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ABSTRACTS

(in order of the conference programme schedule)

Keynote: ROGER GUIMERA, *Rovira i Virgili University, Tarragona, Catalonia*

Title: Social networks: From description to prediction using network inference

Social actors interact with each other through complex networks that are neither perfectly regular nor completely random. Social scientists have studied these networks for over half a century, but only recently, with the advent of information and communication technologies, have we been able to systematically and quantitatively explore the large-scale structure social systems. So far, most of this research has been descriptive, that is, it has focused on describing the structure of social networks. In the last few years, however, we have developed network models that are amenable to statistical treatment and that enable us to be predictive, that is, to make quantitative predictions about the structure and evolution of social systems. In our talk, we will discuss some of these approaches to network inference. We will also discuss how these approaches can be applied to problems as diverse as the prediction of conflict within work teams, the prediction of decisions of judges, or the prediction of user ratings on movies and books.

Keynote: LUDO WALTMAN, *Leiden University, Leiden, Netherlands*

Title: Comparing scientific performance across disciplines: Methodological and conceptual challenges

Quantitative measurement of scientific performance has become a pervasive phenomenon. Research institutions are benchmarked in university rankings, individual researchers are compared using h-indices and other similar types of metrics, and scientific journals compete with each other to have the highest impact factor. What is the scientific basis of these different approaches to the measurement of scientific performance? Do these approaches really allow us to make meaningful statements on the performance of journals, institutions, and individual researchers, even if they are active in different scientific fields with different publication and citation practices? In my talk, I will critically reflect on commonly used metrics of scientific performance, and I will illustrate some important pitfalls in the use of these metrics. I will also show a number of more advanced approaches to the measurement of scientific performance. These approaches have been developed by bibliometric research centers, including my own center at Leiden University. In particular, I will focus on the CWTS [Leiden Ranking](#), a worldwide ranking of universities based on a sophisticated bibliometric methodology, and the SNIP indicator, an alternative to the journal impact factor developed at Leiden University and available in the Scopus database. I will point out the advantages of these advanced bibliometric approaches to the measurement of scientific performance, but I will also highlight their intrinsic limitations. Finally, based on the recently published [Leiden Manifesto](#) for research metrics, I will discuss a number of good practices in the use of quantitative metrics in assessing scientific research.

Keynote: IGOR MOZETIČ, *Jožef Stefan Institute, Ljubljana, Slovenia*
Title: Social media analytics: The role of sentiment

We present several studies of sentiment analysis, applied to different media (Twitter, Facebook, news and blogs), in different languages, and to different domains. The main issue is to find and quantify a relationship between a social media and another complex system. We combine text mining, network analysis and standard statistical methods to uncover and highlight important relations between different systems. In particular, we will demonstrate the role of sentiment in monitoring of political elections, detecting abnormal returns of stocks, spreading of conspiracy theories, identifying influential communities and their leaning towards environmental issues, ranking and mapping emojis by their sentiment, comparing everyday to major news events, and finally, in the evolution of the recent refugees crisis in Europe.

Keynote: MARKUS ABEL, *Ambrosys GmbH, Potsdam, Germany and Potsdam University, Potsdam, Germany*
Title: Machine Learning for power production forecast

In recent years big data and machine learning have buzzed around the world. Methods have been designed by global players, in particular for semantic analysis of data. These methods can be used for numerical data, too, which are often not big, but meaningful. The presented approach is to use machine intelligence paired with physical insight in the systems considered. As an example, it is shown how a forecast system can be designed based on good features and suitable methods. A special challenge is the spatio-temporal analysis of data: one has to reduce the possible “words”, i.e. temporal sequences from different locations to useful “words”, i.e. few sequences which characterize a certain property of the system considered – a kind of clustering is required. We use facts known from turbulence theory to identify good features for wind energy data. Our focus lies on symbolic regression methods and stochastic modeling, but a set of other methods are used for comparison.

Mirna Macur, National Institute of Public Health: On-line gamers in Slovenia – are they addicted?

Use of IT brings a lot of benefits to our everyday lives, however extensive use of Internet may be damaging. Use of Internet for on-line gaming is very popular not only among children and teenagers, but also among adults and this activity is not just harmless. Researchers found excessive on-line gaming as one of so-called behavioral (non-chemical) addictions and continuous research in this field contributed to inclusion of Internet Gaming Disorder in the appendix of the Diagnostic and Statistical Manual of Mental Disorders DSM-5 (American Psychiatric Association, 2013) as condition that requires further empirical and clinical research. Other excessive online activities not involving the playing of online games (e.g., excessive use of social media, such as Facebook; viewing pornography online) were not included in the appendix due to the lack of sufficient research in this area.

Our research focused on motives for on-line gaming (27 items revealing 7 different motives for gaming) and problematic use of Internet. Research was on-line because it was for gamers themselves, who are at least 14 years old. On-line questionnaires were active from June to October 2014, promoted through Slovenian gaming sites, students' organisations, faculties and friends. 784 people completed the questionnaire. The strongest motive for on-line games in Slovenia is recreation (gaming for them is entertaining and they enjoy gaming), followed by coping (gaming helps them get into a better mood, it also helps them get rid of stress) and competition (they enjoy competing with others, they like to win).

