

1st International Conference on  
Decision Support System Technology



An EWG-DSS Conference

Belgrade, Serbia, May 27-29, 2015

# Proceedings of the 1ST EWG-DSS International Conference on Decision Support System Technology – ICDSST 2015



1st International Conference on Decision  
Support System Technologies (ICDSST)  
Big Data Analytics for Decision Making



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## **ICDSST 2015**

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**Proceedings**

**of the**

**1<sup>st</sup> EWG-DSS International Conference on  
Decision Support System Technology**

**on**

**Big Data Analytics for Decision Making**

**Belgrade, Serbia  
May 27<sup>th</sup>- 29<sup>th</sup>, 2015**

**Editors:**

**Boris Delibašić, Fátima Dargam, Pascale Zaraté,  
Jorge E. Hernández, Shaofeng Liu, Rita Ribeiro,  
Isabelle Linden, Jason Papathanasiou**

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## **ICDSST 2015 Proceedings**

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## **Faculty of Organizational Sciences University of Belgrade Welcome Notes**

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***Welcoming Words from the Dean of the Faculty of Organizational Sciences:  
Prof. Dr. Milan Martić***



*The Faculty of Organizational Sciences (FOS), University of Belgrade, is happy to host the ICDSST 2015 International Conference on Decision Support System Technology and warmly welcomes the Working Group of Decision Support Systems of the EURO Association of European Operational Research Societies. FOS is Serbia's highly ranked Management School. During forty years of existence, the curricula have changed in line with the advances in science and technology, and were adapted to the needs of the economy and society.*

*Presently, the curriculum of the Faculty is designed in line with the programs of the most renowned universities and colleges of the world. The faculty program reflects current trends in higher education, scientific research and economic development. For more than a decade, the Faculty has been a leader in South-East Europe in the field of information systems and technology, management, operations management and quality management.*

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## **Organizers**

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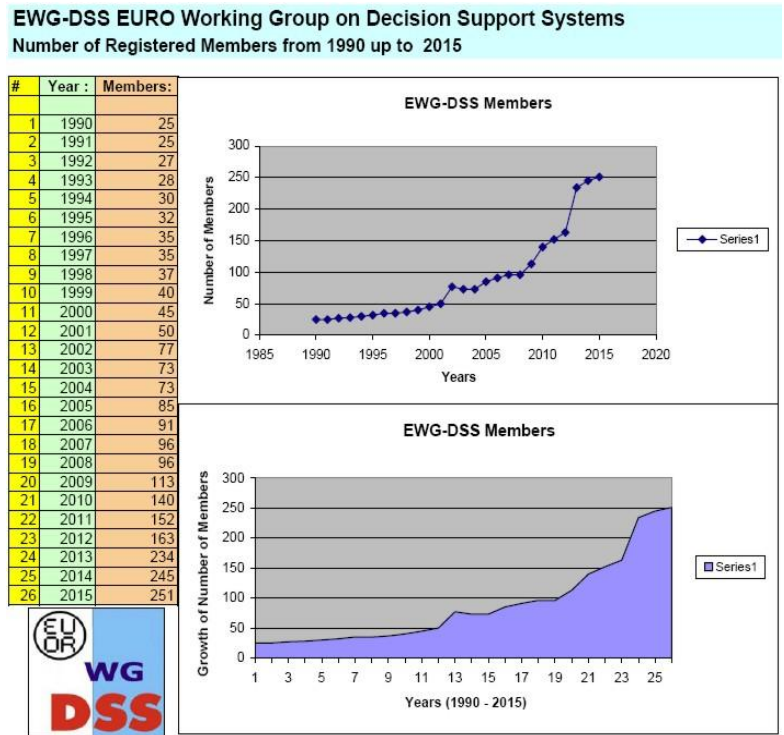
The **EURO Working Group on Decision Support Systems EWG-DSS**, in cooperation with the **Faculty of Organizational Sciences** from the **University of Belgrade**, is organizing **ICDSST 2015 – International Conference on Decision Support System Technologies on “Big Data Analytics for Decision Making”**.

Since its creation in 1989, the EWG-DSS group has annually organized research meetings, workshops, joint mini-conferences and conferences with other groups (check [here](#) for more details). The EWG-DSS series of International Conferences on Decision Support Systems Technology (ICDSST), starting with the **ICDSST-2015 in Belgrade**, were planned to consolidate the tradition of annual research events organized by the **EURO EWG-DSS group**. The ICDSST Conferences offer the European and International DSS Communities, including the academic and the industrial sectors, opportunities to present state-of-the-art DSS developments and to discuss about the current challenges that surround Decision-Making processes, focusing on realistic but innovative solutions; as well as on potential new business opportunities.

The main purpose of the **EWG-DSS International Conference on Decision Support Systems Technology (ICDSST 2015)**, with its main theme on “**Big Data Analytics for Decision Making**”, is to attract researchers, developers and specialists of the related areas of decision-making, its methodologies and technologies; as well as application oriented practitioners directed to the implementation of big data analytics solutions, to get together in order to exchange

experiences and identify the key issues within various decision-making application areas, so that exploitation of new approaches and tools for dealing with Big Data in Decision Making processes can be effectively implemented in future developments.

The **ICDSST 2015** promises to offer a pleasant working environment for all participants, within the beautiful spring time of Belgrade in May.



*We thank you for your participation interest.*

*We hope to you will have a good ICDSST see in Belgrade 2015!*

*The ICDSST 2015 Organizers & the*

*EWG-DSS Coordination Board*

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## **Organizing Committee**

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The main purpose of the EWG-DSS – EURO Working Group on Decision Support Systems is to establish a platform for encouraging state-of-the-art high quality research and collaboration work within the DSS community. Other aims of the EWG-DSS are to: Encourage the exchange of information among practitioners, end-users, and researchers in the area of Decision Systems; Enforce the networking among the DSS communities available and facilitate activities that are essential for the start-up of international cooperation research and projects; Facilitate professional academic and industrial opportunities for its members; Favor the development of innovative models, methods and tools in the field Decision Support and related areas; And actively promote the interest on Decision Systems in the scientific community by organizing dedicated workshops, seminars, mini-conferences and conference streams in major conferences, as well as editing special and contributed issues in relevant scientific journals.

The EWG-DSS has already established a recognized tradition is organizing high level conferences and workshops concerning themes of Decision Support Systems, their applications and development approaches. More details about all the organized events of the EWG-DSS can be found in the link: <http://ewgdss.wordpress.com/workshops/>.

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ICDSST-2015 Organizing Committee

**ICDSST-2015 Chairs: EWG-DSS Coordination Board:**

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**Prof. Dr. Boris Delibašić**  
University of Belgrade, Serbia  
Email: [boris.delibasic@fon.bg.ac.rs](mailto:boris.delibasic@fon.bg.ac.rs)

**Dr. Fátima C.C. Dargam**  
SimTech Simulation Technology & ILTC,  
Graz, Austria  
E-mail: [f.dargam@simtechnology.com](mailto:f.dargam@simtechnology.com)

---

**Prof. Dr. Rita Ribeiro**  
UNINOVA – CA3, Portugal  
E-Mail: [rar@uninova.pt](mailto:rar@uninova.pt)

**Prof. Dr. Pascale Zaraté**  
Toulouse University / IRIT, France  
E-Mail: [zarate@irit.fr](mailto:zarate@irit.fr)

---

**Dr. Jorge Hernandez**  
University of Liverpool, UK  
E-  
Mail: [J.E.Hernandez@liverpool.ac.uk](mailto:J.E.Hernandez@liverpool.ac.uk)

**Prof. Dr. Shaofeng Liu**  
University of Plymouth, UK  
E-Mail: [shaofeng.liu@plymouth.ac.uk](mailto:shaofeng.liu@plymouth.ac.uk)

---

**Dr. Isabelle Linden**  
University of Namur, Belgium  
E-Mail: [isabelle.linden@unamur.be](mailto:isabelle.linden@unamur.be)

**Dr. Jason Papathanasiou**  
University of Macedonia, Thessaloniki,  
Greece  
E-Mail: [jason.papathanasiou@gmail.com](mailto:jason.papathanasiou@gmail.com)

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**ICDSST-2015 Local Team of Organizers:**

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**Prof. Dr. Boris Delibašić**  
**(Local Chair)**  
University of Belgrade, Serbia  
E-Mail: [boris.delibasic@fon.bg.ac.rs](mailto:boris.delibasic@fon.bg.ac.rs)

**Prof. Dr. Milija Suknović**  
University of Belgrade, Serbia  
E-Mail: [milija.suknovic@fon.bg.ac.rs](mailto:milija.suknovic@fon.bg.ac.rs)

---

**Miloš Jovanović, PhD student**  
University of Belgrade, Serbia  
E-Mail: [milos.jovanovic@fon.bg.ac.rs](mailto:milos.jovanovic@fon.bg.ac.rs)

**Sandro Radovanović, PhD student**  
University of Belgrade, Serbia  
E-Mail: [sandro.radovanovic@fon.bg.ac.rs](mailto:sandro.radovanovic@fon.bg.ac.rs)

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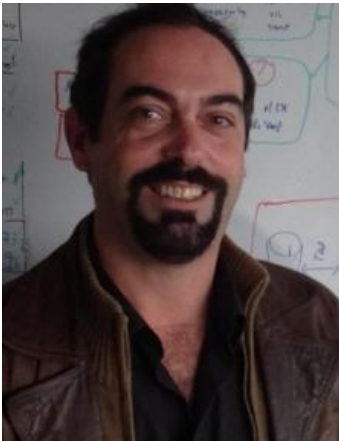
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## ICDSST 2015 – Invited Talks



**[Andre Moitinho de Almeida](#)**

Researcher  
University of Lisbon  
Portugal

**Talk:** [Interactive Visualisation Exploitation of Large Archives, Big Data Analytics for the Gaia mission](#)



**[Antonio Falcao](#)**

Research Engineer at CA3 – Uninova  
Portugal

**Talk:** [Interactive Visualisation Exploitation of Large Archives, Big Data Analytics for the Gaia mission](#)





**[Tatiana Kovacikova](#)**

Full Professor in the Applied Informatics  
Department of InfoCom Networks  
University of Zilina

**Talk:** [COST \(European Cooperation in Science and Technology\) in H2020](#)



**[Zoran Obradovic](#)**

Director  
Center for Data Analytics and Biomedical Informatics  
Temple University, Philadelphia, PA, USA

**Talk:** [Predictive Analysis in Complex Dynamic Networks](#)



**[Daniel J. Power](#)**

Professor of Management Information Systems  
University of Northern Iowa, USA  
Editor of DSSResources.com

**Talk:** ['Big Data' Decision Making Use Cases](#)



**[Yong Shi](#)**

Executive Deputy Director  
Key Lab of Big Data Mining and Knowledge Management  
Chinese Academy of Sciences

**Talk:** [Big Data Mining and Data Science](#)

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**Abstracts of Invited Talks**

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## **Interactive Visualization Exploitation of Large Archives, Big Data Analytics for the Gaia mission**

**Antonio Falcao**

CA3

Uninova, Portugal

**André Moitinho de Almeida**

University of Lisbon, Portugal

### **ABSTRACT**

For Space sciences, most of the data leading to new discoveries are now expected to come from huge online archives. Still, in an age where automated massive data analysis is becoming mainstream, visual exploration remains essential for the understanding and critical interpretation of data and results.

Our work tackles two main challenges: how to interactively visualise very large amounts of multidimensional point-cloud data and how to perform complex selections within 3D representations. Most users will interface with large archives using normal hardware, such as desktops, laptops and mobile devices. Giving these devices the ability to explore big data in real-time must be provided by off-loading strategies implemented at the level of a visualisation server, preferably close to the archive in order to overcome bandwidth limitations. We explore strategies regarding data off-loading, details on demand, sub-sampling and dimensionality reduction.

The second challenge handles the issue of interpreting user interaction and providing mechanisms for complex 3D selections. We consider how widespread 3D interaction devices such as the Microsoft Kinect and more recently the Leap Motion may eventually be used to navigate the data and create spatial selections in conjunction with the normal keyboard and mouse interfaces.

We will present developments within the IVELA project – a demonstrator for a 3D interactive environment for visualisation and selection of the archive of the European Space Agency Gaia mission. Although oriented towards research in astronomy, its design is general and suitable for the visualisation of other large datasets of multidimensional point sources.

## BIOGRAPHIES

**António J. Falcão** holds a Licenciatura in Computer Science Engineering from the Faculty of Sciences and Technology of the New University of Lisbon, and a Master of Science (M.Sc.) degree in Computer Science Engineering from the same University. He is a project manager and research engineer at the CA3 Computational Intelligence Research Group at Uninova (New Technologies Research Institute) working on projects for the European Space Agency since 2002. His research interests include automated analysis of large non-categorical time series datasets. He's looking at automatic detection of correlations and patterns within these datasets, as well as focusing on the topic of causality between these non-categorical data. He is a Certified Scrum Master, as well as having several specific training courses, including Agile Requirements Management, Agile Estimation and Planning. He also concluded Software Engineering and Quality Assurance training courses, both organized by ESA.

