



ICDSST 2021

**The 7th International Conference on Decision
Support System Technology – ICDSST 2021**

on

**Decision Support Systems,
Analytics and Technologies in
response to Global Crisis
Management**

Loughborough University, UK, 26th - 28th May 2021

Editors:

**A.Choudhary, U. Jayawickrama, K. Spanaki and
P. Delias**

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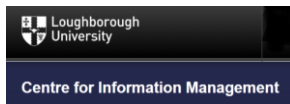
EWG-DSS EURO Working Group on Decision Support Systems
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About the EWG-DSS

The EWG-DSS is a Working Group on Decision Support Systems within EURO, the Association of the European Operational Research Societies. The EWG-DSS was founded during a memorable EURO Summer Institute on DSS that took place at Madeira, Portugal, in May 1989. Most of the participants of the EURO Summer Institute on DSS in Madeira in 1989 still continue nowadays to pursue their goals, working actively in their research areas related to OR and Decision Support Systems.

The EWG-DSS was born with 24 founding-members. Since then, the number of members has substantially grown along the years. Now we are over 300 registered members coming from various nationalities. There has also been established quite a few well-qualified research co-operations within the group members, which have generated valuable contributions to the DSS field in journal publications.

Since its creation, the EWG-DSS has held annual Meetings in various European countries, has taken active part in the EURO Conferences on decision-making related subjects; and has organized several workshops and conferences on different topics around Decision Support Systems.

The main purpose of the EWG-DSS 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 and knowledge among practitioners, end-users, and researchers in the area of Decision Systems.
- Enforce the networking among the DSS communities and facilitate activities that are essential for the start-up of international collaborative research and projects.
- Create professional, academic and industrial opportunities for its members.
- Inspire the development of innovative models, methods and tools in the field Decision Support and related areas.
- Actively promote the interests 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 process-loop shown next translates the main activities of the EWG-DSS envisaging the dissemination of DSS Information (1) and Research (2), in order to encourage DSS Development (3) and Collaboration (4) among the DSS researchers and professionals. Consequently, Publication (5) opportunities to document the research & development processes and the end results are promoted within the EWG-DSS editions.



Specifically, to accomplish the main objectives listed above, the EWG-DSS promotes the following key activities:

- Annual ICDSST Conference and other Conference-Streams organization related to Decision Support Systems topics.
- Annual Journal Special Issues publications, in support of the annual EWG-DSS organized Conferences, providing publication opportunities in the DSS Community.
- Annual EWG-DSS Newsletter publication, promoting the events and the research achievements of the EWG-DSS members and of the DSS Community as a whole.
- Annual EWG-DSS Award: a motivating research initiative for young researchers to submit and present their work in one of the EWG-DSS organized events during the year.
- Collaboration projects among the group members. Check about the EWG-DSS research project Collab-Net Project, as well as the R&D competences of some member-institutions listed for collaboration in European projects.

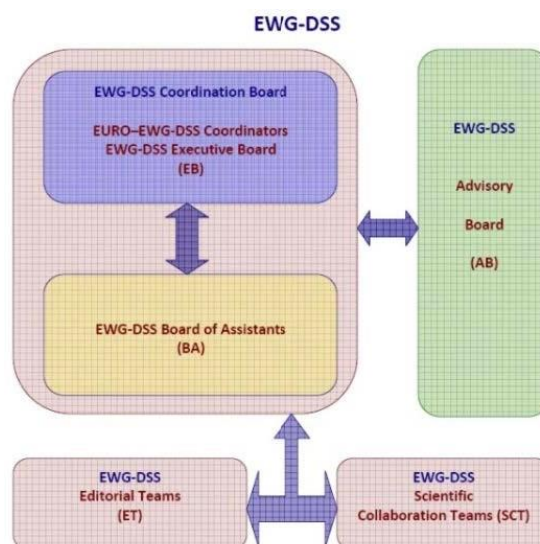
Since 2007 the EWG-DSS has been managed by a Coordination Board. One of the aims of this Coordination Board is to promote joint work among the group members and to encourage more participation of the whole group in DSS related projects and events, the best way possible. The Current EWG-DSS Coordination Board counts with the assistance of a board of six members, namely: Professor Shaofeng Liu, Professor Boris Delibasic, Professor Isabelle Linden, Dr Jason Papathanasiou, Dr Pavlos Delias and Dr Ana Paula Cabral Seixas Costa.