Since on-line gaming can become an addiction we calculated number of problematic Internet users. Internet addiction is a heterogeneous concept. According to Griffiths (2000) researchers have to differentiate between dependence on the Internet, and dependence to the Internet. He argues that a majority of individuals presenting with problematic Internet use are simply using it as a medium to fuel other addictive behaviours such as cybersex addiction or gaming or gambling. Problematic Internet Use Questionnaire (PIUQ-6) (Demetrovics et al. 2015) was used and revealed that 37% of Slovenian gamers are problematic Internet users. This share is very high because we know from representative Slovenian study in 2014 there is only 3,8% problematic Internet users among adult population (age 15 years and more). On-line gaming is addictive and Slovenian gamers are at risk of being and becoming problematic Internet users whose characteristics are (Griffiths, 2005): (1) salience, (2) mood modification, (3) tolerance, (4) withdrawal, (5) conflict and (6) relapse. Problematic Internet users among gamers are younger than nonproblematic ($t = 3,413$ $p=0,001$); but we can see no other differences between gamers who score as problematic or as nonproblematic Internet users (gender, educational level, marital status, work and employment status, motives for on-line gaming). However we have to stress that on-line gamers are dominantly males (77,6%), single (61,0%), don't have a job (50,2%), 47,0% of them study, their average age is 23,11 years (std.dev. = 8,012; min 14 years; max 74 years).

One out of three Slovenian on-line gamers is problematic Internet user, whereas in general Slovenian population only one out of 26 is problematic Internet user! Special attention is needed for this population to prevent them develop loneliness, low self-esteem and addiction.

Bogdan Filipič, Jozef Stefan Institute: Evolutionary Multiobjective Optimization in Engineering Design

Optimization can be viewed as the process of finding the best (or sufficiently good) solution to a given problem. It assumes the problem definition includes an objective function that evaluates the quality of candidate solutions. However, real-world optimization problems often involve not only one but several objectives that are typically in conflict. For example, designing a new device, an engineer strives to maximize its performance and minimize the costs of its operation. In such cases the objective function is formally a vector function, and the problem solving process is known as vector optimization or multiobjective optimization.

Traditionally, multiobjective optimization problems have been approached by first transforming them into a single-objective form (for example, by composing a weighted sum of the objectives) and then solving them by suitable single-objective methods. A more advanced technique, known as the ideal approach to multiobjective optimization, is based on the notions of Pareto dominance and Pareto optimality. Formally, solution x dominates solution y if it is better than y in at least one objective and not worse than y in all other objectives. A solution is called nondominated if no other solution dominates it, and the set of nondominated solutions from the entire solution space is the Pareto-optimal set. Its members represent different trade-offs among the objectives. In ideal multiobjective optimization, the Pareto-optimal set (or its approximation) is first identified and then the final solution is determined by applying additional user preferences.

As the key computational step in ideal multiobjective optimization is finding the Pareto-optimal set, population-based algorithms are natural candidates for multiobjective optimizers. Among them, especially evolutionary algorithms (Eiben and Smith, 2015) have been widely adopted in multiobjective optimization (Deb, 2001). The methodology is being increasingly exploited in science, engineering and business (Knowles et al., 2008).

We present the key concepts of multiobjective optimization and evolutionary multiobjective algorithms and then focus on their application in engineering design. A particular algorithm called DEMO (the acronym for Differential Evolution for Multiobjective Optimization) (Robič and Filipič, 2005) is demonstrated as a design tool in a case study of configuring an energy supply system based on renewable energy sources. The task is to determine the type and number of solar panels, batteries and other system components with respect to two objectives to be minimized, the proportion of unsupplied energy and the costs of installing and operating the system (Filipič and Lorencin, 2012). We show the algorithm is capable of returning a set of trade-off system configurations, providing the user with a better insight into the solution space, and supporting sensitivity analyses for various system exploitation scenarios. We conclude by outlining further challenges in multiobjective optimization in general and multiobjective engineering design in particular.

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Lorena Mihelač, School center Novo mesto: Generating algorithmic composition with computer

I would like to present an example of generating algorithmic composition using a computer. The idea of using algorithms to create some computer-generated songs is based on several years of observation of students and their (in) effectiveness in solving various problems related to school subjects. Even more surprisingly is their relatively weak understanding of the key steps leading to the resolution of a certain problem: or their strategy is either too complex or too flawed.

As algorithm, which can be defined as a set of instructions to solve a specific problem is present everywhere, from shopping in the store, from crossing the road to solving more complex mathematical functions, the author considered the idea to put an emphasis on understanding algorithms and their usefulness by learning algorithms through real life situations and school subjects.