**André Moitinho de Almeida**: Prof. Department of Physics, University of Lisbon. He coordinates the Portuguese participation in the ESA Gaia mission that will survey more than a billion stars in the Milky way and beyond. Extensive exploitation of large astronomical data sets has led to work on data-mining, development of data processing pipelines and on interactive visualization of large data sets. He manages the development of the Visualization services for the Gaia peta-byte archive and is a member of the Management Committee of the COST Action "Big Data Era in Sky and Earth Observation (BIG-SKY-EARTH)". Observational work also made him interested in astronomical instrumentation, having been in charge of opto-mechanic and cryogenic systems of instruments designed for some of the world's largest telescopes. He has served on several committees that shape the future of the exploration of Space, including the European Space Agency (ESA) Astronomy Working Group and the European Southern Observatory (ESO) Observing Programmes Committee. He is presently a member of the ESO Scientific and Technical Committee and of the Portuguese delegation to the United Nations Committee on the Peaceful Uses of Outer Space. He is President of the Portuguese Astronomical Society since 2006.

## **COST (European Cooperation in Science and Technology) in H2020**

**Prof. Dr Tatiana Kovacikova**  
COST Office  
Brussels, Belgium

### **ABSTRACT**

COST mission is to enable breakthrough scientific and technological developments leading to new concepts and products. COST has been supporting the networking of research activities across all 35 Member Countries and beyond for over 40 years.

In H2020 COST will continue to follow the basic principles that made it a success since its foundation: excellence, openness, inclusiveness and bottom up. In 2013, the COST member states established a new implementing structure, the COST Association that will allow an even more efficient and research friendly management. Currently there is a scientific re-organization on going and a new submission, evaluation & selection procedure is being discussed. COST will reinforce its policies in the H2020 context allowing contributing to the Innovation Union's goal.

### **BIOGRAPHY**

Tatiana Kovacikova received her diploma in telecommunication engineering from the University of Transport and Telecommunications in Zilina, former Czechoslovakia. In 1996, she received her PhD in telecommunication systems from the same university. In 2013, she was appointed Full Professor in the Applied Informatics. From 2009 to 2013 she was the Head of the Department of InfoCom Networks at the University of Zilina, Slovakia. Her research interests include ICT and ITS, in particular network architectures, services and applications. She have been involved in a number national and international research projects including EC FP6 and FP7 projects. From 2002 to 2013, she was involved in the European Telecommunications Standards Institute (ETSI) as a leader or member of Specialist Task Forces for CLOUD, TISPAN, ITS and CABLE Technical Committees. Since June 2013, she has been holding the position of the Head of Science Operations in the COST Office in Brussels.

## Predictive Analysis in Complex Dynamic Networks

**Zoran Obradovic**  
Temple University  
Philadelphia, PA, USA

### ABSTRACT

Node attributes and links in information networks often evolve over time and are inextricably dependent on each other. In addition, the evolving network is partially observed, multiple kinds of links exist among nodes and various nodes have different temporal dynamics. In this talk we will present an overview of the results of our ongoing DARPA GRAPHS big data project aimed to address these challenges by developing a structured learning Gaussian conditional random field (GCRF) model, which is shown to be more accurate than several unstructured alternatives in forecasting dynamics of evolving complex networks.

### BIOGRAPHY

Zoran Obradović is a L.H. Carnell Professor of Data Analytics at Temple University, Professor in the Department of Computer and Information Sciences with a secondary appointment in Statistics, and is the Director of the Center for Data Analytics and Biomedical Informatics. His research interests include data mining and complex networks applications in health management and other complex decision support systems. Zoran is the executive editor at the journal on Statistical Analysis and Data Mining, which is the official publication of the American Statistical Association and is an editorial board member at eleven journals. He was general co-chair for 2013 and 2014 SIAM International Conference on Data Mining and was the program or track chair at many data mining and biomedical informatics conferences. In 2014-2015 he chairs the SIAM Activity Group on Data Mining and Analytics. His work is published in about 300 articles and is cited more than 14,000 times (H-index 46). For more details see <http://www.dabi.temple.edu/~zoran/>

## **‘Big Data’ Decision Making Use Cases**

**Daniel J. Power**

University of Northern Iowa and DSSResources.com  
Cedar Falls, Iowa, USA

### **ABSTRACT**

New data streams from social media, passive data capture and other sources are creating opportunities to support decision making. Also, data volume, data velocity and data variety continue to increase. Data-driven decision making using these new data streams, often call "big" data, is an important topic for continuing discussion and research. Given the costs of this data it is important to understand "big" data and any decision making use cases. Current use cases demonstrate how new data streams can support some operating decisions. Claims that new data streams can support strategic decision making by senior managers have not been demonstrated. Managers want better data and desire the "right" data at the "right time" and in the "right format" to support targeted decisions. This article explores the challenges of identifying novel use cases relevant to decision making, especially important, strategic long-term decisions. Analyzing "big data" to find a great business plan or to identify the next revolutionary product idea seems however like wishful thinking. Data is useful and we have more of it than ever before and the volume is increasing because data capture and storage is inexpensive. "Big data" and advanced analytics may provide facts for experienced and talented strategic decision makers, but those uses are not clearly defined. At present, the major strategic decision related to "big" data for senior managers is how much time, talent and money to allocate to capturing, storing and analyzing new data streams. Better defined decision making use cases can help senior managers assess the value of new data sources.

### **BIOGRAPHY**

Daniel J. Power is a Professor of Management and Information Systems at the College of Business Administration at the University of Northern Iowa, Cedar Falls, Iowa and the editor of DSSResources.COM, the Web-based knowledge repository about computerized systems that support decision making, the editor of PlanningSkills.COM, and the editor of DSS News, a bi-weekly e-newsletter. Dan writes a regular column in Decision Support News. Also, Dan is a blogger on the Business Intelligence Network.

Since 1982, Dan Power has published more than 50 refereed articles and book chapters and more than 30 refereed proceedings papers. His articles have appeared in leading academic journals including Decision Support Systems, Decision Sciences, Journal of Decision Systems, MIS Quarterly, Academy of Management Review, Communications of the Association for Information Systems, and Information and Management. He is also co-author of a book titled Strategic Management Skills and he has authored four books on computerized decision support. His DSS Concepts book (2002) titled Decision Support

Systems: Concepts and Resources for Managers is a broad ranging scholarly handbook on the fundamentals of building decision support systems. His expanded DSS Framework has received widespread interest. His book Decision Support Systems: Frequently Asked Questions (2005) organizes important Ask Dan! questions (with answers) published in DSS News from 2000 through 2004. In November 2009, his book Decision Support Basics was published by Business Expert Press, check [businessexpertpress.com](http://businessexpertpress.com). His most recent book from Business Expert Press is titled Decision Support, Analytics, and Business Intelligence.

Professor Power is the founding Editor-in-Chief of the Journal of the Midwest Association for Information Systems (<http://jmwais.org/>), a Senior Editor of the Oxford Research Encyclopedia of Business and Management, was the founding section editor of the ISWorld pages on Decision Support Systems Research and was founding Chair of the Association for Information Systems Special Interest Group on Decision Support and Analytics (SIG DSA, previously SIG DSS). Also, Professor Power was the founding President of the Midwest United States Chapter of the Association for Information Systems (MWAIS, <http://mwais.org/>).

In 1982, Professor Power received a Ph.D. in Business Administration from the University of Wisconsin-Madison. He was on the faculty at the University of Maryland-College Park from 1982 to 1989 and received tenure as an Associate Professor in 1987. Power served as the Head of the Management Department at the University of Northern Iowa (UNI) from August 1989 to January 1996. He served as Acting Dean of the UNI College of Business Administration from January 16, 1996 to July 31, 1996.

Dr. Power is a pioneer developer of computerized decision aiding and support systems. During 1975-77, he developed a computerized system called DECAID, DECision AID. In 1981-83, he reprogrammed and expanded the system for the Apple II PC. In 1986-87, he designed a set of decision aiding tools for the Management Decision Assistant package from Southwestern Publishing.

Professor Power travels nationally and internationally teaching and consulting about Decision Support and Business Strategy. Dr. Power has been a visiting lecturer at universities in China, Denmark, Ireland, Israel, and Russia. Power has consulted with a number of organizations and in Summer 2003 he was a Visiting Faculty Research Fellow with the U. S. Air Force Research Lab Information Directorate (AFRL/IF).

In summary, Dr. Daniel J. Power is a Decision Support evangelist and technology generalist. From his vantage point as editor of [DSSResources.COM](http://DSSResources.COM) and [PlanningSkills.COM](http://PlanningSkills.COM) he tracks a broad range of contemporary decision support and planning topics. In recent years, his writings have positioned him as a decision support theorist. His overall focus is on innovative decision support design and he likes to think of himself as a software designer and technology strategist, an Information Systems researcher and a Data and Decision Scientist.



## **Big Data Mining and Data Science**

**Yong Shi**

Chinese Academy of Sciences  
Beijing, China

### **ABSTRACT**

Big Data has become a reality that no one can ignore. Big Data is our environment whenever we need to make a decision. Big Data is a buzz word that makes everyone understands how important it is. Big Data shows a big opportunity for academia, industry and government. Big Data then is a big challenge for all parties. This talk will discuss some fundamental issues of Big Data problems, such as data heterogeneity vs. decision heterogeneity, data stream research and data-driven decision management. Furthermore, this talk will provide a number of real-life Big Data Applications. In the conclusion, the talk suggests a number of open research problems in Data Science, which is a growing field beyond Big Data.

### **BIOGRAPHY**

Yong Shi, serves as the Executive Deputy Director, Chinese Academy of Sciences Research Center on Fictitious Economy & Data Science and Director, the Key Lab of Big Data Mining and Knowledge Management, Chinese Academy of Sciences. He has been Union Pacific Chair of Information Science and Technology, University of Nebraska at Omaha, USA. Dr. Shi's research interests include business intelligence, data mining, and multiple criteria decision making. He has published more than 22 books, over 200 papers in various journals and numerous conferences/proceedings papers. He is the Editor-in-Chief of International Journal of Information Technology and Decision Making (SCI), Editor-in-Chief of Annals of Data Science (Springer) and a member of Editorial Board for a number of academic journals. Dr. Shi has received many distinguished awards including the Georg Cantor Award of the International Society on Multiple Criteria Decision Making (MCDM), 2009; Fudan Prize of Distinguished Contribution in Management, Fudan Premium Fund of Management, China, 2009; Outstanding Young Scientist Award, National Natural Science Foundation of China, 2001; and Speaker of Distinguished Visitors Program (DVP) for 1997-2000, IEEE Computer Society. He has consulted or worked on business projects for a number of international companies in data mining and knowledge management.

# ICDSST 2015

## 1<sup>st</sup> International Conference on Decision Support System Technology

### An EWG-DSS Conference on Big Data Analytics for Decision Making



May 27th-29th, 2015

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## ICDSST 2015 Reviewers & Abstracts

On behalf of the ICDSST 2015 Organizing and Program Committees, we would like to acknowledge the interest and cooperation of all the authors who submitted their research work for presentation in this Conference. In the sequel, we list the names and affiliations of the researchers who participated in the refereeing process of this conference. We are very grateful to all of them for their constructive reviewing and prompt cooperation.

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**Abstracts of Full Papers**

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## **Implementing a cloud-based decision support system in a private cloud: The infrastructure and the deployment process**

**Imene Benatia<sup>1</sup>, Mohamed Ridda Laouar<sup>1</sup>,**

<sup>1</sup> LAMIS Laboratory,  
Department of Mathematics and Computer Science,  
University of Tebessa, Tebessa, Algeria  
benatia.imene@yahoo.fr, ridda\_laouar@yahoo.fr

**Hakim BENDJENNA<sup>1</sup> and Sean B. Eom<sup>2</sup>**

<sup>1</sup> LAMIS Laboratory,  
Department of Mathematics and Computer Science  
University of Tebessa, Tebessa, Algeria

<sup>2</sup> Department of Accounting,  
Southeast Missouri State University,  
Cape Girardeau, MO, USA  
[hbendjenna@gmail.com](mailto:hbendjenna@gmail.com), [sbeom@semo.edu](mailto:sbeom@semo.edu)

### **ABSTRACT**

This paper proposes a Cloud based multiple criteria decision support system (DSS) for Selecting Urban Housing Sustainable Development Projects in order to help the decision makers to choose the best urban project with conflicting criteria. The DSS is deployed on a platform Cloud (CloudBees) and managed by the OpenStack infrastructure. The Cloud based multiple criteria DSS we designed and implemented has significant advantages. It reduces the deployment and processing time, ameliorates the communication and the cooperation between the decision makers, facilitates the accessibility, and decrease the cost. The DSS is built on the Cloud Computing architecture with three layers and includes the multiple criteria decision making (MCDM) method PROMETHEE II as well as the procedure of negotiation Hare in order to help the decision makers to select the best urban project.

**Keywords:** Cloud Computing; decision support system (DSS); multiple criteria decision making (MCDM); Sustainable Local Development; Urban Housing Development.

