Fakulteta za informacijske študije
Faculty of information studies

ITIS 19
00010011

11th International Conference on Information Technologies and Information Society (ITIS2019)

Book of Abstracts

Edited by Urška Fric

Dolenjske Toplice, Slovenia, November 7–8 2019
Conference organized by the **Faculty of Information Studies in Novo mesto**

Book of Abstracts

Edited by: Urška Fric

Reviewed by: Zoran Levnajić

Published by: Faculty of Information Studies in Novo mesto, Slovenia

For the publisher: Dejan Jelovac, Dean

Design and Typesetting by: Urška Fric

URL: http://itis.fis.unm.si/

Kataložni zapis o publikaciji (CIP) pripravili v Narodni in univerzitetni knjižnici v Ljubljani
COBISS.SI-ID=302685184
ISBN 978-961-93391-6-9 (pdf)

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EDITOR'S NOTE: *Participants were asked to submit abstracts between 400 and 600 characters. Keywords were chosen by participants and their number has not been reduced. Authors of abstracts are responsible for the reliability of contents and other statements made in their work. Abstracts are not proofread.*

CONFERENCE PROGRAMME

Thursday, November 7 2019
20:00 Welcome Dinner in Hotel Balnea

Friday, November 8 2019
9:00–9:10 Opening Address by Dejan Jelovac, Dean of the Faculty of Information Studies in Novo mesto
9:10–10:00 **Keynote Speaker 1: MARK COECKELBERGH**, University of Vienna, Austria: **Artificial Intelligence: Challenges for Ethics and Policy**
10:00–10:50 **Keynote Speaker 2: MARTIN MIHAJLOV**, Ss. Cyril & Methodius University, Skopje, Republic of North Macedonia and Jožef Stefan Institute, Ljubljana, Slovenia: **From Worthless to Valuable: A Brief Introduction in Blockchain Economics**
10:50–11:20 Coffee Break
11:20–12:10 **Keynote Speaker 3: LEO MRŠIĆ**, Algebra University College, Zagreb, Croatia, **Artificial Intelligence: Walking the Line between Creativity, Business Value and Chaos**
12:10–13:30 *Contributed Session 1: Artificial Intelligence in Communication Processes*

- Valerij Grašič (Iskratel d. o. o., Slovenia): **Artificial Intelligence for Real-time Communication when Telcos moving to 5G**
- Blaž Rodič (Faculty of Information Studies in Novo mesto, Slovenia): **Agent Based Modelling of Fake News Dissemination in Social Networks**
- Alenka Trpin, Biljana Mileva Boshkoska and Pavle Boškoski (Faculty of Information Studies in Novo mesto, Slovenia): **Modified kNN Algoritm with Hyperbolic Metric for Face Recognition**
- Nika Mahnič (Festival Grounded, Slovenia): **Artificial Governance: Emerging Technologies in Public Sector**

13:30–14:30 Lunch
14:30–15:50 *Contributed Session 2: Artificial Intelligence in Science and Education*

- Nešad Krnjić and Muhamed Ćosić (University Vitez, Bosnia and Herzegovina): **Information System for Improving the Quality of Education in Central Bosnian Canton in Federation of Bosnia and Herzegovina**
- Juraj Petrović and Predrag Pale (University of Zagreb, Croatia): **Achieving Scalability and Interactivity in a large Enrolment University Course**
- Vladan Rankov (MBS – Modern Business School Belgrade, Serbia): **Information Technology Implementation Examples in Natural and Social Sciences**
- Alan, R. Johnson and Dolores Modic (Nord University Business School, Norway), Borut Lužar (Faculty of Information Studies in Novo mesto, Slovenia), Miha Vučkovič (Logika d. o. o., Slovenia), Borut Rožac (Telekom Slovenije d. d., Slovenia) and Ana Hafner (Faculty of Information Studies in

Novo mesto, Slovenia): **Intellectual Property Linked Open Data: Building Bridges between Science and Business**

15:50–16:20 Coffee Break

16:20–17:40 Contributed Session 3: Artificial Intelligence in Business Sector

- Jurij Urbančič, Urška Starc Peceny and Tomi Ilijaš (Arctur d. o. o., Slovenia): **Tourism 4.0 and Smart Technology Applications in Tourism Industry**
- Ines Isaković (University Vitez, Bosnia and Herzegovina), Lejla Isaković-Dražić (Municipality Bihać, Bosnia and Herzegovina) and Almira Salkič (University Vitez, Bosnia and Herzegovina): **Development of E-Commerce in Bosnia and Herzegovina**
- Ivan Radoš (Faculty of Information Studies in Novo mesto, Slovenia) and Ivona Rados (University of Rijeka, Croatia): **Use of Artificial Intelligence (AI) and Machine Learning (ML) in Car Industry**
- Miljenko Hajnić and Biljana Mileva Boshkoska (Faculty of Information Studies in Novo mesto, Slovenia) and Leo Mršić (Algebra University College, Croatia): **Implementation of Decision Expert (DEX) in the Identity and Access Management of Employees in an Enterprise**