The fact that we can understand algorithms as an extension of our everyday rational reflection process was crucial for the decision to implement them not only in the subject IT, which is a general subject in the first year of the vocational school for preschool education but also in other vocational subjects (e.g. music subject).

The aim of such implementation was to show the students (who do not have specific composers experience or desire), how they can tackle (seemingly unsolvable) problems, such as to write quite simple melody using a simple algorithm, which can be reused for different purposes in their vocational area (preschool education).

Mirna Macur, National Institute of Public Health: Can Internet use become problematic? Evidence from Slovenia

Internet use is part of our everyday lives – private and professional. Data from representative Slovenian sample of adult population (minimum age: 15) show, that 61.2% use Internet every day or almost every day; 11.3% use it at least once a week and 27.5% use Internet less than once a week. Frequency of Internet use strongly depends on the age of the respondent: the mean age of daily Internet users is 38.2 years; of the ones who use it at least once a week is 47.9 years and the ones, who use Internet less than once a week is 64.2 years. Data also reveal that frequent Internet use relates strongly to employment status, since pupils and students use it the most, also majority of employed population, whereas two thirds of retired people use the Internet less than once a week. Unmarried individuals use the Internet more frequently than those married. High educational level is associated with frequent Internet use as well.

These results are expected, however the aim of our study was to explore problematic Internet use (PIU). Despite the fact that the use of Internet is an everyday activity for most people, when taken

to the extreme, it may cause serious harm to the individual and/or to his or her social environment. Although the consensual definition of PIU is still lacking, authors generally agree that the problematic use is clearly associated with indicators of addiction (Spada, 2014). Block (2008) suggested four diagnostic criteria essential to a possible diagnosis of PIU as an addictive behaviour: (1) excessive Internet use, often associated with a loss of sense of time or neglect of basic drives; (2) withdrawal, including feelings of anger, depression and tension when Internet is not accessible; (3) tolerance, including the need for better computer equipment, more software, or more hours of use; and (4) adverse consequences, including arguments, lying, poor school or vocational achievement, social isolation, and fatigue. According to Griffiths (2010) researchers have to differentiate between dependence on the Internet, and dependence to the Internet. He argues that a majority of individuals presenting with PIU are simply using it as a medium to fuel other addictive behaviours such as cybersex addiction, on-line gaming or gambling. Griffiths (2010) also argues that some behaviours engaged on the internet (e.g. cybersex) may be behaviours that the individual would only carry out on the Internet because the medium is anonymous and disinhibiting.

Our study used Problematic Internet Use Questionnaire Short-Form (PIUQ-SF-6) (Demetrovics et al., 2015) on representative Slovenian sample created by Statistical office of the Republic of Slovenia and carried out by National Institute of Public Health. Data show that 3.8 % of adult population (minimum age: 15) are problematic Internet users. Percentage among adolescents is much higher – 15.5 % of those between 15 and 24 years old are problematic Internet users, 6% of those between 25 and 34 years old; whereas the percentage of PIU in age group 35 – 44 is 2.7% and in age group 45 and more is only 0.7%! PIU in Slovenian population also heavily depends on employment and marital status; PIU is typical for students and pupils (15.4%), unemployed (6.8%), unable to work (7.7%), and single (8.1%).

We should become aware of the problems that frequent Internet use causes to those, who cannot control its use and suffer from negative consequences of Internet use in daily lives. One out of 26 Slovenian adults suffers from problematic Internet use, whereas 3 out of 20 Slovenian adolescents (15 to 24 years old) suffer from problematic Internet use. Prevention programs and treatment for those affected are paramount, especially for the young generation.

Boštjan Delak, ITAD Ljubljana: The Data Ownership – Lack of Awareness or Incomprehension

Nowadays, many organizations faces the issue of defining the responsibilities and obligation for data ownership. But what is the data ownership? The Merriam Webster definition of ownership is: “the state, relation, or fact of being an owner” and definition of data is “factual information (as measurements or statistics) used as a basis for reasoning, discussion, or calculation”. Issue of appointing and daily operation of the data ownership last for decades. Some areas have made a huge development of this role, especially area related to patient health records and data. In practice, at the IS auditing activities, we are often dealing with challenges as audited companies have not appointed such a role, and this shortage is reflected by several issues in their daily operations and are consequently increasing companies’ operational risks. In matter of fact, it is a data governance issue, appointing data ownership who manages data privacy control over the data. We know the different types of data: analytical, financial, scientific, personal, patient, rough etc. These are all similar data, but with their different values to companies and society. The most important part of