## **Data-mining and expert models for predicting injury risk in ski resorts**

**Marko Bohanec**

Jožef Stefan Institute  
Department of Knowledge Technologies, Jamova cesta 39  
1000 Ljubljana, Slovenia  
marko.bohanec@ijs.si

**Boris Delibašić**

University of Belgrade, Faculty of Organizational Sciences  
Jove Ilica 154, 11000 Belgrade, Serbia  
boris.delibasic@fon.bg.ac.rs

### **ABSTRACT**

This paper proposes several models for predicting global daily injury risk in ski resorts. There are three types of models proposed: based on data mining, expert modeling, and a combination of both. We show that the expert model that represents the judgment of injury risk experts in the analyzed ski resort is 10-15% less accurate than data mining models. We also show that expert models refined with data-driven analysis can produce models that are in line with accuracy as data mining models, but in addition show some advantages, like transparency, consistency and completeness.

**Keywords:** Decision analysis, data mining, expert modelling, multi-attribute models, DEX, Orange, ski injury.

## **Making sense of governmental activities over social media: a data-driven approach**

**Brunella Caroleo, Andrea Tosatto, Michele Osella**

Istituto Superiore Mario Boella (ISMB)  
Via P.C. Boggio, 61, 10138 Torino, Italy  
{caroleo, tosatto, osella}@ismb.it

### **ABSTRACT**

Although social media attracted significant interest from governments throughout the globe, the challenge of a successful exploitation of big social data to gain valuable insights in the decision making process is still unmet. This paper aims to provide policy makers with hints and actionable guidelines for a data-driven analysis of the social accounts they manage. To this aim, we firstly propose a three-dimensional modular framework to structure the analysis; then, the logical steps required within this framework for meaningfully process big social data are detailed by suggesting text mining techniques useful for the analysis. The proposed data-driven approach could lead public administrators to a better understanding of their use of social accounts and to measure the community engagement around some topics of interest. Findings can constitute fresh insights from which public policy makers may draw for enhancing the community involvement and for becoming far more reactive to the citizenry's needs.

**Keywords:** big data, social media, social data, data-driven decision making, policy making, text mining.

## **Decision support model for participatory management of water resource**

**Annielli Cunha, Danielle Morais**

Production Engineering Department, Federal University of Pernambuco  
Av. Acadêmico, Hélio Ramos, s/n, Cidade Universitária, Recife-PE, Brazil  
{annielli.rangel@yahoo.com.br; dcmorais@ufpe.br}

### **ABSTRACT**

Water resources are unevenly distributed across the territory and there is no stability concerning the availability of these resources. Conflicts over water use, particularly in situations where these resources are shared with other localities, require a participatory governance focused on cooperation and conflict resolution. For this reason, this study proposes a group decision model focusing on the use of the Problem Structuring Method (PSM) to assist decision-makers in identifying decision alternatives and evaluating them based on a voting system to concentrate the group decision around the relevant alternatives. Therefore, this group decision support model allows a full understanding of the problem by decision-makers and encourages the participation of those involved in a structured manner, reducing the negative consequences and dissatisfaction of those involved.

**Keywords:** Water conflicts; decision support; Problems Structuring Methods.



## **Modelling interactions between criteria in MCDM methods: A review**

**Ksenija Mandic, Vjekoslav Bobar, Boris Delibasic**

University of Belgrade, Faculty of Organizational Sciences

Jove Ilica 154, Belgrade, Serbia

ksenija.mandic@crony.rs, vbobar@gmail.com, boris.delibasic@fon.bg.ac.rs

### **ABSTRACT**

This paper reviews approaches for modeling interactions and dependencies between criteria in multi-criteria decision-making (MCDM) methods. Traditionally, MCDM methods only allow the establishment of linear dependence between criteria, so they only allow for simplified models that are mostly inadequate for modeling real-life problems. Several methods have therefore been developed for modeling the interdependence between criteria and sub-criteria in MCDM. This paper makes a comparison between some popular methods that allow modeling of criteria interdependencies: Analytic Network Process (ANP), Decision Making Trial and Evaluation Laboratory (DEMATEL), Interpretive Structural Modeling (ISM), Fuzzy Measures and the Choquet Integral (CI) and Interpolative Boolean Algebra (IBA). These methods allow the establishment of interactions and comparisons between criteria using supermatrices, diagrams, fuzzy measures, fuzzy integrals and logical functions. This paper presents the MCDM approaches that include in their analysis the interdependencies and relation between criteria/sub-criteria and thus enable more efficient and realistic modeling of decision-making problems.

**Keywords:** MCDM, Interactions between criteria, ANP, DEMATEL, ISM, Fuzzy Measures and the Choquet Integral, IBA.

## **Cloud Enabled Big Data Business Platform for Logistics Services: A Research and Development Agenda**

**Irina Neaga<sup>1</sup>, Shaofeng Liu<sup>2</sup>, Huilan Chen<sup>4</sup>**

Graduate School of Management  
Plymouth University, Plymouth, United Kingdom  
{irina.neaga, shaofeng.liu, huilan.chen}@plymouth.ac.uk

**Lai Xu<sup>3</sup>**

Bournemouth University  
Bournemouth, United Kingdom  
lxu@bournemouth.ac.uk

**Yuqiuge Hao<sup>5</sup>**

University of Vaasa  
Vaasa, Finland  
yuqiuge.hao@uwasa.fi

### **ABSTRACT**

This paper explores the support provided by big data systems developed in the cloud for empowering modern logistics services through fostering synergies among 3/4PL (third / fourth party logistics) in order to establish interoperable or highly integrated and sustainable logistics supply chain services. However, big data applications could have limited capabilities of providing performant logistics services without addressing the quality and accuracy of data. The main outcome of the paper is the definition of an architectural framework and associated research and development agenda for the application of cloud computing for the development and deployment of a Big Data Logistics Business Platform (BDLBP) for supply chain network management services. The capabilities embedded in the BDLBP can provide powerful decision support to logistics networking and stakeholders. Two of the three strategic and operational capabilities as operational capacity planning, and real-time route optimization are built upon literature based on operational research, and are extended to the scope of dynamic and uncertain situations. The third capability, strategic logistics network planning is currently under researched and this approach aims at covering this capability supported by big data analytics in the cloud.

**Keywords:** big data, cloud computing, 3/4PL, Big Data Logistics Business Platform (BDLBP), business intelligence, big data analytics

## **The Effects of Performance Ratios in Predicting Corporate Bankruptcy: the Italian Case**

**Francesca di Donato, Luciano Nieddu**

Unint University of Rome

Via Cristoforo Colombo 200, 00145 – Rome, Italy

{francesca.didonato,l.nieddu}@unint.eu

### **ABSTRACT**

Corporate failure prediction is a major issue in today's economy. Any prediction technique must be reliable (good recognition rate, sensitivity and specificity), robust and able to give predictions with a sufficient time lag to allow for corrective actions. In this paper we have considered the case of Small-Medium Enterprises (SMEs) in Italy trying to determine which dimension, in terms of performance indicators, best suits this goal. We have considered three of the most robust and diffused classification techniques on data over a period of 8 years prior to failure. The results tend to suggest that, for the Italian SME system, profitability ratios are always relevant in predicting corporate failure (both in the short and in the medium-long run), while leverage and liquidity indicators, affecting the financial dimension of the company, tend to add information in predicting a possible risk of default only in the medium-long run.

**Keywords:** Bankruptcy Prediction; Discriminant Analysis; Performance Ratios, Small-Medium Enterprises

## **A Tangible Collaborative Decision Support System for Various Variants of the Vehicle Routing Problem**

**Nikolaos Ploskas<sup>1</sup>, Jason Papathanasiou<sup>3</sup>, Nikolaos Samaras<sup>4</sup>**

University of Macedonia

156 Egnatia Str., Thessaloniki 54006, Greece

ploskas@uom.gr, jasonp@uom.gr, samaras@uom.gr

**Ioannis Athanasiadis<sup>2</sup>**

Hellenic Open University

8 Ptolemaion Str., Kozani 50100, Greece

g-athan@hotmail.com

### **ABSTRACT**

The Vehicle Routing Problem (VRP) is a well-known combinatorial optimization problem where a number of customers must be served with a fleet of vehicles. The classical variation of the VRP is the Capacitated Vehicle Routing Problem (CVRP) with the additional constraint that each vehicle must have uniform capacity. Many Decision Support Systems (DSS) have been implemented to solve real life problems of the VRP and its' variants, but they do not allow multiple decision makers to explore several scenarios of a given problem simultaneously and collaborate with each other in order to find the best possible solution. In this paper, we extend our previous work [35] and incorporate in our spatial DSS four variants of the CVRP: (i) Distance Constrained Vehicle Routing Problem (DVRP), (ii) Vehicle Routing Problem with Time Windows (VRPTW), (iii) Vehicle Routing Problem with Backhauls (VRPB), and (iv) Vehicle Routing Problem With Pickup and Delivery (VRPPD). This extension allows decision makers to solve specific routing problems according to their needs. The proposed collaborative spatial DSS allows two decision makers to collaborate with each other in order to find the best possible solution through a tangible interface. The locations are added through interactive Google Maps and other parameters through user-friendly forms that can be manipulated via tangible interfaces. The proposed DSS has been implemented using Java, TUIO protocol, jsprit, and Google Maps.

**Keywords:** Decision Support Systems, Capacitated Vehicle Routing Problem, Tangible User Interface, Geographical Information Systems, Tabletop Display

## **The Roles of Big Data in the Decision-Support Process: an Empirical Investigation**

**Thiago Poletto, Victor Carvalho, Ana Paula Costa**

Universidade Federal de Pernambuco

Brazil

thiagopoletto@hotmail.com, victorheuer@gmail.com, apcabral@hotmail.com

### **ABSTRACT**

The decision-making process is marked by two kinds of elements: organizational and technical. The organizational elements are those related to companies' day-to-day functioning, where decisions must be made and aligned with the companies' strategy. The technical elements include the toolset used to aid the decision making process such as information systems, data repositories, formal modeling, and analysis of decisions. This work highlights a subset of the elements combined to define an integrated model of decision making using big data, business intelligence, decision support systems, and organizational learning all working together to provide the decision maker with a reliable visualization of the decision-related opportunities. The main objective of this work is to perform a theoretical analysis and discussion about these elements, thus providing an understanding of why and how they work together.

**Keywords:** Decision support, decision-making process, Big Data, Business Intelligence (BI), Decision Support System (DSS), organizational learning

## **‘Big Data’ Decision Making Use Cases**

**Daniel J. Power**

University of Northern Iowa and DSSResources.com

Cedar Falls, Iowa USA

Daniel.Power@UNI.edu

### **ABSTRACT**

New data streams from social media, passive data capture and other sources are creating opportunities to support decision making. Also, data volume, data velocity and data variety continue to increase. Data-driven decision making using these new data streams, often call "big" data, is an important topic for continuing discussion and research. Given the costs of this data it is important to understand "big" data and any decision making use cases. Current use cases demonstrate how new data streams can support some operating decisions. Claims that new data streams can support strategic decision making by senior managers have not been demonstrated. Managers want better data and desire the "right" data at the "right time" and in the "right format" to support targeted decisions. This article explores the challenges of identifying novel use cases relevant to decision making, especially important, strategic long-term decisions. Analyzing "big data" to find a great business plan or to identify the next revolutionary product idea seems however like wishful thinking. Data is useful and we have more of it than ever before and the volume is increasing because data capture and storage is inexpensive. "Big data" and advanced analytics may provide facts for experienced and talented strategic decision makers, but those uses are not clearly defined. At present, the major strategic decision related to "big" data for senior managers is how much time, talent and money to allocate to capturing, storing and analyzing new data streams. Better defined decision making use cases can help senior managers assess the value of new data sources.

**Keywords:** data-driven decision making, new data streams, strategic decision making, analytics, computerized decision support, big data, use cases.

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**Abstracts of Short Papers**

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## **Big Data in the Enterprise: Dilemmas and Solutions**

**Dragana Bečejski-Vujaklija**  
Serbian Society for Informatics  
Beograd, Srbija  
draganab@fon.bg.ac.rs  
web-page: <http://www.dis.org.rs>

### **ABSTRACT**

Customer interactions, transactions, as well as Internet of Things through connected homes, vehicles, cities and industries will increasingly generate enormous amounts of data – Big Data. But, having a lot of data does not mean making better decisions. This paper examines the role of Big Data in the Enterprise. It describes the rise of big data and the transition of traditional enterprise data models with the addition of crucial building blocks to handle the dramatic growth of data in the Enterprise.

**Keywords:** Big Data, Enterprise, Big Data Components, Big Data Strategy



## **Towards improving management in spunlace non woven industry: An ontology based solution for collaborating and sharing knowledge**

**Fatima Zohra BENKADDOUR, Noria TAGHEZOUT**

Laboratory LIO, Ahmed Ben Bella Oran 1 university, Oran, Algeria

fatima.benkaddour@univ-oran.dz, taghezout.nora@gmail.com

web-page: <http://univ-oran.dz/>

### **ABSTRACT**

A fundamental limitation of current design support tools is the primary focus on product information and not on the decision process. Decisions need to be explicitly documented so that rationale is easily understood and the proper reuse of design knowledge can be facilitated

Knowledge bases and design repositories in engineering design are evolving towards a distributed design environment in which engineers or operators communicate via the Web or collaborative platform.

We propose an approach that utilizes an ontology and collaborative decision making process to improve management in spunlace non woven industry. The present research considers knowledge integration within a framework of collaborative DSS. A central component of the framework is domain ontology. This ontology represents domain and problem solving knowledge fused from different knowledge sources.