EWG-DSS Management Structure

Since May 2015, the EWG-DSS has updated its Management Structure in order to incorporate into the Coordination Board (CB) with an Advisory Board (AB), which is composed of senior members of the EWG-DSS group and of the international DSS community, including the Professor Pascale Zarate and Dr Fatima Dargam who moved onto the Advisory Board from the Coordination Board. The Advisory Board is chaired by Professor Rita Ribeiro.

The Board of Assistants (BA) is formed by young researchers linked to the Coordination Board (CB) members, in order to assist them with the EWG-DSS annual tasks. Board and Team members can be in more than one of the groups of the EWG-DSS new defined Management Structure. However, the members of the Coordination Board are not supposed to be members of the Advisory Board and vice-versa.

The new Management Structure also distinguishes different teams, namely: the Scientific Collaboration Team (SCT) and the Editorial Team (ET), among the EWG-DSS Members who collaborate with EWG-DSS projects and joint-Editions, respectively, as illustrated in the Figure:



The EWG-DSS Editorial Team (ET) is a dynamic group of researchers composed of EWG-DSS Members that have guest-edited Journal Special Issues and Springer Books with the EWG-DSS. The Scientific Collaboration Team (SCT) includes the researchers who are involved with EWG-DSS research projects and initiatives, for instance the Collab-NetProject. For more details about the EWG-DSS organized events and publications, check the homepage: <http://ewgdss.wordpress.com/>

Joining the EWG-DSS

The EWG-DSS membership does not cost you anything. If you wish to join the EURO-Working Group on Decision Support Systems, all you have to do is to send an e-mail to our group at: ewg-dss@fon.bg.ac.rs with the following information:

Name; Affiliation; Mailing Address; Phone; e-mail; and Homepage link.

Alternatively, you can also join the EWG-DSS via our LinkedIn Group at: <https://www.linkedin.com/groups/1961459/>

Thanks for your interest!

The EWG-DSS Coordination Board

Preface

ICDSST – the International Conference on Decision Support System Technology – is the flagship event of the Euro Working Group of Decision Support Systems (EWG-DSS). The ICDSST series of conference is relatively young and vibrant (since 2015), while its predecessor, including EWG-DSS workshops and summer schools, has a long tradition.

The EWG-DSS was formally established in 1989 during a memorable EURO (European Association of Operational Research) summer school in Madeira, Portugal. Since then, the society has successfully organised wonderful events in many countries with collaboration from fantastic organisations, institutes and communities. Given the COVID-19 crisis, the 2021 edition of the conference was held in a fully online mode, the format that we used in the last year’s conference. This has meant thinking of new ways of managing the conference, of accommodating the sessions to participants from so many places in the world in varied time zones, and in general of new ways of communicating and interacting with the participants in the Conference.

The ICDSST 2021 International Conference on Decision Support System Technology has been organized by the EURO Working Group on Decision Support Systems EWG-DSS in cooperation with the Loughborough University (UK) at its School of Business and Economics, during the period of May 26th to May 28th, 2021. The purpose of this Conference, focused on the main theme of “Decision Support Systems, Analytics and Technologies in response to Global Crisis Management”, is to bring together researchers, developers and specialists in the related areas of decision making, including its methodologies and technologies, as well as application-oriented solutions.

Following on from ICDSST 2020 (Cognitive Decision Support Systems and Technologies - Building the future of Decision Support Systems: The Power of the Mind in the Cognitive processes), the COVID-19 outbreak is a human tragedy and has a growing impact on most aspects of human beings including health, economy, education, sports and many more. There are many ways that we, human beings, could have better managed a global crisis like this. Researchers, engineers, computer scientists, OR and DSS professionals were encouraged to submit their work to the ICDSST 2021. Main topics included:

- Decision Support Systems: Advances and Future Trends
- Multi-Attribute and Multi-Criteria Decision Making
- Knowledge Management, Acquisition, Extraction, Visualisation and Decision Making
- Multi-Actor Decision Making: Group and Negotiated Decision Making
- Collaborative Decision Making and Decision Tools
- Discursive and Collaborative Decision Support Systems
- Mobile and Cloud Decision Support Systems
- GIS and Spatial Decision Support Systems
- Data Science. Data Mining, Text Mining, and Sentimental Analysis
- Big Data Analytics
- Imaging Science (Image Processing, Computer Vision and Pattern Recognition)