data assessment is data classification. Special treatment regarding data ownership reserved patient health data and other personal identified information, which are usually protected by country legislation. There is another issue, with data ownership of the research activities, where scholars daily delivered many analysis with the results, which are data at the end. Our motivation is to find out how the science, scholars and researchers have dealt with data ownership issue, to review the scientific literature for this issue and identify possible approaches and methods on how to implement data ownership. Research hypothesis is: “There are well known approaches and methods how to efficiently implement data ownership role within the company”. On the other hand practitioners used other methods, standards and methodologies. ITIL—does not have data ownership role, but is more concentrated on IS processes: ITIL supports process ownership role. Another approach which covers enterprise governance, and not only data governance is the COBIT5 methodology, issued by ISACA and ITGI. COBIT5 describe 37 processes for effective enterprise information technology (IT) governance. Within one of the processes – APO01 – Manage the IT management framework, there is one key management practice defining information (data) and system ownership. The person accountable for setting up this key management practice is a business executive. ISO/IEC issued several standards – one of them is also ISO/IEC 27000 family – dealing with information security management system. The standard provides also the implementation guidelines for ownership of the asset, and one of the most important asset each organization has, is their data. Literature review shown that several papers are describing data ownership for patient data and records within health organization. Another area of research is describing data exchange in potential compensations within consumer organizations. Out of them special issue are travel – transport and tourist organizations with their customer relationship management tools, and data ownership when interorganizational IS are used. Several papers are describing master data management alone or combined with the data warehouse issues. Recently published papers are describing data ownership and data privacy more concentrating to their roles within cloud computing. Few papers are describing the data ownership of the data as outputs from science researches and analysis. Brief analysis of science, literature shown that there is no silver bullet definition how to implement data ownership and data ownership continues to be a complicated issue and will likely remain so for the foreseeable future.

Tomaž Aljaž, Faculty of Information Studies: Delivering projects at Warp speed

The question of competitive advantage is key element of every organization. They are aware of this fact and are looking ways how to improve the most rational, the way that will bring the most benefits. Unfortunately, on many occasions adding more resources and / or investments do not results in desired results. The main question arises – How we can improve of management of portfolio of projects because we face several undesirable effects like:

- Many initiatives and / or projects does not meet desired deadlines;
- Many project activities and projects does not meet approved budgets;
- In order to meet desired project time schedule we need to compensate with scope / functionalities;
- Resources are not available when needed;
- Initiatives / projects are confirmed on daily basis (»sooner we approve, bigger chance is to finish on defined deadline «)
- Needed information are not available before work will start (requirements, specifications, processes);
- Many changes and error in final stages of the project.

Based on that organizations are implementing many initiatives that were done in similar or

competitive organizations, but unfortunately do not meet desired results. There may be many reasons for that, including conflict with existing way of managing projects, rules, policies and measurements. As we can see, it is not enough just to implement new initiative into the organization, but we need to know what to change (which part of the organization we need to change and which not), what to change to and how to cause the change. Clearly we can see that we need systematic approach to address these needs.

Every system or organization can be characterized as network of interdependent processes or elements. This means that systems are analogous to chains, or networks of chains. Like a chain, the system performance is limited by the weakest link – constraint. This means that no matter how much effort you put into improving the processes of a system, only the improvements to the weakest link will produce any detectable system improvement. The concepts that address this topic was introduced by dr. Eliyahu M. Goldratt, called Theory of Constraints (TOC). Theory of Constraints provide tools and applications that enable organizations to identify the constraints (or few of them), exploit them and subordinate other based on that decision in order to get the most out of the existing system or organization. When properly addressed, it provides a means to improve competitiveness of the organization and reduce possibilities of competition to enter the market because of:

- Stable, robust and predictable project plans;
- Reduced delivery time of the projects;
- Meet project scope, budget and delivery time;
- Increased number of finished project in monitoring time frame;
- Reduced inventory levels;
- Reduced number of resource and project conflict situation;
- Improved rules, policies and measurements to improve flow of the projects; and
- Improved time-to-market and response to new market demands.

In the presentation we will show major issues running project with shared resources and why traditionally managed projects (usually) do not deliver what was promised. Moreover, we will show and demonstrate tools and applications of TOC that enables improved management of resources, thus providing in majority of cases 95% probability to finish projects on time, scope and budget. We will conclude with example and hands-on experience of multiproject environment using Microsoft project.

Blaž Rodič, Bojana Boh Podgornik, Danica Dolničar, Andrej Šorgo and Tomaž Bartol, Faculty of Information Studies: Information literacy of Slovenian students and attitude towards privacy

The contribution presents the analysis of information security aspect of a information literacy performed of 612 students at six Slovenian faculties enrolled in study programmes of life sciences, health, technologies, education of science teachers, informatics, and management. The results are compared with the results of a study on perception of privacy in social networks performed among a different sample of Slovenian youth. The results show that users indiscriminately add “friends” on Facebook, suggest that users have a limited awareness of the threats privacy in social networks, do not use security mechanisms or they are not aware of them, and assign less importance to privacy in social networks than in the real world, as they are willing to share more personal information in social networks than in random meetings on the street. Most of respondents have no negative

experience with abuse of personal data or harassment in social networks, but a lack of caution in sharing information and disuse of security mechanisms increase the risk of abuse.