In this system, functions such as information transfer, knowledge acquisition and integration can be easily achieved. The problem caused by the incompatible semantic and data between different programs is solved, which improves the efficiency and accuracy of dynamic decision-making process in INOTIS enterprise. Our proposed ontology-based system provides an understandable and organized solution to capture knowledge regarding item management and usage. It addresses the integration challenge of spunlace catalogs while providing a framework for collaborative sharing and knowledge acquisition among operators or senior managers.

The suggested system is tested by supporting decisions on diagnosis and semantic understanding of resources failures or any unpredictable events. Experiments have been conducted on INOTIS enterprise indicating the efficiency of the proposed system.

**Keywords:** Collaborative decision-making, Diagnosis, Domain ontology, Facilitator, Spunlace non woven industry, Collaborative environment.

## Characterizing the Comorbidity Based Groups of Patients

**Petra Povalej Brzan, Nino Fijacko, Gregor Stiglic**  
University of Maribor, Faculty of Health Sciences  
Zitna ulica 15, 2000 Maribor, Slovenia  
{petra.povalej, nino.fijacko, gregor.stiglic}@um.si

**Boris Delibasic**  
University of Belgrade, Faculty of Organizational Sciences  
Jove Ilića 154, Belgrade, Serbia  
delibasic.boris@fon.bg.ac.rs

**Alexandros Kalousis**  
University of Geneva  
Route de Drize 7, Geneva, Switzerland  
alexandros.kalousis@unige.ch

**Zoran Obradovic**  
Temple University, Center for Data Analytics and Biomedical Informatics  
386 SERC, 1925 N. 12th St., Philadelphia, PA, USA  
zoran.obradovic@temple.edu

### ABSTRACT

In the past few years, one could witness the emergence of different studies aiming to develop predictive models for one of the three conditions defined by Medicare hospital readmission reduction program. In this study, we propose a two-step approach to characterization of different comorbidity based groups of patients based on their predictive performance potential. Initially, we summarize the data collected from Electronic Medical Records based on the most prevalent diagnosis pairs to collect a dataset of repeated readmission classification results with the corresponding feature selection information. This step is followed by discovery of subgroups of patients with high positive predictive value or other classification performance metric. The results of such characterization can be used by medical experts to identify specific groups of patients and build predictive models in environments where high classification performance at the point of hospital discharge can be expected.

**Keywords:** Data Mining, Feature Selection, Hospital Readmissions, Electronic Medical Records, Comorbidities.

## Mobile data uses: current investigations and future research avenues

**Christian Colot, Isabelle Linden**

University of Namur, Department of Business Administration  
FOCUS Research Group  
Rempart de la Vierge, 8, 5000 Namur, Belgium  
christian.colot@unamur.be, Isabelle.linden@unamur.be  
web-page: <http://directory.unamur.be/staff/{colotc,ilinden}>

### ABSTRACT

Mobile devices leave an unprecedented volume and variety of digital traces of human beings like the historic of visited locations or the activity on social network. In particular, most people carry one or several of them almost all the time and consider them as personal. This turns mobile devices into a prodigious way to better grasp human life. Indeed, thanks to these new data sources, various analyses of human activity can now be led using information on actual behavior where, previously, demanding data collection campaign were required to know declared behaviors. In this paper, we propose an overview of multiple uses of mobile data published in the scientific literature.

The organization of the report follows a typology build on two criteria: interaction level and focus of analysis. The interaction level assesses to which extent mobile data is used to interact with a mobile user. This dimension includes four levels: passive, pull, push and participative. The focus of analysis makes the distinction between studies related to a person from those related to a community of people. Crossing these two dimensions would suggest 8 research areas. Only 4 of them are actually covered by the collected pieces of work, we qualify them of User Activity, Human Activity, Mobile Recommendation System and Mobile Promoting System. They are discussed in turn showing off the main characteristics of them such as application domains covered and main issues.

Finally, the discussion of the 4 remaining areas highlights new research areas with a special focus on the possibility to use mobile data to influence individual users towards efficient collective behaviors. To conclude, current and future research avenues suggest that mobile devices and their underlying data are likely to be employed in many domains and may be used not only to observe human life but also to influence it.

**Keywords:** Mobile data, Mobile Systems, Human Activity, Recommendation Systems, Survey, Data Mining

## A multicriteria decision analysis model for ranking Serbian Banks

**Radovan Đalović, Nevenka Žarkić-Joksimović, Boris Delibašić**

University of Belgrade, Faculty of Organizational Sciences

Jove Ilića 154, 11000 Belgrade, Serbia

djalovic@yahoo.com, nevenka@fon.bg.ac.rs, boris.delibasic@fon.bg.ac.rs

### ABSTRACT

Since banks play a vital role in economy of every country, evaluating the performance of banks is very important, because it provides useful results for both investors, creditors and other stakeholders. The conventional methods for selection are inadequate for dealing with the imprecise or vague nature of linguistic assessment which are present in bank performance. To overcome this difficulty, fuzzy multicriteria decision making methods (MCDM) are proposed to evaluate the performance of banks. The proposed model for performance evaluation of Serbian banks is built with the integration of two methods: Fuzzy Analytic Hierarchy Process (FAHP) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS). FAHP method is applied to determine the relative weights of the evaluation criteria and sub-criteria based on the opinions of economic experts, and then these weights are used like input to the TOPSIS method to rank the alternatives. Several financial indicators are used for ranking top ten most successful banks of Serbian Banking Sector. Finally, FAHP and TOPSIS propose a ranking of banks. To validate the proposed ranking, the results are compared with results obtained by another popular MCDM method, i.e. VIKOR. TOPSIS and VIKOR methods are selected for comparison, because both are based on an aggregating function which represents “closeness to the ideal solution” The complementary use of the two models provides a wider and more realistic view on the tendencies in the banking sector and the combination of the results obtained with two models provides a useful background for more comprehensive evaluation of the banks efficiency.

**Keywords:** Multicriteria decision analysis, Fuzzy AHP, TOPSIS, VIKOR, Bank ranking, Serbia

## The Role of Decision Making in the Big Data Era

Fátima C. C. Dargam<sup>a1</sup>, Pascale Zaraté<sup>b</sup>  
Rita Ribeiro<sup>c</sup>, Shaofeng Liu<sup>d</sup>

<sup>a</sup> SimTech Simulation Technology  
Graz, Austria  
(*f.dargam@simtechnology.com*)

<sup>b</sup> IRIT / University of Toulouse  
Toulouse, France  
(*pascale.zarate@univ-tlse1.fr*)

<sup>c</sup> UNINOVA – CTS  
Lisbon, Portugal  
(*rar@uninova.pt*)

<sup>d</sup> University of Plymouth  
Plymouth, UK  
(*shaofeng.liu@plymouth.ac.uk*)

<https://ewgdss.wordpress.com/>

### ABSTRACT

We current live in an era, in which data heavily, constantly, and globally flows into all areas of our activities. This mobile world based on the Internet of Things and the concepts of Web 2.0, 3.0 and 4.0, connects us at anytime with our conveniences and contacts, keeps our appointments up-to-date, feeds our information needs, influences our moods, guides our shopping tendencies, and informs us about businesses and opportunities in a way that most of the times it is difficult to manage, due to the massive amount of data involved. Time has come that individuals and mainly organizations have to tackle the problem of how to process large amounts of data in support of their respective needs and operations, aiming at improving their handling and response efficiency. Big Data gives birth to an era, which cannot count anymore with classical database tools to manage and analyze information data-sets. New methods and technologies are required to enable the decision maker to understand and examine the massive, multi-dimensional, multi-source, time varying information stream to make effective decisions, sometimes in time-critical situations. In this work the authors discuss the importance of having appropriate technologies for Decision Making and Decision Support Systems to exploit the potentiality of Big Data analysis, so that organizations can improve their productivity to face increased competition in this new Big Data-Driven Decision-Making era. The study behind this paper also addresses the problem of the current widespread data-centrism tendency for almost all applications requiring decision support, since not all of them have the answers to their problems based only on data.

**Keywords:** Decision Making, Big Data, Analytics, DSS, Decision Support Systems, Internet of Things.

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<sup>1</sup> Fátima Dargam also collaborates as senior researcher at ILTC Institute of Logic and Theory of Science ([www.iltc.br](http://www.iltc.br)) in Rio de Janeiro, Brazil.

## Supporting Process Discovery for Complex Processes

**Pavlos Delias**

Eastern Macedonia and Thrace Institute of Technology  
Agios Loukas, Kavala 65100, Greece  
pdelias@teiemt.gr  
web-page: <https://pavlosdeliassite.wordpress.com>

**Stelios Tsafarakis**

Technical University of Crete  
University Campus, Chania 73100, Greece  
tsafarakis@dpem.tuc.gr

### ABSTRACT

Process discovery is one of the most challenging tasks in process mining. State-of-the-art techniques still have problems dealing with large and/or complex event logs and process models. Complexity (either due to the large number of distinct activities comprising the process, or due to the huge number of traces in the event log (the Big Data case) is the main reason why the discovery problem is hard, since most discovery techniques are exponential in the number of activities. An additional reason why discovery is hard is that when producing a process model, one must consider conflicting criteria.

In general, four process model quality criteria have been identified: *Fitness* (how good is the model in replaying the traces in the log), *Simplicity* (how complex is the model beyond what is necessary), *Precision* (how much the model is underfitting - allowing for “too much” behavior), and *Generalization* (how much the model is overfitting). The proposed technique addresses the later two (precision and generalization). Since these criteria are generally conflicting, the discovery methods should find a way to trade-off their requirements. On the other hand, despite its hardness, the discovery problem remains interesting because organizations need process models that reflect the real processes for documentation, verification, performance analysis etc. These needs are reflected in the growing interest of Business Process Management vendors, consultants and researchers.

This work leverages concepts from graph theory and eigenvalue analysis to facilitate process discovery. The key components of our work are the representation of activities in an affinity matrix, the introduction of two optimization criteria relevant to the discovery problem and the projection of the problem into a graph spectrum.

By leveraging the activities clustering task into a graph partitioning problem, one should expect to end up with coherent clusters in terms of the dependencies between the tasks. Having obtained a robust clustering of the activities, we can filter the event log to distribute it horizontally. Then, process discovery algorithms can be applied to every cluster in isolation, and later the marginal results (a.k.a. process fragments) can be merged.

**Keywords:** Process Discovery, Event Log Distribution, Spectral Clustering

## Modelling Complex Systems using Interpolative Boolean algebra

Vladimir Dobrić, Pavle Milošević, Bratislav Petrović

Faculty of organizational sciences

Jove Ilića 154, 11000 Belgrade, Serbia

vdobric@gmail.com, pavle.milosevic@fon.bg.ac.rs, petrovic.bratislav@fon.bg.ac.rs

web-page: www.labsys.fon.bg.ac.rs

### ABSTRACT

Boolean networks are widely used for modelling and analysis of complex systems of interacting entities. Such models have the form of directed graphs, with a state variable and a Boolean function assigned to each node. States of nodes evolve in time, governed by Boolean functions. Classical Boolean networks are binary, relevant for modelling systems with complex switch-like causal interactions. In such systems, below (or above) a certain level a component has a little or no influence on the behavior of others, while above (or below) this level the influence saturates rapidly to a constant level. If the causal interactions are not governed by thresholds, that is, when more detailed description of a system behavior is required, Boolean networks can be generalized by the real-valued realization of state variables and Boolean functions. If this is accomplished by using conventional fuzzy logics, based on truth functionality principle, the generalized model cannot secure the Boolean frame. Consequently, the validity of the model's dynamics is not secured. The aim of this paper is to present the Boolean consistent generalization of Boolean networks. The generalized model has drastically more descriptive power than the classical one. It can be used for gaining quantitative insight into the behavior of complex systems. The generalization is accomplished by using Interpolative Boolean algebra, the real-valued realization of Boolean algebra, based on structure functionality principle.

**Keywords:** Boolean networks, complex systems, Interpolative Boolean algebra, fuzzy logic, fuzzy systems, causal models.

## Process Mining and Clustering for Injury Risk Assessment based on Skiing Patterns

**Milan Dobrota**

LOGIT d.o.o. Beograd  
Bul. Milutina Milankovića 25b, 11070 Belgrade, Serbia  
[milandobrota@gmail.com](mailto:milandobrota@gmail.com)  
web-page: <http://www.logit-solutions.com/>

**Boris Delibašić**

University of Belgrade, Faculty of Organizational Sciences  
Jove Ilića 154, 11000 Belgrade, Serbia  
[delibasic.boris@fon.bg.ac.rs](mailto:delibasic.boris@fon.bg.ac.rs)  
web-page: <http://www.fon.bg.ac.rs/eng/>

**Pavlos Delias**

Eastern Macedonia and Thrace Institute of Technology  
Ag. Loukas, 654 04 Kavala, Greece  
[pdelias@teikav.edu.gr](mailto:pdelias@teikav.edu.gr)  
web-page: <http://www.teikav.edu.gr/teikav/index.php?lang=en>

### ABSTRACT

This paper investigates relation between skiing patterns and risk of injury. Data, collected from ski-lift gates in form of process event logs, is analyzed. After initial transformation of data into process traces, process vectors and similarity matrix, using several clustering methods different skiing patterns are identified and compared. Quality of clusters is determined by how well clusters discriminate between injured and non-injured skiers. The goal was to achieve the best possible discrimination. Several experimental settings were made to achieve and suggest a good combination of algorithm parameters and cluster number. After clusters are obtained, they are categorized in three categories according to risk level (high, medium, low). The goal of this paper is to provide a framework which can be used for estimating level of skiers' injury risks, based on skiing patterns. We concluded that the proposed method can be used to distinguish skiing patterns by risk category based on injury occurrences, while further research should be directed towards investigating process mining techniques potential for skiing injury prevention.