17:40 – 18:30 **Keynote Speaker 4**: **VOJISLAV KECMAN**, Virginia Commonwealth University, USA: **Machine Learning, Artificial Intelligence, New/Old Algorithms** (video lecture)

18:30 Closing Remarks

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Editor's Foreword

The **11th International Conference on Information Technologies and Information Society (ITIS2019)** took place between **November 7–8 2019** in Hotel Balnea in Dolenjske Toplice which lies near Novo mesto in south-eastern Slovenia. The conference was organized by the **Faculty of Information Studies in Novo mesto (FIS)**.

The scientific scope of ITIS2019 event was the rapidly developing interdisciplinary interface between social and computational sciences**.** Specific focus this year was on the nature of artificial intelligence (AI) and both current and future implications/frontiers of its usage in different spheres of society.

We've invited all scientists working in the fields covered by the conference to present their work. Presenters could choose between a short talk and a poster presentation. In a both cases presenters were submitted the title, keywords and the abstract.

On ITIS2019 we've hosted 4 reputable keynote speakers and 12 participants with short talks or posters – from Austria, North Macedonia, Croatia, USA, Slovenia, Bosnia and Herzegovina and Serbia.

Keynote Speaker 1

Artificial Intelligence: Challenges for Ethics and Policy

Mark Coeckelbergh
University of Vienna, Austria

Abstract: Artificial intelligence (AI) invites fear and wild speculations about the technological future. This talk turns away from science fiction and focuses on the real and urgent challenges for society, policy, and business in the near future. Drawing on expertise in ethics of technology and experience with policy advice for the European Commission and the Austrian government, this talk outlines the ethical problems raised by AI and discusses the challenges for policy and innovation. How can we ensure responsibility for AI and promote democratic decision making about the future of human lives and society in an environment pervaded by AI? What are the barriers that need to be overcome? And what does AI ethics mean in a global context?

Keynote Speaker 2

From Worthless to Valuable: A Brief Introduction in Blockchain Economics

Martin Mihajlov
Ss. Cyril & Methodius University, Skopje, Republic of North Macedonia
Jožef Stefan Institute, Ljubljana, Slovenia

Abstract: Blockchain is just one of the many distributed-ledger technologies that first became popular due to the emergence of the Bitcoin cryptocurrency. This has initiated a tidal wave of change in the worlds of both Information Technology and Economic Science, requiring a realignment of the concept of value. This is necessary to determine how investors can place value on computer code, with no central entity or physical asset as a backing support. Drawing insight from the realms of behavioural economics this talk will provide a clear understanding of how a blockchain-based technology can create (and dismantle) value out of "thin air", just like our entire economic system.

Keynote Speaker 3

Artificial Intelligence: Walking the Line between Creativity, Business Value and Chaos

Leo Mršić
Algebra University College, Zagreb, Croatia

Abstract: Delivering on its strategy on artificial intelligence adopted in April 2018 today the European Commission presented a coordinated plan prepared with Member States to foster the development and use of artificial intelligence in Europe. Commission in four key areas: increasing investment, making more data available, fostering talent and ensuring trust. Complementing national investments, the Commission will invest €1.5 billion by 2020, 70% more than in compared to 2014–2017. For the next long-term EU budget (2021–2027) the EU has proposed to invest at least €7 billion supported by various project lines. A recent poll completed by Tata Consultancy Services focused on the current and future impact of AI, shows that 84% of companies see the use of AI as "essential" to competitiveness, with a further 50% seeing the technology as "transformative." Almost all of them believe the greatest disruption by 2020 will be the business implications of AI in every division: whether that's in marketing, customer service or human resources. AI technologies have emerged as transformative tools, spreading across almost all areas of business therefore it's essential to become more familiar with existing and emerging technologies to prepare for the inevitable implications for leadership and management. Lecture will discuss how your company can benefit from AI and how to avoid most common pitfalls learned from real life project and education experience in past years.

