracy, there are a number of other metrics for evaluating classifier performance. Model evaluation is introduced in a prediction framework that is implemented using automated machine learning. The performance metrics are calculated for each classification model generated for our analysis. Unlabeled data gathered using a 360-degree evaluation form goes through a clustering process before being analyzed by classification. The most performant classifier is identified through model evaluation, and a detailed metrics analysis is performed.*

Keywords: Classification algorithms, CatBoost classifier, Classification accuracy

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BIG DATA AND MACHINE LEARNING. DIFFERENT INDUSTRY CHALLENGES

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Georgiana STĂNESCU (NICOLAIE), *Bucharest University of Economic Studies*
Andreea-Maria COPĂCEANU, *Bucharest University of Economic Studies*
Andreea-Alexandra CÎRNARU, *Bucharest University of Economic Studies*

Abstract: *Big data, along with Machine Learning are an important part of today's industry. This article aims to create an overview over Machine Learning applicabilities in different economic sectors. In this paper, Machine Learning methodology has been applied on a time series dataset that contains traffic information with the purpose of performing a predictive analysis. Two algorithms were trained (Linear Regression (LR) and Random Forest Regression (RFR)) in order to find the one that provides the best result.*

Keywords: Big Data, Machine Learning, industry, managed data, predictive analysis.

INTERCHANGING DATA JAVA-PYTHON WITH APPLICATIONS IN MACHINE LEARNING SOLUTIONS

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Claudiu VINȚE, *Bucharest University of Economic Studies*
Cosmin PROSCANU, *Bucharest University of Economic Studies*

Abstract: *There is a great variety of programming languages available nowadays to ap-plication developers for a multitude of purposes. Choosing a certain programming language for a specific task is a process based on multiple factors, such as the application domain, the goal intended to be achieved through the software solution, the familiarity of the team members with the associated technology, the set of additional tools available, such as libraries, packages, and other third-party components, platform compatibilities, corporate strategy regarding the reliance on a given technology, and many others. When it comes to the development of machine learning solutions, most studies show that Python is the most popular language. Python has a well-earned reputation for excellence in AI / ML programming. It is almost implicitly associated with this field. However, developers use multiple programming languages to tackle AI and ML projects, as part of a multilingual environment, or to meet specific needs in projects where the AI or ML components are only parts of the whole. In this article, we propose two solutions to use Python code in Java applications for interchanging data: by intra-process communication, using standard input / output channels, and by communicating via TCP / IP sockets, at inter-process level.*

Keywords: Java-Python data interchange, intra-process communication, TCP / IP sockets.

PERSPECTIVES OF CRYPTOCURRENCY PRICE PREDICTION

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Dominic BUCERZAN, *University of Arad*
Mihaela Daciana CRĂCIUN, *University of Arad*

Abstract: *Cryptocurrency is a relatively a young research field. Since its development, when Bitcoin was lanced (2008), until today it become a highly volatile market with more than 9 thousand types of*

cryptocurrencies. In latest years several algorithms and techniques have been developed in order to predict the cryptocurrency price evolution. However, a general classification of the available methods has not been proposed yet. For these reasons, in this paper the main ideas underlying cryptocurrency price forecasting are presented and compared. In the first part of the paper is presented the general framework of cryptocurrency development, namely Blockchain Technology and e-Business social environment. In the second part several techniques for cryptocurrency price prediction are presented and their main characteristics are discussed. The last section concludes.

Keywords: Bitcoin, Price Forecasting, Blockchain, Cryptocurrency.

SENTIMENT ANALYSIS ON SHORT TEXTS: THE CASE OF THE ROMANIAN LANGUAGE

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Gheorghe Cosmin SILAGHI, *Babes-Bolyai University, Cluj-Napoca*

Abstract: *Falling under the umbrella of Natural Language Processing, Sentiment Analysis represents a tool to investigate humans' emotions and opinions as revealed by their writing and a mean to evaluate the maturity of language resources and computational models developed with respect to a specific language and communication context. Models developed for sentiment analysis over various sorts of English texts proved to reach a very good performance, such that obtained results are further used in social science research and in practical business setups. But, for low-resourced languages like Romanian, maturity of recently developed resources like lexicons or pre-trained language models is still not well demonstrated. In this article we approach the problem of polarity inference on product reviews collected from the biggest online shopping platform operating in Romania. Our purpose is dual: to construct a good-accuracy classifier such that to automatically infer the polarity of a given review and to evaluate the maturity of existing language resources, questioning whether they could enhance the performance of various deep learning methods. Working with the most popular document representation strategies, namely bag-of-words and words embeddings, we test various classical Machine Learning methods like Bernoulli Naïve Bayes, Random Forest or Support Vector Machines and novel Deep Learning methods like densely connected neural networks, convolutional neural networks, and recurrent neural networks (long short-term memory and Gate recurrent units). We try some word embedding developed for the Romanian language like FastText or the*

Romanian DistilBERT, evaluating the degree they enhance the performance of the resulting CNN, LSTM or GRU models over our dataset. For all indicated methods, we describe the processing pipeline from raw text to the automatic sentiment detection. We contribute the scientific literature by providing a novel dataset in the Romanian language of reasonable size to be used in further NLP analyses, similar with other existing ones in English, and by evaluating the maturity of some pre-trained embedding resources for Romanian with respect to the most important deep learning approaches for text classification.

Keywords: Sentiment analysis, Romanian language, Short text, Classification, Machine learning

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CREDIBILISTIC VALUATION OF MERGER AND ACQUISITUIN TARGETS WITH FUZZY REAL OPTIONS

Jani KINNUNEN, *Åbo Akademi University, Finland*
Irina GEORGESCU, *Bucharest University of Economic Studies*

Abstract: *Fuzzy real options modeling has developed greatly in the last decade. Fuzzy real options are for real investments what financial options are for investments on financial assets. Main differences from the valuation perspective include, e.g., that real investments are often unique, and their real option value cannot be derived from market data. The valuation of real investments typically uses investors' in-house knowledge, which can be combined with real-time market data. The investor in our case is an acquiring company with a task to ex-ante evaluate potential acquisition target companies for which the acquirer obtains real options to create value through managerial flexibility arising from the merger and acquisition process, where strategic and eco-nomic capital of the acquired and the target company are put together. In this paper, we extend the credibilistic fuzzy pay-off method to interval-valued fuzzy trapezoidal numbers with an optimism-pessimism measure and discuss how it can be integrated to a digital coaching tool developed by the authors. We demonstrate through a numerical example with R code how the method can be used in valuing corporate acquisition targets with real options available to an acquiring company together with an optimism-pessimism level of analysts about the value-creation through managerial actions.*

Keywords: Credibility theory, Optimism-pessimism measure, Real options, Interval-valued fuzzy numbers, Mergers and acquisitions.

A STUDY ON THE SYSTEMATIC IMPORTANCE OF MAJOR BANKS IN CHINA

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Abstract: *In recent years, the outbreak of the global financial crisis has made people aware of the threat of the existence of systemic risk to the financial system. In the financial system, there are some banking-type financial institutions that have a pivotal position due to their large scale and other reasons and have a greater influence on systemic financial risks, so the identification and supervision of such financial institutions are very important. In China, banks occupy an important position among various financial institutions, and the main content of this paper is to identify the systemically important banks in China. In the research process, we refer to international disclosures and previous studies to determine the assessment models for different types of banks, then substitute the data of selected institutions to derive their systemic importance scores, select the threshold values to identify systemically important banks, explain the assessment results, and finally propose policy recommendations based on the assessment results.*

Keywords: Systemically Important Banks, Indicator Method, Entropy Method.

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