**Keywords:** process mining, spectral clustering, skiing, injuries, risk assessment



## **An AHP Model for Contractor Prequalification**

Omar Fadel Elkaseh<sup>1\*</sup>, Dr. Boris Delibašić<sup>2\*</sup>

<sup>1\*</sup> PhD Candidate, Department of Information Systems and Management - Faculty of Organizational Sciences, Belgrade University - Jove Ilića Street 154, 11000, Belgrade, Serbia  
Email: [omar4fon@gmail.com](mailto:omar4fon@gmail.com)

<sup>2\*</sup> Associate professor, Department of Information Systems and Management - Faculty of Organizational Sciences, Belgrade University - Jove Ilića Street 154, 11000 Belgrade, Serbia  
Email: [boris.delibasic@fon.bg.ac.rs](mailto:boris.delibasic@fon.bg.ac.rs)

### **Abstract**

Construction industries are huge and complex. Given that contractors execute a considerable portion of construction works, the successfulness of these projects depends mainly on their capabilities and qualifications. Therefore, the selection of an eligible contractor is a vital role that involves a critical decision to be made. To do that effectively, it is better to conduct a prequalification process to evaluate their eligibility prior to the bid awarding stage where the final decision of the selection is made. Since the problem represents a typical multi-criteria decision making (MCDM) problem, the AHP method was used. The aim of this paper was to propose a model to help the Libyan Central Committee of Tendering in prequalifying future candidate contractors. The model was evaluated on four Serbian construction companies and consists of four criteria namely, experience, technical capability, managerial capability, and human capability. A sensitivity analysis was done to test the robustness of this model. We conclude that the proposed model can offer a reliable framework for the committee when exercising such a prioritization decision and that it would work efficiently, yield acceptable results, and succeed in dragging reasonable decisions in construction contractor prequalification process, which definitely enhances the credibility and transparency of bid awarding processes in the country.

**Keywords:** contractor prequalification process, analytical hierarchy process, decision-making.

## Modeling Consumer Heterogeneity: A Novel Approach

**Mohammad Ghaderi, Núria Agell**

ESADE Business School, Universitat Ramon Llull

Av. Pedralbes, 60-62, 08034 Barcelona, Spain

mohammad.ghaderi@esade.edu, nuria.agell@esade.edu web-page:

<http://www.esade.edu/>

**Francisco J. Ruiz**

UPC-BarcelonaTech

Av. Víctor Balaguer, s/n, 08800 Vilanova i la Geltrú, Spain

francisco.javier.ruiz@upc.edu

web-page: <http://www.upc.edu/>

### ABSTRACT

Understanding the heterogeneity in consumer preferences is a crucial issue in decisions on marketing mix. These decisions are based on understanding the differences among consumer evaluations of product attributes. We propose a methodological framework for processing consumers' preferential data, to learn their preference models and get insights on the heterogeneity level of their preferences. The proposed methodology starts by taking from each consumer a ranking list over a set of products, and represents the preference model of each consumer by a set of nonlinear (piecewise linear) monotonic value functions over the set of product attributes. The individual preferences are shrunk toward the population preference model using Mahalanobis distance. Individual level preferences distant from the population preferences are penalized. Penalties are greater in the directions where less variation in preferences exists across individuals. The population preferences are estimated simultaneously with the individual preferences. The mathematical programming associated to the proposed model is quadratic under certain situations. Using this property, an efficient algorithm for solving the model is proposed. The model is flexible in handling several types of preferential information, as well as different reference sets for different consumers. The reference set, i.e. the subset of products which are evaluated, is not needed to be complete or equal for all the consumers. In addition, the method is not restricted to the full-profile ranking, but it can accommodate preferential informations in the form of pairwise comparisons or judgments based on a subset of attributes, at the same time.

**Keywords:** Preference Learning, Heterogeneity, Multicriteria Decision Aid

## **Towards a BI Platform to Support Food Traceability Management: Benefits and Challenges Identification.**

**Maria Gianni, Katerina Gotzamani**

University of Macedonia, Department of Business Administration  
Business Excellence Laboratory  
156, Egnatia St., GR-54636, Thessaloniki, Greece  
giannima@uom.edu.gr, kgotza@uom.edu.gr  
web-page: <http://bel.uom.gr/>

**Isabelle Linden**

University of Namur, Business Administration Department  
FOCUS research group  
8, rampart de la Vierge, 5000 Namur, Belgium  
isabelle.linden@unamur.be  
web-page: <http://directory.unamur.be/staff/ilinden>

### **ABSTRACT**

Traceability is one of the key challenges in the food industry drawing attention particularly when a food scandal takes place. It is not just about meeting the quality specifications of the consumer and to abide by the diverse legal requirements and recommendations issued at various levels of authority. Traceability as a key principle aims at providing a fast and efficient support to the management of any identified - actual or potential – quality or safety incidents in the food supply chain. Business Intelligence (BI) platforms are specifically conceived to provide a centralised view on multiple distributed data sources. They are thought to offer many analytical capabilities on these data in order to turn them into information and knowledge and to support managers in their decision making process.

However, BI solutions are usually deployed within a single (usually big, multi-national) company, whilst traceability involves multiple actors with potentially divergent interests and diverse levels of willingness to participate. Along this line of thought, integration of management systems within a focal company and throughout the overall supply chain raises specific challenges both technical and managerial. From the starting point of addressing the specific needs of the food supply chain current paper opens the question of a supply chain wide BI platform. Considering this particular context, this first piece of work aims (i) to formalise the potential benefits of such a platform for the domain and (ii) to identify the key challenges.

**Keywords:** Integrated Management System, Business Intelligence, Food Traceability

## **Big Data Business Analytics: Challenge, Opportunity, and Talent Gap**

**Xin James He**

Fairfield University

1073 North Benson Road, Fairfield, CT 06824 USA

xhe@fairfield.edu

### **ABSTRACT**

This research investigates the challenge, opportunity, and talent gap with respect to big data business analytics. Specifically, we first analyze key challenges related to big data such as huge data volume that is beyond the ability of traditional database software tools, business analytics such as statistical techniques and data mining technology for the purpose of actionable intelligence, and data security such as cutting edge technology and government regulations to safeguard data safety and privacy. Then we explore major opportunities as a result of big data business analytics such as automated and computerized database management, text mining, actionable intelligence, and predictive forecasting. Finally we study a newly launched graduate program in business analytics and conduct a survey on undergraduate students in various counties to analyze the talent gap for the next generation of big data business analytics professionals.

**Keywords:** Big Data, Business Analytics, Talent Gap

## Using the MapReduce to improve query-response in a survey platform

**Aleksandar Ivanović,**

The Faculty of Organisational Sciences  
Jove Ilica 154, 11000 Belgrade, Serbia  
salenceiv@gmail.com  
web-page: <http://fon.bg.ac.rs>

**Milan Tomić, Dr. Dušan Vujošević**

The Faculty of Computer Science  
Knez Mihailova 6, 11000 Belgrade, Serbia  
milangtomic@gmail.com, dvujosevic@raf.edu.rs  
web-page: <http://raf.edu.rs/en>

### ABSTRACT

A hybrid approach, where a classic database management system and a data management system allowing MapReduce approach are used in parallel, is proposed in this paper as a new way of improving data availability in a case where the amount of actual data storage increases. The case concerns our platform that has been implemented for defining and completing surveys. The platform allows a web user to define a survey as a set of questions with appropriate answers to each question and the number of answers that can be selected. A survey or a particular question can be illustrated with multimedia files, as well as with the links toward external web locations.

The anticipated growth of our survey platform database size requires a new approach to obtaining data. A single database would no longer be sufficient in running multiple queries in a timely manner. Distributed databases running MapReduce algorithm could improve the query response rates.

Initially, the proposed solution would improve the response time in analytics, allowing administrators and researchers to make better decisions in real-time, as big data would be analyzed in parallel and returned in a timely manner. Further on, various collective intelligence algorithms could be implemented on the top of the proposed solution to create new users' features, boosting thus users' experience and preserving the pool of satisfied loyal users.

**Keywords:** Surveys, NoSQL, MapReduce, Query performance, decision support

## **Epileptic seizure detection using Artificial Neural Network**

**Marina Jeremić, Pavle Milošević**

Faculty of Organizational Sciences

University of Belgrade

Jove Ilića 154, Belgrade 11000, Serbia

marinajeremic@hotmail.com, pavle.milosevic@fon.bg.ac.rs

### **ABSTRACT**

Epilepsy is one of the world's most common disease with neurological disorder, affecting nearly 1% of the world's population. For many patients with epilepsy, medications are not effective or they frequently suffer side effects. Electroencephalogram (EEG) is widely used for detection and analysis of epileptic seizures. The diagnosis of an epileptic EEG signal is a vital issue and it is done manually by experts. This paper describes an EEG-based automated classification method, in order to help patients with epilepsy lead more normal and safe lives.

The decision making algorithm consists of 3 steps: 1) feature extraction from EEG signal is done through Discrete Wavelet Transform (DWT), 2) dimension reduction using Principal Component Analysis (PCA) and 3) classification with Artificial Neural Network (ANN). The DWT technique is used to identify the characteristic points of an EEG signal with fairly good accuracy, even in the presence of severe high-frequency and low-frequency noise. The PCA is utilized in order to reduce high number of channels and features. The ANN classifies signal as "Preictal" for pre-seizure or "Interictal" for non-seizure signal. In this research were used EEG data sets, which belong to two subject groups: epileptic subjects during a seizure-free interval (interictal EEG), and epileptic subjects just before a seizure (preictal EEG).

The PCA application on wavelet subband for feature extraction is done by standard linear PCA, which is not optimized for very high dimensional data, however Kernel PCA implementation has proved to be very efficient. In combination with Scaled Conjugate Gradient (SCG) the performance of proposed algorithm is benchmarked against the performance of the standard Backpropagation algorithm (BP) and the Broyden-Fletcher-Goldfarb-Shanno quasi-Newton backpropagation algorithm (BFGS). The results corresponding to the selected algorithm (DWT-KPCA-SCG) show that it could achieve a classification accuracy of approximately 90%.

**Keywords:** Electroencephalogram, Discrete wavelet transform, Principal component analysis, Artificial neural network

## **Interpretable Sparse Models Using ICD-9 Hierarchy For Predicting Pediatric Readmission**

**Miloš Jovanović, Sandro Radovanović, Boris Delibašić**  
University of Belgrade, Faculty of Organizational Sciences  
Jove Ilica 154, 11010 Vozdovac, Belgrade, Serbia  
milos.jovanovic@fon.bg.ac.rs, sandro.radovanovic@fon.bg.ac.rs,  
boris.delibasic@fon.bg.ac.rs

### **ABSTRACT**

Learning interpretable predictive models in high-dimensional datasets is both challenging and important, especially in domains such as medicine and health-care. Algorithms that embed attribute selection by inducing sparsity are a promising approach in such scenarios, because sparse models are easier to interpret, especially when they incorporate domain knowledge. This paper aims at developing sparse logistic regression models for predicting readmission for pediatric patients, based on their diagnoses at discharge. Domain knowledge in form of an ICD-9 disease hierarchy is used to guide the sparsity of the solution, and forces the model to select groups of features which could be interpreted as higher diagnoses concepts, well known by the domain experts. Experiments are conducted on 67K pediatric hospital discharge records from California, State Inpatient Databases (SID), Healthcare Cost and Utilization Project (HCUP) in the period from 2009 to 2011. We use a tree-lasso regularized logistic regression model to incorporate the ICD-9 hierarchy, and compare it to regular logistic regression, L2 regularized and L1 regularized version. The results show tree-lasso model to be competitive in accuracy (measured by AUC), but easier to interpret in terms of higher disease concepts from ICD-9 hierarchy. The results also suggest which disease groups are informative for detecting readmission of general pediatric patients, and we apply the same approach on the subgroups of patients with selected diseases which are known to cause higher levels of readmission.