-
- Human-Computer Interaction
 - Internet of Things
 - Social Network Analysis for Decision Making
 - Simulation Models and Systems, Regional Planning, Logistics and SCM
 - Business Intelligence, Enterprise Systems and Quantum Economy
 - Machine Learning, Natural Language Processing, Artificial Intelligence
 - Virtual and Augmented Reality
 - New Methods and Technologies for Global Crisis Management
 - Analytics for Mitigating the Impact of Pandemics
 - Intelligent DSS for Crisis Prevention
 - Innovative Decision Making during Global Crises
 - New DSS Approaches for Post-Crisis Recovery of Economy
 - Decision Making in Modern Education
 - Decision Support Systems for Sports
 - General DSS Case Studies (Education, E-Government, Energy, Entrepreneurship, Environment, Healthcare, Industrial Diversification and Sustainability, Innovation, Logistics, Natural resources, etc.)

It is a great pleasure to introduce you to the papers and posters presented at ICDSST 2021, comprising this e-version of proceedings “Decision Support Systems, Analytics and Technologies in response to Global Crisis Management”. Each paper/poster in the proceedings has been evaluated by multiple reviewers. The papers are published in two forms: a selection of high quality, long papers are published by Springer in their book series of “Lecture Notes in Business Information Processing”. All abstracts, posters and a selection of short papers are published electronically in this proceedings. Hope you will find the proceedings really interesting and stimulating.

The technical realization of the conference takes place in the School of Business and Economics of the Loughborough University, Loughborough, UK, during the period of May 26th-28th, 2021. Every year more than 18,000 students pass through the Loughborough University, which has consolidated its position and reputation. The University is now ranked at 5th in the UK on Times Higher Education League Table. It is one of the 10 best universities out of over 130 throughout the UK in all three University Ranking National League Tables. It was crowned as the “University of the Year” at the 2020 WhatUni Student Choice Awards. Moreover, Loughborough University has been named the best university in the world for sports-related subjects for the third year running by the global QS higher education league table.

We don’t want to end without thanking many people who have greatly contributed to the success of the proceedings and the conference. Organizing a conference is certainly not an easy task and demands hard work, dedication, and management efforts that we luckily find among the EWG-DSS Coordination Board members, Advisory Board members, Board of Assistants and members of the Organizing Committee of the ICDSST 2021, despite the uncertain environment we have faced during the past year. We also would like to thank EURO and the School of Business and Economics, Loughborough University, UK for the support they have given to the realization of the conference.

We wish to thank all authors and participants of the conference, for having trust and interest in the EWG-DSS organized conferences by submitting their work for reviewing, presentation, and publication. Special thanks go to all Program Committee members for their excellent reviewing support on this conference. We have accepted 41 submissions contributed by 142 authors from 21 countries and we had a tight schedule for providing review feedbacks. We would not have achieved our reviewing goals without the highly qualified, constructive, and effective cooperation of our team of reviewers. We sincerely express our gratitude to all the people for their help and support which has made this conference happen!

We wish all the ICDSST 2021 participants an enjoyable and fruitful collaboration time during the conference, with lots of networking for further cooperation and joint work. Finally, you have been deprived of a visit to the beautiful town of Loughborough this time, but, of course, we hope you can enjoy its appeal in the not-too-distant future. Enjoy the ICDSST 2021!

The Editors:

Alok Chaudhary

Uchitha Jayawickrama

Konstantina Spanaki

Pavlos Delias

Keynotes

How Spies Think



Prof. Dr Sir David Omand GCB

In this talk the outputs of intelligence analysis will be examined from the perspective of the user of intelligence in terms of the categories Situational Awareness, Explanation, Estimation and Strategic notice. This SEES model will be used to identify the common cognitive biases of analysts together with suggested ways of identifying such errors. A contrast is drawn between the situations where there is sufficient path dependency to use Bayesian inference to move via explanation from data about a situation to estimation and modelling of how events may unfold and the strategic notice which may be obtained by working backwards from possible future states of risk to identify preventative and precautionary measures against such risks crystallizing. A comparison is made with the classic distinction in intelligence studies between secrets and mysteries. The lessons for systems of warning will be identified. The availability of impartial professional SEES advice is seen as an essential complement to the necessary values and goal driven outlook of the final decision taker.