Borut Rončević, Urška Fric, Kristina Cigler, Naja Lampe, Martin Gjoreski, Aleš Hočvar, Katja Beg and Maja Zoran, Faculty of Information Studies: Inter-organizational trust and industrial symbiosis – Presentation of results of the project Po kreativni poti do praktičnega znanja

Industrial symbiosis represents a technical, material and social relationship between two or more companies, involved in exchange of waste products, by-products, waste water and energy which are re-used. The purpose of industrial symbiosis is to improve ecologic and economic efficiency by re-using material resources in industrial and non-industrial technological processes (e. g. in agriculture). An important factor in the success of industrial symbiosis is inter-organizational trust – trust among cooperating companies. On the one hand, the key goal of this project was to study industrial symbiosis in Slovenia, which is still in its development phase; on the other hand, we wanted to provide research on inter-organizational trust as one of the sociocultural aspects of industrial symbiosis in general.

Project goals were then divided into three pre-conditional goals we needed to attain before we could finalize the research. The first pre-condition was to determine the presence of industrial symbiosis and its phenomena in Slovenian companies. The other pre-condition was to identify the understanding of inter-organizational trust in companies, which cooperate with other social actors (such as local communities) and economic actors (companies) when performing their primary economic activities. The third pre-condition was to find out how inter-organizational trust interweaves with other sociocultural aspects of industrial symbiosis.

20 Slovenian companies were involved in data collection, out of which 13 had no previous knowledge of the term industrial symbiosis. 9 out of 13 companies had never heard of this term or any similar term, while 2 companies have heard of the term industrial ecology, 2 have heard of the term industrial eco-symbiosis, and 1 company has heard of eco-symbiosis. The rest (7 companies) already know industrial symbiosis either as a term or in practice. When further analyzing the latter 7 companies by subjects, which we had defined from their answers, we found that 1 company performs industrial symbiosis in the form of selling waste products/by-products/waste water; 1 company leases these products; 3 companies are involved in inter-organizational cooperation/projects/other forms of collaboration; 1 company processes waste products/by-products/waste water; and 1 company hadn't explained their activities, related to industrial symbiosis. 16 out of 20 companies provided their interpretation of inter-organizational trust. Analysis of their answers showed that 8 companies refer to inter-organizational trust as trust between economic actors; 2 companies refer to it as cooperation between economic actors; 2 companies as respecting their business partners; and 4 companies see it as the basis/pre-condition for cooperation. 14 companies believe that inter-organizational trust is an essential prerequisite for inter-organizational cooperation; 5 companies don't believe it is necessary; while 1 company failed to answer this question.

When researching inter-organizational trust as one of sociocultural aspects of industrial symbiosis in 20 companies, we found the following facts: for 4 companies (out of 7), who know industrial symbiosis or practice it, inter-organizational trust is a 'very important' factor (measured on a scale

from 1 to 5); 3 companies see it as 'important'. This shows that there is a connection between inter-organizational trust and industrial symbiosis, motivating us to continue our research on the impact of inter-organizational trust on inter-organizational cooperation for the purpose of practicing industrial symbiosis.

The project took place between april and july 2015 and was selected in the 2nd call for tender for funding Po kreativni poti do praktičnega znanja, launched by the Slovene Human Resources Development and Scholarship Fund. The project was funded by the Slovene Human Resources Development and Scholarship Fund and the European Union from the European Social Fund.

Andrej Kovačič and Mateja Rek, Faculty of Media: Online Exposure and Critical Thinking
Results from our national research on media literacy in Slovenia, focusing on online exposure and critical thinking, are presented in this article. We found out that media exposure is changing, as more than eight out of ten Slovenians are daily online in comparison to (only) six which daily watch TV. Interestingly credibility of information on the internet is evaluated higher than that of any other media sources including TV. In the analysis we have also identified important critical skills black spots especially regarding the publication of personal information online. The results of this study call for action in media literacy education and in an increased academic research efforts.

Tanja Miličić and Ana Meštrović, University of Rijeka: Comparison of Language Networks Measures for Legal Texts and Literature

In the last decade we have witnessed tremendous advances in understanding networked systems across a number of disciplines. One of the reasons for this lies in the discovery that for each system there exists a common set of fundamental laws and principles, despite their diversity. Inspired by complexity theory, it is recently acknowledged that human language can be modeled as a complex network and that it shares a number of non trivial statistical patterns such as small world phenomenon, disassortative mixing, power law degree distribution, etc. As the network model of any other type of real-world system, linguistic networks consist of a set of nodes that represent a linguistic unit (e.g. word) and a set of edges representing the pairwise relations between them. Various linguistic networks have already been analyzed, such as word co-occurrence network, syntactic, syllables or semantic networks. In this experiment co-occurrence language network measures from two different categories of texts are compared on a global and a local level. On a global level, we consider average values of a given measure, while comparison on a local level is performed via rank plots. Networks are constructed in a way that words represent nodes which are in turn joined by an edge if they are adjacent in an area between delimiters. All networks are generated as directed and weighted, where weight of a link between two nodes represents overall co-occurrence frequencies of the corresponding words. Our dataset consists of eight texts divided into two categories of four legal texts and four short novellas both written in English. The reason for choosing this particular text types is their obvious structural and linguistic distinction. The aim of this experiment was to investigate how complex network measures operate in different structures of texts and which of them are sensitive to different text categories. The results of our measuring show that there is no uniform rule to differentiate mentioned styles of texts on a global level. However, local perspective rank plots of average node strength indicate that there are structural differences between legal texts and literature.