**Keywords:** Prediction, Readmission, Sparse, Disease, Hierarchy, Interpretable

## **A Communication-Tool DSS for Conflict Resolution**

**Rami A. Kinsara**

Industrial Engineering Department, College of Engineering  
King Abdulaziz University, Jeddah, Saudi Arabia  
Department of Systems Design Engineering, University of Waterloo  
Waterloo, Ontario, N2L 3G1, Canada  
rkinsara@uwaterloo.ca  
web-page: <http://www.eng.uwaterloo.ca/~rkinsara/>

**D. Marc Kilgour**

Department of Mathematics, Wilfrid Laurier University  
Waterloo, Ontario, N2L 3C5, Canada  
Department of Systems Design Engineering, University of Waterloo  
Waterloo, Ontario, N2L 3G1, Canada  
mkilgour@wlu.ca  
web-page: <http://wlu.ca/faculty-profiles/science/d-marc-kilgour.html>

**Keith W. Hipel**

Department of Systems Design Engineering, University of Waterloo  
Waterloo, Ontario, N2L 3G1, Canada  
kwhipel@uwaterloo.ca  
website: <http://www.systems.uwaterloo.ca/Faculty/Hipel/>

### **ABSTRACT**

The novel Decision Support System GMCR+ encapsulates advanced communication features, including the capabilities to define, analyze, and communicate models and analyses, that enable it to support negotiation and the management of strategic conflict. A major feature of GMCR+ is its ability to visualize conflicts explicitly using enriched graph models. Other tools that facilitate communication are the automatic calculation of conflict parameters, and the ability to export them to Excel. Finally, a novel status quo analysis enables the analyst to examine scenarios, and understand stabilities, based on an initial state.

**Keywords:** Negotiation, Communication, DSS, Graph model, GMCR, Conflict Resolution



## Toward Automatic Creation of Clinical Pathways

**Kathrin Kirchner**

Berlin School of Economics and Law  
Alt-Friedrichsfelde 60, 10315 Berlin, Germany  
kathrin.kirchner@hwr-berlin.de  
www.hwr-berlin.de

### ABSTRACT

Clinical pathways describe the treatment steps for a certain disease in a specific hospital. They can improve the efficiency and transparency of patients' treatments: Length of stay in the hospital as well as cost can be reduced, patient safety is increased and new medical personnel can learn more quickly how a certain treatment process is executed. A clinical pathway is usually developed manually by the medical personnel which is costly and time consuming. A once modeled pathway has to be updated regularly so that it is always following new regulations. An automatic support of clinical pathway creation would therefore be helpful.

Process mining allows the analysis of processes based on event logs extracted from process executions. The underlying techniques are often used if a formal description of a process cannot be obtained by other approaches, or if the quality of existing process documentation is questionable. Although useful on industrial processes, process mining algorithms are not often used on medical pathways till now.

Therefore, this paper discusses ideas how process mining can support the efficient creation of clinical pathways in a better way. Challenges based on a literature review and on an own case study in a German hospital are discussed. The biggest challenges in an automatic creation are the integration of big amounts of various medical data from different clinical information systems and the flexibility and complexity of process execution in handling a patient with a certain disease.

An additional integration of medical data as well as of expert knowledge can improve the automatic creation of a clinical pathway. This would include solving interface problems and the extraction of relevant information from documents like discharge letters.

**Keywords:** Clinical Pathway, Process Mining, Medical Data

## **Integrating open source components for human ear feature extraction**

**Aleksandar Komarica, Uroš Šošević, Dušan Starčević**

University of Belgrade, Faculty of organizational sciences

Jove Ilića 154, 11000 Belgrade, Serbia

zeus032@gmail.com, uros.osevic@fon.bg.ac.rs, dusan.starcevic@fon.bg.ac.rs

<http://mmklab.fon.bg.ac.rs>

### **ABSTRACT**

Person recognition based on their biometric modalities has become very popular research field in last several decades. One of biometric modalities that has been given significant attention in the literature is human ear. There are several reasons for this, and some of them include adequacy of human ear for usage together with face recognition. Also, nonintrusive characteristic of human ear makes it interesting for usage in biometric systems, especially multimodal biometric systems. This paper presents a possible way for integrating OpenCV library with MATLAB functions in order to develop a working biometric system based on human ear recognition.

**Keywords:** biometrics, ear recognition, open source, human ear feature extraction

## ICDSST 2015 on Tracking Users` Emotional Reactions and Behavioral Biometrics – toward developing system for students` authentication

Ivana Kovačević

Faculty of Organizational Sciences

Jove Ilića 154, 11000 Belgrade, Serbia

kivana@fon.bg.ac.rs

web-page: <http://www.fon.bg.ac.rs/>

### ABSTRACT

Behavioral biometric is promising field offering the methodological framework for analyzing data obtained by observing and quantifying individual activity patterns for the purpose of identifying or verifying genuine identities. Significant progress is already made in the field of confirming identities by different authentication systems based on the voice recognition, mouse using dynamics or keystroke measures, etc. The emerging issue in human computer interaction studies is related with detecting human emotions while using systems and there are some endeavors to provide methods of tracking and responding to affective reactions while performing different tasks. Affective computing often considers human emotional reactions during the activity of technologically supported learning. As behavioral biometrics predominantly relies on nonverbal signals and emotional expression is usually communicated nonverbally, there is a hypothesis that recording affective reactions might be valuable data source for biometrics.

Accordingly, there is an idea to exploit the learning situation for collecting personal data referring to the emotional reactions` patterns and for building affective blueprints repository of enrolled learners. Data base could be used for verifying user`s identity alongside with login password and other identification requests. There is one more potential use of tracking emotions while doing, for example, the on-line tests. The idea is, not only to recognize irregularities of one`s affective behavior in order to confirm or doubt his authenticity, but to track differences in emotional reactions on questions with the aim to detect the potential identity deception by using physiological sensors that are proven to be linked with the emotional expression and indicators of arousal. There is a hypothesis that the level of arousal might be different in situation of forgery and that it could be detected by analyzing differences between physiological parameters for questions regarding learning material, control questions and for so called relevant questions (in this case personal questions closely linked to the individual).

**Keywords:** behavioral biometrics, identity authentication, affective computing, emotional reactions, biological signals

## **An Alternative Approach to In-Memory Data Processing: A case of financial institutions**

**David Lešjanin, Ognjen Pantelić, Ana Pajić**

Faculty of Organizational Sciences, University of Belgrade

Jove Ilića 154, Belgrade, 11000, Serbia

david.lesjanin@gmail.com, pantelico@fon.bg.ac.rs, ana.pajic@fon.bg.ac.rs

web-page: <http://www.fon.bg.ac.rs/>

### **ABSTRACT**

The idea of in-memory based data processing has been present since the 1980s. Today, the technology has evolved on parallel with the big data concept in order to provide a complete solution for modern day business. With the current data growth rate, in-memory based processing systems are a necessity for a business of any size. The main reason why more companies are not implementing them is the price. The main goal of this paper is to present the benefits of in-memory data manipulation and provide a solution for businesses which cannot afford the commercial systems. An architecture model is given which is based on the standard three-layer architecture. The business logic layer has been granulated and extended to provide good structure for further development, upgrades and maintenance. The model has been proven as efficient through the implementation of two processes which are common in financial institutions. Depending on the nature of the process, it is determined that using the in-memory approach the processing speed can be increased even several hundred times. The costs are practically minimal since the solution is aimed at in-house development for critical business processes, compering to the commercial solution of the same type.

**Keywords:** Real Time Processing, Big Data, Performance, Business Solution, Cost Management, Relational Database

## Multiplicative Utilities for Health and Consumption

### Casey Lichtendahl

Darden Business School, University of Virginia  
100 Darden Boulevard, Charlottesville, Virginia, USA  
lichtendahlC@darden.virginia.edu  
<http://faculty.darden.virginia.edu/LichtendahlC/>

### Samuel E. Bodily

Darden Business School, University of Virginia  
100 Darden Boulevard, Charlottesville, Virginia, USA  
bodilys@virginia.edu  
<http://faculty.darden.virginia.edu/BodilyS/>

### ABSTRACT

Improving health and consumption over a lifetime is fundamentally important in a multitude of choices individuals make. We offer new forms of utility for uncertain streams of health and consumption that follow from appropriate conditions, are assessable using well-established and understandable methods such as time-tradeoff or standard-gamble, and have many desirable properties. The discrete-time multiplicative-linear and multiplicative-exponential forms that result, when taken to their continuous limit, produce strategically-equivalent continuous-time multiplicative-exponential forms. Our new forms express correlation aversion (or seekingness, if desired) with respect to health and consumption and, with a stationarity condition can incorporate constant-rate discounting of future health and consumption. Unlike additive forms, our multiplicative forms are consistent with empirical evidence in the health economics literature that observes that individuals choose standard-gamble probabilities and proportional time tradeoffs that are not constant in life duration and that their standard-gamble probabilities exceed their corresponding proportional time tradeoffs. Our forms give a double exponential utility in life duration that exhibits risk aversion, decreasing (or increasing) absolute risk aversion, and increasing (or decreasing) relative risk aversion. This form can be viewed as constantly risk averse in quality-adjusted life years (QALYs), where life duration is adjusted for health, consumption, and time-discounting.

**Keywords:** decision analysis; multiattribute utility; health utility analysis; medical decision-making; time tradeoff; multiplicative utility; standard gamble; QALYs; life-cycle consumption planning; correlation aversion

## IBA-based Order Relation in Reliability Engineering

**Nemanja Lilić, Bratislav Petrović**

Faculty of Organizational Science

Jove Ilića 154, 11000 Belgrade, Serbia

nemanja.lilic@gmail.com, bratislav.petrovic@fon.bg.ac.rs

web-page: <http://fon.bg.ac.rs>

### ABSTRACT

The objective of this paper is to present the application of IBA-based order relation on reliability engineering. We will base our study upon the concept of system signatures which analyzes the structural connection between the components of the system. Unlike the analysis based on system's structure function which is an exponential problem on the number of system's components ( $2^n$ ), system signature approach reduce the problem to  $n$ -dimensional, where  $n$  is the number of components. System signatures approach is focused on determining how the system will fare if a single component fails, depending on the connections between that component and the rest of the system and irrespective of component's own reliability.

While signatures of the components are pertaining to their expected times of failures, cumulative/tail signatures are related to the expected time of failure of the whole system. This offers us the opportunity to apply order relation based on Interpolative Boolean algebra to the tail signature vectors of various coherent systems of the same order to determine which one is better in terms of reliability. In case order between these vectors cannot be established we will propose a logical aggregation to asses which one can be considered better.

**Keywords:** Reliability, Generalized order relation, Logical aggregation, Structure function, System signature, Interpolative Boolean algebra.

## Measuring a technology's potential for innovative In-Vehicle Information Systems: an MCDM approach using a large set of alternatives

Isabel C. Lisboa<sup>1</sup>, Joana Vieira<sup>2</sup>, Sandra Mouta<sup>2</sup>,

Sara Machado<sup>3</sup>, Nuno Ribeiro<sup>3</sup>, Estêvão Silva<sup>3</sup>, Rita A. Ribeiro<sup>4</sup>, Alfredo F. Pereira<sup>1</sup>

<sup>1</sup> University of Minho  
School of Psychology  
Braga, Portugal  
isabel.lisboa@psi.uminho.pt  
alfredo.pereira@psi.uminho.pt  
webs.psi.uminho.pt/lvp/site

<sup>2</sup> Centro de  
Computação Gráfica  
Guimarães, Portugal  
joana.vieira@ccg.pt  
sandra.mouta@ccg.  
pt  
ccg.pt/piu-equipa-2

<sup>3</sup> Bosch Car Multimedia  
Portugal, S.A.CM/MFI2-CH  
Braga, Portugal  
sara.machado@pt.bosch.com  
nuno.ribeiro@pt.bosch.com  
estevao.silva@pt.bosch.com  
www.bosch.pt

<sup>4</sup> UNINOVA, CTS  
Campus FCT-  
UNL, Caparica,  
Portugal  
rar@uninova.pt  
ca3-uninova.org

### ABSTRACT

Driving a car is a complex skill that includes the primary task of driving but also secondary tasks related with interacting with multiple systems in the car (e.g. infotainment). Current automobile industry trends, point towards maximizing the benefits of using more secondary task functions inside the car without affecting the primary task of the driver. Technologies for novel IVIS (In-Vehicle Information Systems) must satisfy different criteria since they should be innovative and pleasurable to use but also secure, feasible to implement and, at the same time, improve secondary task performance.

We report here a multi-criteria decision making approach for rank ordering a large set of existing human-machine interaction technologies. The decision problem was assessing their potential for innovative IVIS products. Alternatives were either available as commercial products or were still in their conceptual and prototype form, and included more than a hundred technologies; the list was diverse with nine different categories. We were interested in the properties of the best alternatives and examined the criteria tradeoffs in the top quartile.

**Keywords:** Multi-criteria decision making, In-Vehicle Information Systems, Human Factors, Automotive

## Bankruptcy Prediction of Serbian Companies using Soft Computing Techniques

**Dara Marinković, Pavle Milošević, Ivana Dragović**

Faculty of Organizational Sciences

Jove Ilića 154, 11000 Belgrade, Serbia

marinkovic.dara@gmail.com, pavle.milosevic@fon.bg.ac.rs, ivana.dragovic@fon.bg.ac.rs

web-page: <http://labsys.fon.bg.ac.rs/>

### ABSTRACT

The prediction of business results is an increasingly frequent topic that attracts a lot of attention. This paper provides a detailed analysis and comparison of different methods used in order to forecast possible bankruptcy of companies within the Republic of Serbia in the next year. We specially reflect on the usage of soft computing techniques as the more flexible approach for predicting bankruptcy of enterprises.