Keynote Speaker 4

Machine Learning, Artificial Intelligence, New/Old Algorithms

Vojislav Kecman
Virginia Commonwealth University, USA

Abstract: The seminar has presentation at two levels but before entering the main topics it touches some hot events around the recently very popular area of Artificial Intelligence (AI) first. Next, it presents some commonalities shared by the various well known machine learning tools today which belong to the additive models. This will lead us to discussing similarities and differences between Neural Networks (NN) and Support Vector Machines (SVMs). However, this can't be done without pointing at the different norms used in designing the two models. Why composite norms of the two parts (loss and regularise) are needed will be explained on a very simple example. Finally, we'll point at basic ideas of Deep Learning Algorithms.

Artificial Intelligence for Real-time Communication when Telcos moving to 5G

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Abstract: Existing Telco operators are preparing for 5G, the fifth generation of cellular network technology. It will be based on IMS network, using the cloud, virtualisation and internet of things. We are interested in artificial intelligence regarding RTC (Real-Time Communication) which represents audio, video and text communication in real-time. The options are different and in different fields. We are interested in the role of artificial intelligence today, as well as the possibilities that artificial intelligence opens in the future.

Keywords: 5G, IMS, Real-Time Communication (RTC), Cloud, AI, Telcos

Agent Based Modelling of Fake News Dissemination in Social Networks

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Abstract: Viral spread of digital misinformation has become so severe that the World Economic Forum considers it among the main threats to human society. Misinformation can drive the misallocation of resources during terror attacks and natural disasters, the misalignment of business investments, and can corrupt elections. In order to curtail the negative influence of the fake news as an evolving phenomenon, we should continuously strive to understand it better, and study the mechanisms underlying the rapid diffusion of fake news in social networks. Most of existing research focuses on analysis of large datasets of social network posts to develop statistical models. We attempt to fill the gap in existing research by developing a new, original ABM model to develop and test theories on rules that influence the dissemination of fake news in a social network at the level of individuals. The current state of our research is presented in this talk.

Keywords: fake news, agent based modelling, social networks, viral news

Modified kNN Algoritm with Hyperbolic Metric for Face Recognition

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Abstract: Face recognition has an important role, not only in our personal lives but also in control and safety. Hence a lot of research has been performed in terms of face recognition from different aspects such as neuroscience, psychology, computer vision, pattern recognition, image processing, and machine learning. The process of face recognition requires identification of different facial features that are common for people. In most of the currently available research, those features are captured and defined by applying a distance measure. Most algorithms are based on Euclidean metrics. We propose to use hyperbolic metric, in particular Poincaré metric in the process of image classification based on k-nearest neighbour (kNN). We tested the modified kNN on a set of grayscale images that were obtained on the UCI Machine Learning Repository. The result was that the existing classification machine learning algorithm can be modified with Poincaré metric. The EM algorithm (algorithm based on Euclidean metric) provided the best results when used with the Edge histogram and PHOG filters. The comparison of both classification methods showed that the algorithm PM was better with the BPP filter (for k = 1 the classification was 98.44 %).

Keywords: image classification, k-nearest neighbour, Poincaré metric

Artificial Governance: Emerging Technologies in Public Sector

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Abstract: In the last few years, state control has become increasingly tied to data-driven technologies. My paper will delve into concrete examples of data processes in the public sector in Slovenia and other European countries. It will reflect on the utilisation of AI and emerging technologies in state-citizen interactions. Drawing from organisational strategies and a recognised shift in public policy, I will emphasise the issues related to democratic processes, beyond Cambridge Analytica and interference in elections.

Keywords: AI ethics, public sector, governance

Information System for Improving the Quality of Education in Central Bosnian Canton in Federation of Bosnia and Herzegovina

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Abstract: The educational process, as a basic task of school institution, is a complex and comprehensive process of successful, fast and timely management of information on the course of realization. In this paper, an attempt has been made to find an adequate information model that would serve as an improvement to the quality of the educational and teaching system at the elementary and secondary schooling level of the Central Bosnia Canton (hereinafter SBK / KSB). The starting point of the research and proposed solutions is the legal regulation that regulates this area at SBK / KSB level. On several points of the work, a direct reference to the examples will be given if necessary, to which research has come up with. These examples will be considered from the viewpoint of achieving the goals on which the work focuses. A proposal for an information system model will be presented with the required functionality.