Ana Meštrović, Slobodan Beliga and Sanda Martinčić-Ipšić, University of Rijeka: Network-based quantification of the scientific collaboration at the University of Rijeka

In this research we examine and quantify collaborative relations between researchers at the University of Rijeka. Today research is product of teamwork rather than of one scientist. The relations between scientists can be easily modeled by using complex networks. Therefore scientific collaboration and coauthorship networks are important to study in the field of scientometrics. A variety of techniques for the analysis of collaboration networks yield insights into its composition and might be used to quantify the scientific collaboration relationships. For the purpose of this experiment we collect the data from the Croatian Scientific Bibliography (CROSBI) which stores scientific papers published in the period from 1997 to the present. We construct networks for eight constituents of the University of Rijeka: Department of Informatics, Department of Mathematics, Department of Biotechnology, Faculty of Humanities and Social Sciences, Faculty of Engineering, Faculty of Civil Engineering, Faculty of Maritime Studies and Faculty of Economy. Then we examine the structure of the collaborative networks both on the global and on the local level. We compare collaboration networks of different constituents and quantify the scientific collaboration of the University constituents and research groups. Of particular interest in this experiment are centrality measures, more precisely we analyze: degree centrality, closeness centrality, betweenness centrality and eigenvector centrality. In this research we are trying to answer the question which centrality measure is the most appropriate to measure the success of the scientific collaboration.

Jože Bučar, Faculty of Information Studies: Estimating sentiment orientation and monitoring sentiment dynamics of the Slovenian News texts

The World Wide Web generates a huge amount of data daily. It has allowed people to express and aggregate their feelings about products, services, events, celebrities more intensively. The understanding and predicting the sentiment change of the public opinions allow organizations to act against negative sentiment, to build strategies with the objective to affect the public opinion. In this talk, he will present computational approach to deal with estimating sentiment orientation and monitoring the sentiment dynamics of the Slovenian News texts, which are enriched with political, business, economic, and financial content from five different web media (24ur, Dnevnik, Finance, Rtv slo, Zurnal24) and were published between September 1st 2007 and December 31st 2013. By annotating a sample of 10.427 documents he obtained an annotated corpus, which was used as a training set to train, test and evaluate classification techniques. The developed tools support monitoring sentiment dynamics of people, places, companies, events, etc. In particular, how did their sentiment reputation change over time in addressed web media. Experiments on his corpus show that the model can achieve above 91% accuracy, when classifying texts into two classes (negative & positive), and above 65% accuracy, when classifying texts into three classes (negative & neutral & positive).

Zvonko Kostanjčar, Stjepan Begušić, Harry E. Stanley and Boris Podobnik, University of Zagreb: A Network-Based Approach to Modeling Market Bubbles and Crashes

Political, social and economic systems are built upon networks of individuals and organizations that mutually compete and cooperate. The underlying mechanisms behind these forces arise from the individuals' specific preferences, and surface in various processes, such as bargaining – which result in deals, trades etc. Although standard axiomatic bargaining theory idealizes the bargaining problem by assuming rationality and complete information, in reality

incomplete information and herding effects shift the outcomes beyond rational levels. This is particularly pronounced in financial systems, where such irrational behavior directly influences financial markets and induces the formation of so-called “bubbles”. Market bubbles are most commonly characterized as states when assets are traded at prices far beyond their intrinsic (rational) values, and often end in abrupt market crashes. The problem of identifying these phenomena and possibly anticipating the systems’ tipping points remains a question of great significance for the entire global economic system.

Here we introduce an alternative bargaining model, based on assumptions of herding behavior in price formation, and cooperation and competition forces within the supply and demand sides. We present networks of mutually competing agents that cooperate with the other side through the bargaining process. Moreover, a feedback mechanism in price formation and trading is introduced by a variable R that accounts for the intrinsic market value and quantifies the degree of market overpricing. As a result, the network structures induce the emergence of bubbles, which, after some persistence, lead to critical shifts in networks and cause the market to crash. Due to the feedback and the complex nature of the system, the tipping points and the extent of bubble persistence are non-deterministic and depend on the changes in the intrinsic values and the variable R . We detect a strong hysteretic behavior of the probability that the market index will drop in the next year, from which we estimate the tipping point. Furthermore, we find that the probability distribution of R has a bimodal shape, which is typical of small systems near tipping points.