Professor **Sir David Omand GCB** is Visiting Professor in War Studies, King's College London, PSIA Sciences Po in Paris and the Norwegian Defence University in Oslo where he teaches intelligence studies. Previously his posts in British government service included UK Security and Intelligence Coordinator in the Cabinet Office, Permanent Secretary of the Home Office, Director GCHQ, and Deputy Under-Secretary of State for Policy in MOD. He served for 7 years on the Joint Intelligence Committee (the JIC). He is the author of *Securing the State* (Hurst, 2010) and co-author with Professor Mark Phythian of *Principled Spying: The Ethics of Secret Intelligence* (OUP, 2018). His latest book is *How Spies Think: 10 Lessons from Intelligence* (Penguin Viking, 2020).

Evidential Reasoning Rule for Evidence Based Decision Making, Probabilistic Inference and Explainable Machine Learning



Prof. Dr Dong-Ling Xu

In this talk, the Evidential Reasoning (*ER*) rule will be introduced and how it extends Bayes rule will be explained. The ER rule extends both Bayes rule so that it can be used for probabilistic inference with imperfect data and in situations where prior probabilities are impossible or difficult to estimate. It has been applied to model and analyses complex decision-making problems and to develop explainable machine learning (ML) tools to model relationships between feature variables and labels. A number of such case studies will be presented in different areas including healthcare, engineering, and legal service. Compared with other ML tools such as artificial neural networks (ANNs), these cases will demonstrate that the explainable ML models driven by the ER Rule can be constructed and trained by data. judgements or both, with or without ambiguity, can achieve similar prediction accuracy to what ANNs can do, and are transparent so that users can check why they work, whether they can be trusted and how they can be extrapolated. It will also be shown that by using the ER rule the effect of different types of uncertainty, such as randomness, ambiguity and inaccuracy, can be explicitly modelled and analysed in a unified format and information in imperfect data can be utilized for evidence-based decision making.

Dr Dong-Ling Xu is Professor of Decision Science and Systems at Alliance Manchester Business School, The University of Manchester, UK. Over the past 30 years, she has been conducting research in data analysis, statistical inference, machine learning and decision support systems under uncertainty; system and process modelling; statistical fault detection, system development and their applications in a wide range of areas. She has developed several interactive web-based decision support systems and co-developed a Windows-based software package called Intelligent Decision System (IDS) via Evidential Reasoning for general purpose multiple criteria decision analysis, and several statistical fault detection systems. Those systems are used in a wide range of decision making and risk assessment activities by organizations such as General Motors, Tesco, NHS, Ford, Shell, BP and CNOOC in areas such as healthcare and finance; modelling and analysis of system safety and security; and organizational self-assessment in quality management. The Evidential Reasoning approach and the IDS software is used by practitioners and researchers from over 50 countries. She has published over 100 peer reviewed journal papers, book chapters and books.

Cheap: Decision-Making, Winning and Losing In An Era of Low Transaction Costs



Prof. Dr Peter Kawalek

One of the best understood effects of digital technology is that information processing becomes cheaper. What happens next? Here I present qualitative evidence from police detectives, academics, industry executives and decision-makers, of an overwhelming world of splintered attention, contested decisions and constant accountability for a never-ending brief. Drawing from Herbert Simon and other classical information theorists I show that the informational experiences of our world today were foreseen a very long time ago. Through this we can invoke theories of the Attention Economy and question how we academics can extend this theory-base. We look also at how aspects of digitization such as robotics and industry 4.0 might extend some of the problems we have seen in the informational world and speculate a little on the downside of cheap communication and technology. Throughout, we will be drawing on the experiences of professionals today as they reflect on how a commoditization of information begets a commoditization of attention and their lives beyond.

Dr Peter Kawalek is Professor of Information Management and Director of the Centre for Information Management, School of Business and Economics, Loughborough University, UK. He has additional visiting positions at Letterkenny Institute of Technology, Donegal and Deusto Business School, Bilbao. Previously of Manchester Business School, Instituto de Empresa, Warwick Business School and School of Computer Science at Manchester, he also has wide experience working with organizations including Siemens AG., SAP, IBM, Office an Taoiseach (Prime Minister) in Dublin, the Department of Communities and Local Government (London), Leeds City Council, Salford City Council, Lancashire Constabulary, Greater Manchester Police, Manchester City FC., New York City FC. Peter has held and managed over £2m in research grants from government and research councils.