Keywords: quality, education, information systems

Achieving Scalability and Interactivity in a large Enrolment University Course

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Abstract: Scalability, referring to the property of methods underlying assessment and education practices to support an increasing number of students, and interactivity, referring to the possibility for students to actively engage in an educational session, are important, yet difficult to achieve in higher education. The authors analyse, describe their experiences, and report results of using peer review and audience response systems, two specific technologies to support achieving scalability and interactivity in a large enrolment course at the University of Zagreb, Faculty of Electrical Engineering and Computing.

Keywords: peer review, audience response systems, scalability interactivity, large enrolment courses, higher education

Information Technology Implementation Examples in Natural and Social Sciences

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Abstract: Information technologies are crucial in understanding complex data in natural and social sciences. Here are represented two examples of IT implementation, one in medicine and another in psychology. Medical example illustrates benefits of using image processing techniques in gaining a greater understanding of human tissue behaviour under stress. In order to preserve microscopically resolution of larger, possibly whole, sections of a tissue, image stitching and blending were applied. This application in medicine resulted in greater understanding of cancer behaviour in different types of tissue. Implementation of IT in psychology is illustrated through understanding of rodent whisker behaviour in exploration mode. For understanding the whisker movement behaviour in different situations, snout and whisker movement was analysed that enabled building robots with whisking capabilities that help with searching spaces with low visibility.

Keywords: image processing, stitching, blending, multiple object tracking

Intellectual Property Linked Open Data: Building Bridges between Science and Business

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Abstract: Linked open data (LOD) sources, including intellectual property rights (IPR) data, are an important source of information for researchers as well as for technology intensive companies. Our IP LodB project, supported by the European Patent Office (EPO), in part focuses on disambiguation procedures for actor names and organizational affiliations in their patent bibliographic data and matching names and affiliations in scientific publication data. Connectivity between patent bibliography and scientific publication is the cornerstone of our project that aims to contribute to the understanding of innovation processes, from basic scientific research to novel products on the market.

Keywords: linked open data, intellectual property rights, patent bibliographic data, scientific research data, European Patent Office

Tourism 4.0 and Smart Technology Applications in Tourism Industry

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Abstract: Today's tourism industry is one of the world's largest economic sectors, responsible for generating in 2018 10% of the total employment and 10.4% of the whole GDP. However, it has been known for several decades now that tourism can also bring degradation to both the natural and social environment. On the local destination level, these negative consequences include overreach in water consumption and the skyrocket in rental prices for residents. Globally, tourism is also responsible for the emission of 8% of the greenhouse gasses, thus significantly contributing to climate change. However, a proper touristic implementation has the potential to not only provide economic benefits to the local community but also drive the sustainable development of the whole destination. For these reasons, the Slovenian government decided to include tourism into its smart specialization strategy as one of the priority areas for government investment. Hence, the Tourism 4.0 initiative was lunched by the high-tech company Arctur with the goal of establishing a collaboration between all tourism stakeholders in order to position Slovenia as a top destination for sustainable tourism with high economic value. It includes among other a consortium of leading research organizations from the three main Slovene universities, together with top organizations from the industrial sector. The name Tourism 4.0 itself originates from Industry 4.0, the fourth and ongoing industrial revolution which is characterized by smart and autonomous manufacturing process made possible via data exchange and machine learning. Tourism 4.0 aims to improve the efficiency and increase the added value of tourism through creativity and innovation. It recognizes the potential of technologies made available within Industry 4.0 (such as Big Data, Internet of Things, High Performance and Cloud Computing, Artificial Intelligence, Blockchain, Virtual and Augmented Reality) and merges them with the concept of Smart Tourism. The projects main goal is the creation of a Collaboration Platform that will enable communication and collaboration between all the active participants in the tourist ecosystem. This will not only include tourists and tourism service providers, but also the local community and government. Through this platform, data collection, analysis and exchange will be enabled for the needs of strategic activities like resource allocation, optimization of energy consumption, personalized marketing and

tourist dispersion. All of this is aimed at minimizing the negative consequences on the local environment and also improve the tourist experience itself. For this reason, research both basic technology research and experimental testing (through Living Labs) will be carried out by the consortium partners.

Keywords: Tourism 4.0, Industry 4.0, Smart Tourism, Human-Centered Technology

Development of E-Commerce in Bosnia and Herzegovina

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Abstract: With the increase of e-commerce, distinctive buying patterns and preferences have emerged for specific groups as well as for the customers on the different demographic locations in Bosnia and Herzegovina for the last several years. Since e-commerce is still a relatively new trend in Bosnia and Herzegovina our aim was to collect enough information and to determine the patterns in order to understand how consumers connect with the new technology. The globalization has been one of the most prominent phenomenon of the 20th century which has dramatically shaped the world's economy. The globalization process is followed by the elimination in administrative barriers for trade, the development in information and communication technology which all have allowed the development of the new investment opportunities by expanding onto additional markets, and by accessing new raw materials and resources. These are the reasons for the creation of this paper on e-commerce which will explain all the benefits and help needed for Bosnian citizens to keep the pace with the rest of the world. This paper will focus on how e-commerce progressed in Bosnia and Herzegovina, as well as, how it has impacted economic development in Bosnia and Herzegovina.