The model is used to examine the S&P 500 market index, where the intrinsic price is estimated using a modified free cash flow (FCF) model. Without any fitting, we report that the average value of the ratio between the S&P 500 index price and our intrinsic price estimate is very close to 1, which, given that the S&P 500 is considered an efficient market, additionally supports our estimates. We demonstrate that the financial data of the S&P 500 index exhibits a hysteresis and a tipping point in agreement with the model predictions. Moreover, we report that the model price outputs based on the estimated S&P 500 intrinsic values are cointegrated with the real S&P 500 traded prices, examined on the S&P 500 data from 1920 until today. Based on the internal network structures and processes we construct early-warning indicators and demonstrate the applicability of the model in identifying and anticipating critical phenomena in markets.

David Fabjan, Jozef Stefan Institute: Unnoticeable systems for motion detection

With miniaturization and low power consumption of the hardware components, we are seeing the uptake of the Internet of Things (IoT). Different dedicated sensors, often with already embedded processors and memory are on demand connected to remote central controllers and on actuators.

They are becoming ubiquitous with their numbers increasing rapidly and diversity with many different ambient signals they are able to detect and process. Such devices are easily placed in familiar environment or on the human body and used to increase comfort, detect medical conditions and regularly used when dealing with various issues of personal and public security.

This overview paper is exploring novelty ways in detecting human behavior by introducing this new technologies, with emphasis on non-intrusion, privacy, and ambient based sensors for non-intrusive, and kinetic measurement of walking.

Andrej Dobrovoljc, Faculty of Information Studies: Measuring the attack potential of typical threat agents

Measuring severity of software vulnerabilities is extremely important. It is one of the cornerstones of security risk management. A widely used system for describing and scoring vulnerabilities is the open standard CVSS. However, CVSS attributes and calculated vulnerability scores do not tell us enough about potential threats for the information system. It would be useful, if we could identify the most dangerous threat agents for a specific software product. However, threat agents are dangerous only when they are both, motivated and capable to exploit vulnerabilities. By our definition, such threat agents have the attack potential.

The primary goal of our study was to identify the threat agents with the highest attack potential for a specific software product. For this purpose, we needed a suitable technique to describe profiles of typical attacker groups, which would reveal their goals, capabilities and constraints. Among existing threat taxonomies, we found the Intel's Threat Agent Library the most comprehensive. It offers the attributive description of threat agent profiles of twenty-one most common attackers for information systems.

By combining attributes from attacker profiles with CVSS attributes, we determined whether the threat agent is motivated and capable to exploit a vulnerability. Ordinal attributes from profiles allow differentiation among threat agents in six dimensions: skills, visibility, objectives, access, limits and resources. In our measuring model, they express attacker's capability. From the remaining attributes, which are "intent" and "expected outcome", the attacker's motivation is determined.

In the experiment, we focused on five typical software products, which are globally present and therefore interesting within the threat agents' society as well. We used data from the National Vulnerability Database. Results prove that threat agents have different attack potentials on different software products. From results we can recognize, which products are more exposed to individual threat agents than the others.

Marc Grau Leguia and Zoran Levnajić, Faculty of Information Studies: Simulated annealing of derivative-variable correlations reconstruction methods

Inferring the topology of a complex dynamical system is a difficult task. With the growth of this field, numerous reconstructing methods has been proposed. Among those, we were inspired by a method that used the derivative-variable correlation to reconstruct a complex system from the dynamical time series. They used the Fourier harmonics as a tuning function to find their results. Here we propose a simulated annealing process of the coefficients of the Fourier function in order to improve the precision. We have found that the simulating annealing does improves the precision by a considerable margin. Moreover, we also studied the convergence of differents realizations of the annealing process into a global minima of the precision.

Darko Zelenika, Janez Povh and Bernard Ženko, Faculty of Information Studies: Localization of Text in Document Images

Today a lot of potentially useful textual information is stored in an unstructured form of images of documents such as invoices, contracts, web pages, etc. Text detection in document images plays an important role in optical character recognition systems and is a challenging task, especially

for documents which have multi colored and complex background. Text in such documents may be of different sizes, orientations, colors, etc. In order to effectively recognize and extract this text with Optical Character Recognition technology, location of the text within the image must be detected first. The first step of text detection in document images is the document segmentation, which is followed by a classification of segments obtained in the first step. Document segmentation is a task which splits a document image into segments or blocks of interest. Blocks of interest can usually be classified as text or non-text. We are mainly interested in text blocks, so our goal is to identify them and separate them from non-text blocks. We proposed text detection method which uses self-adjusting bottom-up segmentation algorithm to segment a document image into a set of connected components. The segmentation algorithm is constructed with a combination of Sobel edge detection and dilation methods. The segmented connected components are then described in terms of the following features: number of connected components, aspect ratio, foreground density, color density, standard deviation of the heights and widths of connected components, standard deviation of the lengths of horizontal and vertical runs, local binary patterns, vertical and horizontal spread, average instantaneous rate of change and zero-crossing rate. These features are extracted from original and resized (100 pixels in height while maintaining the width to height aspect ratio) segmented connected components. After feature extraction process we used a machine learning algorithm to classify segmented connected components as text or nontext. We have used publicly available dataset ICDAR 2015 from which we have collected 6100 training images of text blocks and 8000 training images of non-text blocks in order to build dataset of features for a machine learning algorithm, and to evaluate our method in the Robust Reading Competition (Challenge 1: Born-Digital Images (Web and Email)). Dataset of features is built by extracting described features from each collected training image of ICDAR 2015 dataset. Classification model is built by using Radial Support Vector Machine. The results of our text detection method are compared with 15 submitted methods of other authors, and our method is currently at 6th place with 78.69 % recall and 93.14 % precision. However, there is enough space for improvement and future research.