Abstracts

I

Multicriteria

approaches

DEX2Web – A Web-Based Software Implementing the Multiple-Criteria Decision-Making Method DEX

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ABSTRACT

DEX2Web is an online suite of tools to help individuals and groups with their decision-making. DEX2Web implements the qualitative multiple criteria decision-modelling method DEX. DEX is useful for supporting complex decision-making tasks, where there is a need to select a particular option from a set of possible ones to satisfy the goals of the decision-maker. DEX2Web primarily supports interactive development and evaluation of DEX models. Most of the functionality of the first available version of DEX2Web is inherited from its desktop ancestor DEXi: development of DEX model structure, editing of attributes and their scales, definition of decision rules, multi attribute evaluation and analysis of alternatives, and presenting evaluation results with charts. DEX2Web has a modern software architecture and employs a newly developed DEX software library. DEX2Web is freely available on <http://dex2web.ijs.si/>.

Keywords: DEX2Web, DEX, Decision-Making Software, Multiple-Criteria, Web, Software, Group Decision-Making.

A Survey on Criteria for Smart Home Systems with Integration into the Analytic Hierarchy Process

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ABSTRACT

While smart home systems and smart home applications are utilized more and more, the assortment of smart products gets broaden and is accompanied by a constant growth. This stable increase of products leads to confusion and perplexity and, consequently, it hinders a deliberate and well thought through decision. This paper presents a survey on the most important criteria which enable a conscious assessment of smart home systems. It provides an elaborate review of various research outputs pertaining usability, sustainability and complexity of smart home applications. By connecting such applications with the terms platforms and IoT, a new door is opened enabling an up to date assessment. Security, safety as well as data protection extend the discussion and shepherd towards a most complete description in order to appraise smart home products. Finally, based on the reviewed topics, a list containing 18 discretized criteria is given which allows an integration into the Analytic Hierarchy Process.

Keywords: Smart Home, Domestic Technology, Literature Review, Assessment, Analytic Hierarchy Process.

The Multi-Actor Multi-Criteria Analysis (MAMCA) for Mass-Participation Decision Making

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ABSTRACT

The Multi-Actor Multi-Criteria Analysis is a methodology that allows for the involvement of multiple stakeholders within a decision-making process. It reveals the consensus and conflicts between the different groups of people that are involved in the evaluation but hold different interests. Nowadays, the concept of the “stakeholder” in MAMCA gradually shifts to the “stakeholder group”, and there is a need for involving more than one evaluator in the stakeholder group to make sure all the voices from the group will be heard instead of being represented by one. Especially when a stakeholder group contains a large variation in interests, concerns, and socio-economic characteristics. Additionally, one group can have subgroups that might be hard to reach, and therefore are not or un-der-represented in the analysis. This is typically the case for the ‘citizens’ stakeholder group.

In order to fulfil the needs of the involvement of many different stakeholders within stakeholder groups, the mass-participation function was developed in MAMCA and the MAMCA survey tool is designed. This tool allows the decision-maker to design the dedicated survey for the stakeholder group which needs the mass-participation function. The easy-to-understand evaluation process is used to avoid time-consuming elicitation. It is possible to check the homogeneity and heterogeneity of the stakeholders within the stakeholder group based on the socio-economic profiles collected in the survey.

Keywords: Mass Participation, Multi-Criteria Decision Making, Multi Actor Multi Criteria Analysis, Survey.

Comparison of AHP, PAPRICA, PROMETHEE, DEX and TOPSIS on an application for employee selection

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ABSTRACT

Employee selection is an essential process that in many organizations depends only on human judgement, and in today's fast-changing work environment, is susceptible to human errors. Hence, the problem of selecting the most appropriate employee is complex and costly, especially if the selected employee is unsuitable for the job position. The complexity of the problem arises from several requirements: each job position requires more than one criterion to be fulfilled by the job candidate; each candidate has a different set of skills, and usually, several candidates apply to one job position. The decision-maker has to make a quick selection decision, as the longer employee selection process is, the greater the costs are. In this article, we build 20 decision support models for four different job positions with five Multi-Criteria Decision Making (MCDM) methods and we compare them on a real set of data from an employment agency. The goal of this comparison is to recommend which method is most suitable by comparing the correctness of the results, ranking with missing values and difficulty to use. The results show which MCDM method is better for filtering most suitable employees given all required criteria and which MCDM method would be recommendable for employees ranking.