We collected the data for the 102 different companies and calculated financial ratios for each observed company in order to use these ratios as inputs in further analysis. All collected data refers to the companies in the territory of the Republic of Serbia, in the period from 2010 until the end of 2013.

Several models, both traditional and novel, are used in this study. First, financial ratios are utilized to obtain Altman's Z-score and Ohlson's O-score, the traditional bankruptcy prediction scores. The prediction results of these models will be used as reference values in our research. Afterwards, we use artificial neural networks (NN) for prediction. We apply pattern recognition with Backpropagation and Quickpropagation learning method. Adaptive neuro fuzzy inference system (ANFIS) with Backpropagation and Hybrid learning algorithm is also used in the study. Finally, we mutually compare the results of each of the proposed models used for forecast of companies' bankruptcy. The significant difference appeared between these models. The best results are achieved using NN with Backpropagation method. These results show how powerful and successful they are when it comes to this kind of complex and nonlinear problems.

For the purposes of this paper we created Java application and included Java libraries for neural networks. Also, we enabled communication with Matlab, in order to use ANFIS.

**Keywords:** Soft computing, Bankruptcy prediction, Altman's Z-score, Ohlson's O-score, Neural networks, ANFIS



## Enhancing Functionality Of Biometric Systems Using Technical Standards

Milorad Milinković, Miroslav Minović  
University of Belgrade, Faculty of Organizational Sciences,  
Jove Ilića 154, 11000 Belgrade, Serbia  
milorad.milinkovic@mmklab.org, miroslav.minovic@mmklab.org  
web-page: <http://www.mmklab.fon.bg.ac.rs/>

Miloš Milovanović  
University of Belgrade, Faculty of Organizational Sciences,  
Jove Ilića 154, 11000 Belgrade, Serbia  
milos.milovanovic@mmklab.org  
web-page: <http://www.mmklab.fon.bg.ac.rs/>

### ABSTRACT

This paper indicates two the most common problems in functioning of biometric systems, problem of interoperability between system's components as well as between different biometric systems and problem of biometric data security and privacy protection, both in storage and exchange.

Presenting the structure of BioAPI platform, CBEFF framework and their relationship, the benefits of the application of these standards as a solution to the aforementioned problems have been highlighted.

**Keywords:** Biometrics, Standards, BioAPI, CBEFF

## Predicting Patients' Readmission Probabilities on the Basis of Patient Similarities

**Elena Milovanović, Nina Turajlić, Boris Delibašić,  
Sandro Radovanović, Miloš Jovanović**

Faculty of organizational sciences, University of Belgrade  
Jove Ilića 154, 11000 Belgrade, Serbia

milovanovic.elena@fon.bg.ac.rs, turajlic.nina@fon.bg.ac.rs, delibasic.boris@fon.bg.ac.rs,  
radovanovic.sandro@fon.bg.ac.rs, jovanovic.milos@fon.bg.ac.rs  
web-page: <http://www.fon.bg.ac.rs/>

### ABSTRACT

The aim of this paper is the development of a decision support system for healthcare experts which would take advantage of the large volumes of existing medical data (stored in available Electronic Medical Records) to predict patients' future health states, thereby allowing healthcare experts to appropriately adapt treatment procedures and patients' follow-up and ultimately improve the quality of healthcare and reduce costs.

Recently a method for inferring the discharge diagnosis for a new patient has been proposed, which is based on the computation of similarities between patients along a minimal set of dimensions such as medical history and demographics from past hospitalizations, as well as diagnoses characteristics. Given that the proposed method has yielded promising results, the aim of this paper is to explore the possibility of exploiting these similarity measures to predict patients' future health state, or more specifically, to estimate the readmission probability for existing patients (along with the likely readmission diagnosis) on the basis of information from past hospitalizations.

To this end, four different patient similarity measures (pertaining to patients' medical histories, ages and gender) and two diagnosis similarity measures (which take into account the diagnoses correspondences and co-occurrence frequencies) are computed. From each pair of similarity measures (one patient similarity measure and one diagnosis similarity measure) a single score is calculated, thus resulting in 8 classification features overall. The proposed method was tested on a real HCUP (Healthcare Cost and Utilization Project) data set containing over 10000 admissions records for about 7000 patients covering a period of 3 years.

**Keywords:** Machine Learning, Decision Support Systems, Healthcare, Readmission Prediction, Patient Similarity, Electronic Medical Records.

## **Incorporating Individual Characteristics of the Negotiators in the Negotiation Process Supported by Negotiation Support System**

**Jadielson Alves de Moura, Ana Paula Cabral Seixas Costa**

Universidade Federal de Pernambuco

Avenida Professor Moraes Rego, 1235, 50670-901, Recife, Brazil

jadielson.moura@gmail.com, apcabral@hotmail.com

### **ABSTRACT**

The lack of face-to-face contact in negotiation supported by Negotiation Support System (NSS) has been the main problem presented by this kind of system. Such absence of the subjective characteristics of negotiators can generate dissatisfaction with the negotiation process. This search proposes the use of personality traits and negotiation style during the whole negotiation process to improve the negotiators' satisfaction in terms of communication and negotiation, as well as decrease the number of interactions to reach an agreement. Experiments are being conducted on a developed platform (NegPlace) that incorporates the MBTI and TKI models.

**Keywords:** Negotiation Support System, Personality Traits, Negotiation Style, Negotiation Satisfaction.

## Process Mining on ERP systems: Logical Structure of The Artifact-Centric Approach of Log Extraction

**Ana Pajić, Dragana Bečejski-Vujaklija**

Faculty of Organizational Sciences, University of Belgrade

Jove Ilića 154, Belgrade, 11000, Serbia

ana.pajic@fon.bg.ac.rs, draganab@fon.bg.ac.rs

web-page: <http://www.fon.bg.ac.rs/>

### ABSTRACT

The incredible growth of event data is currently a major topic in information systems field. Organizations adopt Enterprise Resource Planning (ERP) systems to integrate the data and processes of organization into single database. They handle a huge amount of data related to the actual execution of business processes and the goal is to discover from transaction log a model of how the business processes are actually carried out. Process mining can be used to gain insights into process execution and to identify the gaps, but the major challenge is the problem of converting the data from relational database to event logs. Most process mining techniques require a specific format of event data as an input, assuming it is possible to sequentially record events and event record refers to precisely one process instance and one activity. The paper addresses the issue of converting the data from relational database into event logs. Special attention is dedicated to artifact-centric approach which is more suitable for ERP systems, since business process in ERP systems can be viewed as a set of interrelated documents. Detailed analysis of the artifact-centric approach concepts is conducted and description of its constructs is presented by ontological metamodel. Through the model definition the underlying logical and semantically rich structure of the approach will be represented. The paper points out the necessity of analysing and defining the metamodel to understand in depth the complex structure of artifact-centric approach and purpose with the aim to adopt approach and using it in practice. Moreover, Microsoft Dynamics NAV ERP system is used as an example and we describe its characteristics to illustrate data-oriented structure of ERP relational database.

**Keywords:** Ontological metamodel, Event log, Microsoft Dynamics NAV, Business process

## **Machine learning algorithms in service of improving human gait recognition**

**Sandro Radovanović, Miloš Milovanović**

Faculty of Organizational Sciences, University of Belgrade  
Jove Ilića 154, Belgrade 11000, Serbia  
{sandro.radovanovic, milos.milovanovic}@fon.bg.ac.rs

**Miroslav Minović, Milan Vukićević**

Faculty of Organizational Sciences, University of Belgrade  
Jove Ilića 154, Belgrade 11000, Serbia  
{miroslav.minovic, milan.vukicevic}@fon.bg.ac.rs

### **ABSTRACT**

Advances in computer vision technology enabled the development of human gait recognition as a research field. Introduction of structured light technology enabled very precise tracking and analysis of human motion. One research stated significant success in using a distance based approach for frontal gait recognition. This approach allowed a transfer of the problem from spatio-temporal domain into spatial domain (2D image). 2D image descriptors such as histograms were used as feature vectors in comparison. In this research we extend this distance based approach by using state-of-the-art machine learning algorithms as well as several techniques for feature reduction and weighting. Experimental results indicate that this approach can be used to fine tune the decision making process and finally improve results with accuracy of over 97%.

**Keywords:** Gait recognition, machine learning, feature weighting

## Fuzzy Control of Moving Average Filter for Financial Time Series Smoothing

**Aleksandar Rakicevic, Ana Poledica, Bratislav Petrovic**  
University of Belgrade, Faculty of Organizational Sciences  
Jove Ilica 154, 11000 Belgrade, Serbia  
aleksandar.rakicevic@fon.bg.ac.rs, ana.poledica@fon.bg.ac.rs,  
bratislav.petrovic@fon.bg.ac.rs

### ABSTRACT

In the past decades, there has been a growing interest among economists, financial engineers and traders in financial time series, and representing their underlying trends in particular. Since financial data are always noise-corrupted, it is a common procedure to use smoothing techniques to reduce the noise components from a signal, recognize patterns and trends in time series or to make forecasts. One of the most common schemes to produce smoothed time series is the moving average (MA) filter. Its variations include simple, linear and exponential forms considering the method of weight assignment. In this paper, a fuzzy logic approach is used to control MA performance using time series characteristics such as volatility and autocorrelation. In other words, the idea is to use a fuzzy controller to tune MA filter parameters. Fuzzy rules have proven to be a good tool for modeling expert knowledge, which can be a valuable asset in dynamic and uncertain market conditions. In addition, fuzzy control is an agile approach to switch between working regimes of the model providing the ability to quickly adapt to changes in trend. The proposed fuzzy controller is applied to the exponential form of the MA filter to control the weight parameter. The obtained MA values are further used as a price trend indicator. To evaluate the proposed approach, an automated trading strategy is designed to trade based on a trend following principle using the proposed approach as an indicator of price trend. The results are compared to conventional exponential weighted MA filter approach. The aim was to investigate whether the filter can be controlled by fuzzy rules so that it improves trading performance of the trend following strategy.

**Keywords:** fuzzy logic, fuzzy control, moving average, filter, smoothing, financial time series, automated trading.

## **Adaptive Air Traffic with Big Data Analysis**

**Arcady Rantrua**

Sopra Steria / IRIT

10 Rue Claude-Marie Perroud, 31100 Toulouse, France  
118 Route de Narbonne, F-31062 TOULOUSE CEDEX 9, France  
arcady.rantrua@soprasteria.com, arcady.rantrua@irit.fr

**Sébastien Chabrier**

Sopra Steria

8 avenue Yves Brunaud, 31770 Colomiers, France  
sebastien.chabrier@soprasteria.com

**Marie-Pierre Gleizes**

IRIT

118 Route de Narbonne, F-31062 TOULOUSE CEDEX 9, France  
marie-pierre.gleizes@irit.fr

### **ABSTRACT**

Air traffic generators are widely used in the air traffic control and aeronautics industry for training purposes and to validate new concepts or new systems. But it is difficult for a machine to generate realistic trajectories and behavior for an aircraft which lead to the participation of many humans in the simulation to compensate. Traditional generators require performance data for aircrafts and heavy preparation to generate realistic trajectories. Our approach takes advantage of widespread flight location data to learn from their behavior and improve traffic generation. Combining cooperative multi-agent learning methods [1] and big data we show that it is possible to design and generate a realistic and intelligent traffic more easily and without human intervention.

**Keywords:** simulation, multi-agent system, decision making, air traffic management, machine learning, data value

## **A multicriteria decision support for the sustainable production of an apparel factory**

**Luiza Cristina Jordão Braga Vilaça da Rocha, Suzana de França Dantas Daher**  
Universidade Federal de Pernambuco

Centro de Tecnologia e Geociências, Departamento de Engenharia de Produção, Av. da  
Arquitetura, s/nº, 50740-550, Recife-PE, Brazil  
luizacvilaca@gmail.com, suzanadaher@gmail.com

### **ABSTRACT**

Cleaner production has been a tool that companies have found useful to support sustainable policies. One reason is its capacity to promote environmental and economic benefits with few investments that require financial resources. The number of companies that are promoting actions to reconcile environmental objectives with organizational/production strategic objectives is still increasing. However, decision makers very often have to deal with constraints such as time and financial resources in problems involving the need to select or prioritize actions they are faced with. This paper analyzes a local productive arrangement (LPA) in the apparel sector in the northeast of Brazil. It sets out to develop a multicriteria decision support model, based on the PROMETHEE V method, that will enable a single DM in an apparel factory to define a portfolio of actions that seeks to promote improvements in sustainable production.

**Keywords:** cleaner production, sustainability, decision support system, multicriteria decision aid.



## **Impact of social-networking on Collaborative Multicriteria WEB based decision-support system (CMWEB - DSS)**

**Taghezout Noria, Bessedik Imene, Benkaddour Fatima-Zohra**  
Laboratory LIO, Computer Science Depart-  
ment Oran 1 University- Algeria  
taghezout.nora@gmail.com

### **ABSTRACT**

Collaborative decision-making is a concept which has been gradually emerging over the past years, and has been the subject of numerous studies in various domains of application such as design, production management, and resource allocation. This paper proposes a collaborative multicriteria WEB based decision-support system (CMWEB-DSS), which is a decision-support framework that can be of use in supplying decision-enabling information in a number of industrial domains for manufacturing management. When humans interact, the social dynamics will change individuals' perspectives toward a problem, hence lead to different decisions. In this study, human production agents shared and discussed resources allocation problems and/or resources failures with each other. But these discussions lead to many conflicting situations among them. Analytical Hierarchy Process methodology is applied to evaluate sorting solutions in respect of human participants' preferences. The Collaborative environment is integrated in the suggested WEB-based DSS.