Keywords: E-commerce, online shopping, mobile commerce

Use of Artificial Intelligence (AI) and Machine Learning (ML) in Car Industry

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Abstract: In many science fields we are trying to use artificial intelligence (AI) and machine learning (ML) techniques to overcome human limitation of reviewing big junks on data in relatively small amount of time. In this paper, we are trying to find means of live data and how it can be used in forecasting tools. Idea of this paper isn't to pick up random parts of data and putting them through linear regression (which we can find in many tools today). Finding relevant patterns in user behaviour in one of biggest market niche that is in EU can bring us closer to better understanding of market needs. Using example of car industry, we have examined behaviour of more than 10.000 users in 5-year period. Already we have found some patterns that can be use in future understanding of customer needs. Using data at hand, we can see that distance from buyer home to seller is in correlation within funds that buyer is willing to pay a product (car). The coefficient of the distance variable is significant (through out of observed years) and positive, that is, by increasing the distance by one second, the price increases (from 63 lipas to 1.10 kuna; depending on the years). The coefficient of the "gender" variable is always significant and positive, indicating that on average, men buy more expensive cars than women (Man use the online option of buying a car more. About 80% of the sample are men, but there are slight variations over the years.). The inclusion of additional variables in the model (car length and total consumption) has a significant impact on the result of the estimated coefficients (gender is significant only in 2018, while the distance in seconds is only significant in 2014 and 2016). Compared to previous models and the explicit power of the model (The coefficient of determination increases from an average of 2% to an average of 30%. It is also evident that car length has the greatest impact on prices (nothing new, as expected), while consumption has a negative effect. The increase in fuel consumption of one litter affects the average decrease in the car price of HRK 5.359. Further data analysis will be introduced as final result of data study. Once all key parameters are introduced, we can start profiling agents for future ABM testing. Idea is to

create a method which will guide company through a complex network of data, find a pattern within current customers and give key parameters for simulation modelling. Validity of data can be tested with agent-based models and compare with historical data of company.

Keywords: AI, ML, Car industry, ABM

Implementation of Decision Expert (DEX) in the Identity and Access Management of Employees in an Enterprise

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Abstract: Choosing appropriate criteria for assessing the knowledge, education and skills of potential candidates for a job and recruiting candidates as a company workforce could be a difficult and long-lasting task where is no guarantee that the competition conditions and expected goals will be fully met. Although, the selection and testing of candidates are not simple tasks, they are also a significant challenge for people in charge for candidate selection. Each process has its cost of ownership for the company, and the process which is slow and last long is expensive and less effective for the company. How to choose an adequate person who possesses the necessary knowledge, skills and predispositions, to a new, free position in the company? How to choose an appropriate replacement of worker in the workplace which requires a periodic replacement of worker? How to choose a person who can temporarily and sufficiently perform certain business tasks, using specific knowledge and skills, initiated by business dynamics of a company? What characteristics of the person are more important for selection purpose of a potential candidate for the job? We have tried to achieve answers to these questions by conducting research. Future article will describe research process, results, conclusions and proposed multicriteria decision analysis as an auxiliary tool to carry out the best answers to previous questions caused by business dynamics. The Decision EXpert (DEX) method for decision support system (DSS) was used in this research. The main reason of using a qualitative method in this research is the fact that certain characteristics of person or organizational unit and the impact of these characteristics on the final decision are better defined by words than numbers. One of the DEX method's popular feature is ability of use qualitatively explained input values of person's characteristics, e.g. bad, good, very good and excellent. All characteristics of person, used for evaluation in appropriate candidate selection process, are grouped according to significant entities and organized into a hierarchical tree where

the root of the three represents the input value of each individual characteristic, and the trunk of the three represents the result, the output value generated by decision rules used in the model. Our decision support operating model is not universal for all companies. It must be configured separately due to the specific conditions each company has. Once defined DSS model becomes the foundation of an automatized process of candidates' evaluations and selection proposals that significantly accelerates selection process and thus generates significant company operational savings.

Keywords: decision support, identity and access management, human resources management