Keywords: Employee, Selection, Multi-Criteria, Decision, Employment.

A Bibliometric Network Analysis for MCDA applications in environmental management

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ABSTRACT

Decision making in environmental management requires trade-offs among economic, social, political, and environmental factors, while it is often affected by diverging stakeholder perspectives. Multiple Criteria Decision Analysis (MCDA) has evolved into a systematic approach for processing various types of information and stakeholders' values in order to support decision making in a variety of fields, but it can be particularly useful in decision-making regarding environmental management. Hence, this paper presents an exhaustive literature review based on the database of Web of Science, which examines papers published from 2000 to 2021, including 765 publications. As a first stage, we analyzed basic characteristics of the results, such as the number of publications over the selected years, the most frequent categories relevant to environmental management, and the most frequent journals. As a second stage, we conducted a bibliometric network analysis, and we tried to examine the frequency and clusters of authors' keywords and countries. Among others, the findings indicate that MCDA's environmental applications have grown significantly in the last five years in all environmental application areas, while they seem to quite popular in certain countries. All in all, it could be argued that MCDA techniques have been used successfully in a variety of environmental decision-making processes.

Keywords: Multiple Criteria Decision Analysis, MCDA, Sustainable Development, Bibliometric Analysis.

A module for improving the incompatibility in AHP-Group Decision Making

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ABSTRACT

This poster presents a preliminary version of a software module for improving the incompatibility in a local AHP-group decision making context. The module, which has been integrated into the PRIOR software, implements a sequential procedure using the RGM as the prioritisation method and the GCOMPI as the incompatibility measure. At each iteration, the judgement that further improves the GCOMPI is selected, and this judgement is modified up to a pre-set threshold, known as the permissibility. Incompatibility reduction tries to reach (if possible) a level of the GCOMPI below a fixed threshold by making small modifications to the judgements in the collective matrix. Thus, the new collective priority vector will be close to the initial one. Five different indicators based on the measurement of distance between vectors are used to assess the magnitude of changes in priorities. A graphical representation of the relationship between the compatibility (GCOMPI) and the modifications of the collective priority vector associated to different permissibility levels is provided. The incorporation of these graphs in the module being designed aims to facilitate the resolution of group decision making problems and the learning and extraction of knowledge about them.

Keywords: AHP, Group Decision Making, Compatibility, GCOMPI, Permissibility, Graphical Visualisation

II
West Time
Zone 1

Using FITradeoff Method for supply selection with decomposition and holistic evaluations for Preference Modelling

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ABSTRACT

The FITradeoff method is a Flexible and Interactive method used to solve Multi-Criteria Decision Making/Aiding (MCDM/A) problems, with additive aggregation in the context of Multi-Attribute Value Theory. This study discusses the combination of two perspectives of preference modelling in the FITradeoff method for a supply selection decision problem. Five criteria are considered: Price, Product Quality, Delivery Time for supplying, Confidence of the Supplier and Service, associating to the classical objectives of manufacturing and operations strategies. The two perspectives are: the elicitation process by decomposition and the holistic evaluation. The combination of these two perspectives offers flexibility for the decision-maker during the FITradeoff decision process. The FITradeoff is implemented in a Decision Support System, in which the holistic evaluation is performed using graphical and tabular visualizations.

Keywords: FITradeoff method, Elicitation process, Holistic evaluation, Multi Criteria Decision Making/Aiding (MCDM/A), Multi-Attribute, Supply selection.

Industry 4.0 maturity models assessment - a multicriteria approach

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ABSTRACT

The advent of industry 4.0 has been in evidence in recent years, mainly due to significant manufacturing processes improvements such as autonomy, virtualization and decentralization. These advances are based on disruptive technologies as artificial intelligence, internet of things, physical cyber systems, big data and cloud computing. Simultaneously, studies have been proposing new ways of applying technologies to improve processes, while numerous models for assessing the organizations maturity regarding industry 4.0 have been developed. Such models generally comprise the identification of the current maturity level, as well as possible actions to reach higher levels. However, these models have different characteristics, as far as their objectives, approach, application contexts, extensions or dimensions are concerned. Thus, the characteristics previously mentioned are responsible for most of the complexity of the analysis and definition of models that can be used for assessing the maturity of a segment of organizations. Thus, this paper proposes the application of a multicriteria method (FITradeoff) to support the decision of ranking maturity models in the context of scientific research related to textile manufacturing processes in Brazil. Results obtained demonstrate the applicability of the multicriteria approach, more precisely the FITradeoff method in the analysis of maturity models, showing that it also contributes to the case study through the recommendation of models that suit the context under study.