Janez Povh, Maximilian Moser and Vincent Grote, Faculty of Information Studies: Modelling cardiovascular age by heart rate variability

Human biological age is a concept approached by many researchers from medicine, biology, genetics etc. However, there is no universal definition of this concept and many approaches are based on ad hoc heuristics taking into account chronological age, weight, education, some crucial habits like doing sports, drinking alcohol, smoking etc. and predict biological age using some data model.

In this talk we present a systematic approach to model biological age based on health of the heart, measured through the heart rate variability. We rely on high quality data obtained by measuring 24 hours heart rate variability of 1123 people with a different health situation. From each 24-hour measurement we constructed a list of 152 features describing different aspects of heart rate variability. Using linear regression combined with forwards, backward and lasso-ridge regression we obtained a list of top 5 models giving a numerical value which we proclaim as a cardiovascular age. We further enhanced the model with the orthogonal regression where the first principal component of the data with chronological age included was used as cardiovascular age predictor. Most of the models confirm expectations that the sick people have cardiovascular age higher than chronological age. However the people with orthopedic implicants turn out to have on

average lower cardiovascular age than chronological age. This contradicts our expectations and is a topic for further research.

Uroš Mesojevec and Zoran Levnajić, Faculty of Information Studies: High performance network analysis in the cloud

Cloud computing is a hot topic in scientific and business community. There are many applications of cloud computing spanning different areas. One of the most interesting is client independent high performance network analysis. We will present some interesting areas for further research.

Albert Zorko and Zoran Levnajić, Faculty of Information Studies: A novel approach to determine the central cardiorespiratory coordination in major depression

A large part of clinical psychophysiology deals with autonomic dysfunctions. Study deal with investigations of the overall autonomic tone in order to obtain a valuable measuring instrument for central autonomic state. Methods include measuring heart rate and respiration frequency in 42 depressed patients and their matched healthy controls. Recording of ECG and respiration were plotted starting from the previous R-peak to detect the degree of pulse-respiration-coupling. Results: Unmedicated and medicated depressives coupled significantly less than controls.

Dragana Miljković, Darko Aleksovski and Vid Podpečan, Jozef Stefan Institute: Data mining methods for Parkinson's Disease

We present the results of a literature-based study of data mining methods used for Parkinson's disease management. The study was motivated by requirements of the EU H2020 project "PD_manager", which aims to develop innovative, mobile-health, patient-centric platform for Parkinson's disease management. One part of the data mining module of this platform will be predictive data mining algorithms designed to predict the changes in patients' symptom as well as their severity. The second segment will include also descriptive data mining methods which will analyze and provide deeper insight in patients' condition by discovering new rules and pattern of the disease.

In general, data mining algorithms search for patterns and/or models in data which are interesting and valid according to the user defined criteria of interestingness and validity. Both predictive as well as descriptive data mining methods are lately rapidly used in the healthcare domain. Use of data mining methods brings numerous advantages in healthcare, such as lowering the cost of the available medical solutions, detection of disease causes and proper identification of treatment methods, developing personalized health profiles, drug recommendation systems, etc.

There are several symptoms that are important for diagnose, management and treatment of Parkinson's disease patients. It appears that one of the crucial roles in managing Parkinson's disease is detection and classification of tremor. Tremor, which is a primary symptom of the disease, is an involuntary, rhythmical, forwards and backwards movement of a body part and is assessed in some studies with Hidden Markov models, neural networks and different methods for time domain and spectral analysis. Besides tremor, freezing of gait (FoG) is one of the advanced symptoms in Parkinson's disease. Very few computational methods have been developed so far to detect it and they can be grouped into following categories: analysis of electromyography signals, 3D motion analysis, foot pressure analysis and motion signal analysis using accelerometers and gyroscopes. The problem of gait initiation, the transient state between standing and walking, is studied in terms

of differentiation between normal and abnormal gait initiation. In addition to these symptoms, medical studies have shown that over 90% of people with Parkinson's disease suffer from some form of vocal impairment. The analysis of voice can be used for successful diagnosing Parkinson's disease.

Moreover, there were several EU projects devoted to different aspects of the Parkinson's disease, which we have also studied. On the basis of this state-of-art search, we propose in this work the design and the functionality of the data mining module that will be implemented within the mobile e-health platform for the purpose of the PD_manager project.