**Keywords:** Analytic Hierarchy Process (AHP); Collaborative environment, Human Production Agents (PA); collaborative multicriteria WEB based decision-support system (CMWEB-DSS).

## Importance of Data Normalization in Decision Making: case study with TOPSIS method

Nazanin Vafaei, Rita A Ribeiro, Luis M. Camarinha-Matos  
Department of Electrical and Computer Engineering  
Faculty of science and Technology  
Nova University of Lisbon  
2829-516 Caparica, Portugal  
E-mail: nv@ca3-uninova.org, rar@uninova.pt, cam@uninova.pt

### ABSTRACT

Data normalization is essential for all kinds of decision-making problems, to ensure we obtain dimensionless units, from heterogeneous data measurements, which can be aggregated for rating and ranking decision alternatives. Further, with the advent of big data, collected from many different sources, selecting a suitable normalization technique is a big challenge, due to the need of performing data reduction and synthesis, to enable understandable information and computational efficiency for supporting decision makers.

Many multi-criteria decision making methods (MCDM) use normalizations, which neither take into account the type of data nor if its modeling truly represents the source data. This study discusses the importance of selecting suitable normalization techniques with an illustrative example using the TOPSIS method. The example will first address the results of using only a benefit-based normalization technique versus using both cost and benefit ones. Second, using the same example we compare results using four well-known normalization techniques, to assess which one is more suitable for the TOPSIS method.

**Keywords:** Normalization, TOPSIS, Cost Criteria, Decision Making.

## Using data mining techniques in specialized individual insurance policy issuance process optimization

Dušan Veličkovski, Jelena Lazarević  
IN2 Belgrade D.O.O.  
Vladimira Popovića 40, 11070 Belgrade, Serbia  
dusan.velickovski@in2.rs, jelena.lazarevic@in2.rs  
<http://www.in2.rs>

### ABSTRACT

This paper describes how to optimize parts of data mining methodology in order to create a custom tailored insurance policy for a new client of an insurance company. The aim is to come up with the insurance policy the customer is most likely to accept and to consequently increase the insurance company profit.

The standard insurance policy may not necessarily satisfy the client. It is assumed that the personalized offer, tailored to suit client's needs is likely to be accepted with a higher probability.

In order to create personalized insurance policies, different scientific methods and data mining techniques have been used. The Cross-Industry Standard Process for Data Mining (CRISP-DM) methodology proved to be the most successful. An open source tool - RapidMiner has been selected for the methodology implementation. The result is based on eleven carefully chosen input attributes and presented through three output attributes.

As part of the methodology, the process of analysis has been optimized and slightly adapted. The optimization included fusion of multiple attributes to a single one and vector presentation of attributes through application of functional analysis. This way, the output is presented in two-dimensional manoeuvring space in which the client's requests have been successfully paired with services offered by insurance company. The final decision is based on client's needs by moving the border in favour of the insurance company.

**Keywords:** Data analysis, Data Mining, Insurance Company, Client, Profit Optimization

## BUSINESS PROCESSES RESULTS PREDICTION USING NEURAL NETWORKS

**Nikola Vojtek,**

PhD student at Faculty of organizational sciences  
Radnička 37b/5, 11000 Belgrade, Serbia  
vojtekn@gmail.com

### ABSTRACT

As a result of the dynamic environment, planning of business processes is becoming more difficult every day. The period for which process owners predict the expected process results is shortened and possibility of error is increased due to a number of external factors that can't be influenced. Process owners need to project results for the next periods as much accurate as they can. The results of the business processes are affected by numerous internal and external factors, as well as their connections. As internal factors we consider process inputs such as money, assets, tools, staff and information, as well as other factors that may come from an organizational system which process belongs. External factors come from other organizations (customers, competitors, suppliers, government) through different requirements and behavior. When planning and forecasting results, process owners do not possess sufficient information about internal and external factors and are not familiar how they are related to each other. This paper aims to show the usage of neural networks in solving the described problem of business processes results prediction. Based on the data from the previous period, neural networks take into account influence and behavior of external factors and their relationship to internal factors and with greater certainty predict results. Also, the relationship between internal and external factors is usually nonlinear and neural networks are able to successfully include that kind of relationship, unlike conventional methods.

As an example, sales process of one retail company with three stores has been analyzed. Based on the records of the first half of the year, using Feedforward neural networks with various structures, expected sales results for the second half of the year are obtained. Number of shifts, availability of employees per shift, product margin, marketing initiatives and the number of online shop server failures are used as an input for network. Influence of external factors is not explicitly included in the network, but implicitly, through the results of the previous period. As a result, the number of sold products in the first six months (Jan-Jun) is used. Considering all data, results are acquired from different structures of networks, and best structure is chosen for treated problem. Also, the chosen network will be further used to examine the impact of changes in individual planned inputs in the next period and see whether their reduction or increase leads to a change in the expected results.

**Keywords:** Artificial Neural Networks, Prediction, Business processes, Expected process results

## **Privacy Preserving DSS for reducing Hospital Re-admission rates based on predictive models and knowledge and data sharing**

**Milan Vukicevic, Sandro Radovanovic, Ana Kovacevic, Boris Delibasic, Milija Suknovic**  
University of Belgrade, Faculty of Organizational Sciences  
Jove Ilića 154, 11000 Belgrade, Serbia  
{milan.vukicevic, sandro.radovanovic}@fon.bg.ac.rs,  
{boris.delibasic, milija.suknovic}@fon.bg.ac.rs

**Zoran Obradović**  
Center for Data Analytics and Biomedical Informatics, Temple University  
1925 North 12th Street, Philadelphia, PA, USA  
{ana.kovacevic, zoran.obradovic}@temple.edu

**Gregor Štiglic**  
Faculty of Electrical Engineering and Computer Science, University of Maribor  
Smetanova 17, 2000 Maribor, Slovenia  
gregor.stiglic@um.si

**Alexandros Kalousis**  
Department of Computer Science, University of Geneva  
30, quai Ernest-Ansermet, 1211 Genève, Switzerland  
alexandros.kalousis@hesge.ch

### **ABSTRACT**

In healthcare predictive analytics, the lack of data is often the major obstacle for evolving highly accurate predictive models. This lack of data can be caused by several reasons: rare diseases, long and expensive procedures for data collection and confidentiality of personally sensitive information. We address this problem by proposing privacy preserving system for sharing data between hospitals based on randomization techniques. In order to prevent information loss (and thus predictive accuracy of the algorithms), we utilize recently proposed Virtual Example (VE) generator of Electronic Health Records (EHRs) that exploits advantages of domain knowledge and available data as complementary information sources. Virtual examples generated using this technique can be shared between different sites directly or through common VE repository, because they protect the confidentiality of personally sensitive information. Initial evaluation was conducted for 30-day hospital re-admission prediction problem on pediatric hospital discharge data from 8 hospitals from California. It is showed that besides privacy, this system preserves (and in some cases even improves) predictive accuracy.

**Keywords:** virtual examples, electronic health records, hospital readmission

## **Building interpretable models for 30-day hospital re-admission prediction using evolutionary generic decision trees and knowledge based feature compression**

**Milan Vukićević, Sandro Radovanović, Petar Marković, Boris Delibašić**

Faculty of Organizational Sciences, University of Belgrade

Jove Ilica 154, Belgrade, Serbia

{milan.vukicevic, sandro.radovanovic, boris.delibasic}@fon.bg.ac.rs

### **ABSTRACT**

In healthcare predictive analytics it is utterly important that models have high predictive accuracy, but also high level of interpretability in order to be utilized in medical practice. Even though, decision trees provide highly interpretable models that also allow visualization, they most often fail to evolve highly accurate models for prediction of 30-day hospital re-admission based on Electronic Health Records. This is because decision trees cannot tackle well high dimensionality, sparsity and class imbalance of the problem. In this research, we approached this problem by exploiting the synergy between recently proposed Evolutionary Generic Decision Trees and knowledge based feature compression methods. Initial evaluation showed that proposed model is competitive with state of the art models in terms of predictive accuracy, and that provides much higher level of interpretability.

**Keywords:** Decision tree, hierarchical feature selection, evolutionary search hospital readmission

## Open source algorithms performance on unconstrained facial images

Miloš Živadinović, Ivan Milenković, Dejan Simić

Faculty of Organizational Sciences

Jove Ilića 154, 11000 Beograd, Serbia

mzdv@outlook.com, ivan.milenkovic@mmklab.fon.bg.ac.rs,

starcevic.dusan@fon.bg.ac.rs

web-page: <http://www.mmklab.fon.bg.ac.rs>

### ABSTRACT

The purpose of this paper is to test open source face recognition software on unconstrained images. Facereclib, a Python library, was used to conduct a fair comparison between several face recognition algorithms on LWF (Labeled Faces in the Wild) database. Also, biometric menagerie was used to describe performances of the algorithms. Experiment results are analyzed, and conclusions and suggestions for further research given. Results show that open-source face recognition software is not reliable enough to perform well with unconstrained facial images.

**Keywords:** Face-recognition, Algorithms, Biometric-menagerie, Open-source

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**Abstracts of Posters**

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## **CAMES (Corporate Action Methodology for Enterprise Systems): Decision Management through Improved Communication**

**Olaf Cames, Peter Smith**

University of Liverpool DBA

Liverpool, UK

olaf.cames@online.liverpool.ac.uk, peter.smith2@online.liverpool.ac.uk

### **ABSTRACT**

This paper presents a decision support system (DSS) having the capability to incorporate Action Science principles and evaluate whether Action Science is suitable as an intervention technique during the management of projects. The CAMES system will be primarily a cloud, big data and quantum models of computing solution that manages the data collected from project participants on a 24/7 basis, an enrichment layer for data discovery, refinement, and data quality and an analytics layer that supports real-time analytics. Key to the system will be that data are visualized via graph databases.

**Keywords:** Decision Management, Communication, Project Management, Data visualization, Cloud, Big Data, Quantum Computing

## **Organizational Knowledge Framework for Performance Decision Making**

**Oluwafemi Oyemomi, Shaofeng Liu, Irina Neaga**  
Graduate School of Management/ Plymouth University  
Plymouth, PL4 8AA, Devon, United Kingdom  
{oluwafemi.oyemomi, shaofeng.liu, irina.neaga}@plymouth.ac.uk

### **ABSTRACT**

In current knowledge economy, organizations have identified knowledge sharing as a catalyst to improve business. Therefore, the need to build relationships between organizational processes and knowledge activities are crucial to gain competitive advantages over competitors. However, there are new challenges facing organizations in transferring from business processes to knowledge processes. A major contribution of this research is providing measureable contribution of knowledge assets, knowledge practices that will improve efficiency and effectiveness of employees, also reducing cost and errors in organizational business processes.

## Multicriteria Decision Analysis for banks risks evaluation

**Jean Baptiste Rakotoarivelo**

Universite de Mahajanga / Irit

Toulouse, France

Jean-Baptiste.Rakotoarivelo@irit.fr

**Pascale Zarate**

University Toulouse, Irit

Toulouse, France

zarate@irit.fr

**Josvah Paul**

University Fianarantsoa

Madagascar

### ABSTRACT

This poster aims to observe a better choice for risks evaluation Financial organisms. Our aim is to support banks during operations of customers with respect to funding opportunities, investment or credits reaching. First of all, we identify different types of risks associated with this activity and we secondly analysed them thanks to a method of multi-criteria analysis AHP (Analytic hierachy Process) with different means adopted to identify them. It should be noted that a financial institution is risky and it is in no case possible to annihilate full all sources of risk. Was examined certain types of risks inherent in this activity, these risks are grouped into four criteria such as operational risk, financial risk management, risk against parties and external risks. Although professionals in risk management are trying to better understand the risks and they use to do this complex models, but many of the risks are still not well understood. Therefore, this work has contributed to the resolution of risk, and deliver results that will allow the institution to address the factors that may prevent the achievement of its objectives.

**Keywords:** risk of financial management, AHP method, multi-criteria decision analysis

## **Decision Support System for Quality Design of Steel Products through Just-In-Time Modeling**

**Hiroyasu Shigemori**

Steel Research Laboratory / JFE Steel Corporation

1 Kokan-cho, Fukuyama 7218511, Japan

[h-shigemori@jfe-steel.co.jp](mailto:h-shigemori@jfe-steel.co.jp)

<http://www.jfe-steel.co.jp/en/>

### **ABSTRACT**

Quality design is the decision-making process for determining manufacturing conditions in each production process that satisfy the quality requirements of customers. JFE Steel has developed a decision support system for quality design of steel products using a type of Just-In-Time modeling. The present research focuses on how to determine the optimal manufacturing conditions for securing the target quality by using locally weighted regression, a type of Just-In-Time modeling. The proposed method can improve design accuracy and shorten design time significantly in comparison with the conventional technique. The developed system has been applied practically at JFE Steel's steelworks and has contributed to reduction of quality deviations and production cost.



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