Keywords: Industry 4.0, Maturity models assessment, Multicriteria, FITradeoff, Ranking.

Analyzing the Public Opinion Polarization about COVID-19 Vaccines in Brazil Through Tweets

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ABSTRACT

The evolution of the SARS-CoV-2 pandemic caused great mobilization in all countries, leading to the adoption of social isolation measures to prevent its spread. The occasion was also marked by a constant concern with overcrowding intensive care units (ICU) for the most severe cases of the disease. The months of December 2020 and January 2021 were the initial milestones for vaccination worldwide, with an intense public mobilization in Brazil's social networks, both pro and anti-vaccination. This paper aims to present the results of a public opinion polarity analysis about the vaccines in Brazil based on this mobilization. For this purpose, techniques and tasks associated with social web mining and natural language processing (NLP) were applied, starting with tweets collection, and culminating in the use of deep learning to classify the polarity of the texts obtained. The results intend to corroborate the importance of techno-social analysis of people's movements in social networks, investigating society's behaviour in relation to the coronavirus disease 2019 (COVID-19) immunization programs.

Keywords: COVID-19, Pandemic, Vaccination, Opinion Mining, Social Networks, Twitter, Polarity Classification, Deep Learning.

E-voting: A web system customizable for participatory decisions based on the Random-Subset Voting (RSV) method

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ABSTRACT

Information systems (IS) support the decision-making process by instituting an information technology that aims to facilitate the electoral situation. This paper presents an analysis of the literature on probabilistic voting systems/methods, intending to relate probabilistic voting to an IS technology. It seeks to propose an information system, web, that is customizable for participatory decisions and based on the assumptions of the random-subset voting (RSV) method. This method recommends the evaluation of random subsets with a predefined dimension instead of the complete set of alternatives. It offers some advantages regarding the reduction of the options of the set as well as the convergence as a result of the set with the subset. Preliminary studies on the RSV confirm such advantages through theorem and simulation. Our initial results, which stemmed from a real situation, were obtained using RSV with the support of a pilot application through the web. The situation involved undergraduate students (N = 218) and their participatory decision concerning institutional projects from a Brazilian higher education institution. We evaluated the convergence with the result in addition to impressions of voters' ability to use the system. The results showed that voters agree that the RSV system offers a positive experience in terms of usability, as well as demonstrated similarity among the results the set with a subset of alternatives for a particular case. As such, there is an opportunity for research regarding the development of an information system based on the web for collective decisions using RSV. In this research in progress, we will implement RSV modeling through a website, where voters will be able to customize the electoral scenario, selecting the number of alternatives, the number of random options, and the particular method applied in the RSV. In terms of value and originality, we believed that the development of this system will provide greater ease in the voting process given the premises of the RSV. It also will offer the advantage of evaluating fewer alternatives in the context of a collective decision, in addition to corresponding with the involvement of stakeholders in public decisions, which in turn contributes to the promotion of democracy.

Keywords: Random-Subset Voting, Information Systems, Group Decisions and Bounded Rationality.

Decision Support System to Brazilian Public Security Management: a hybrid methodology (unstructured and structured data)

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ABSTRACT

This paper aims to illustrate DS.Security (Decision support system for public safety management). This system contributes to the security management in Pernambuco state, Brazil. The software has a hybrid methodology, incorporating structured and unstructured data to increase the accuracy of machine learning algorithms that act to establish neighborhood classification, as well as crime prediction. As a result, agencies involved in public security hold software that has a level of accuracy that brings more accurate results that contribute to actions against local crime.

Keywords: Decision Support System; Public Security; Machine Learning

Knowledge Discovery Database Model to Public Safety Management: Brazilian Case Study

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ABSTRACT

This paper aims to present a model for knowledge extraction in databases linked to public safety. It combines machine learning, big data and KDD techniques to classify neighborhoods, taking into account the knowledge generated by this analysis. As a result, agencies involved in public security can identify neighborhoods with greater difficulty and establish a set of actions aimed at minimizing the occurrence of crime and, consequently, increase security in these locations.

Keywords: KDD, Machine Learning, Public Safety.

III

East Time Zone

The Design of Decision Support System for Partner Selection Using Unified Modeling Language (UML) Diagram

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ABSTRACT

Decision Support System (DSS) is an interactive computer-based information system that supports organisational or business decision-making activities. It is used to support determinations and judgements in solving problems and involve decision-makers in the organisation to produce effective decisions. Due to the increased competition in global markets, finding and selecting compatible partners to form Collaborative Networks (CNs) is required. Consequently, before operating the CNs, it is crucial to develop a DSS application to help decision-makers select potential partners. This DSS application considers the partner-related criteria performance measurement for selecting the partners. However, there is an issue that the development of DSS applications does not fulfil the users' needs and satisfaction. Without user acceptance and satisfaction, the implementation of DSS will do not achieve the desired benefits. Therefore, a DSS development in this study considers the problem by providing solutions through designing DSS using the Unified Modeling Language (UML) diagram. This diagram helps software developers implement an application that satisfies and accepted by the users of the system.

Keywords: Collaborative Networks, Partner Selection Criteria, Decision Support System (DSS).

Methodology for Multi-Aspect Ontology Development: Use Case of DSS Based on Human-Machine Collective Intelligence

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ABSTRACT

The lack of interoperability observed in modern DSSs becomes even greater when complex systems covering multiple domains are considered. In the present research, the apparatus of multi-aspect ontologies is used as a means to represent knowledge of DSSs based on human-machine collective intelligence for enabling interoperability between the system components and coordinate interrelated processes. The available ontology development methodologies are not quite suitable for the development of multi-aspect ontologies because they leave aside the problem of choosing approaches for integration of reusable ontologies. Since the structure of a multi-aspect ontology imposes some restrictions on the aspects integration, the objective of this research is to propose a methodology for the development of multi-aspect ontologies that incorporates an aspects integration approach. For the research purpose, the existing ontology development methodologies have been analyzed and an ontology development pattern followed by most methodologies has been revealed. The developed four-stage methodology extends it with an aspects integration approach. The methodology is illustrated through the development of a multi-aspect ontology to support semantic interoperability in DSSs based on human-machine collective intelligence.

Keywords: Ontology Development Methodology, Multi-Aspect Ontology, Decision Support, Human-Machine Collective Intelligence.

Team Formation Characteristics and Methods: A Short Review

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ABSTRACT

Collaborative operations involve the creation of a team(s), depending on the task that is needed to complete, these formations can have weak or strong links to each other. Team creation is a time-consuming, complicated, crucial and necessary process for the lifecycle of team growth, especially when the participant list is not known. If the atmosphere encourages genuine encounters, learning and intellectual development can be improved among individuals in a team. The success of a composed team, however, is not always assured. Researchers point out that when team formation is incorrect, many individuals obstruct the learning process of the team. The creation and testing of team structure models/methods using best practices and other approaches has been an increasing concern for many researchers over the last decades. Depending on the characteristics, attributes, personalities of the team members, the team process and the techniques used to shape the team(s) may vary. After reviewing more than 60 studies in the last decade in team formation techniques, we present in this paper the most common team formation characteristics and computational methods that are used in team formation.

Keywords: Team formation, Member's characteristics, Methods, Techniques, Attributes, Review

**The impact of COVID-19 crisis on the digitalization
transformation for maritime supply chain: the adoption of
interorganizational information systems**

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ABSTRACT

Coronavirus (COVID-19) has turned into a global crisis. Maritime transportation has been the main transportation approach for moving goods worldwide, and it has become ever more important as it ensures the movement of vital goods against the pandemic. International collaboration between organizations is required to overcome this crisis. Notwithstanding the challenges caused by COVID-19, it would also be an opportunity for maritime supply chain to accelerate the transformation of digitalization. Organizations that could adjust their business strategies accordingly would not only survive in this challenging moment, but also gain its competitiveness in the post-pandemic stage. Based on a generic technology-organization-environment (TOE) framework and conversations with practitioners in the maritime supply chain, this article discusses the adoption of IS in maritime supply chain and its role during the pandemic period.

Keywords: Digital Transformation; Maritime Transportation; Technology-Organization-Environment; COVID-19.

IV

**Decision Support
Systems in Global
Crisis Management**

Modelling the Effects of Lockdown and Social Distancing in the Management of the Global Coronavirus Crisis - Why the UK Tier System Failed

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ABSTRACT

This study explores key determinants of how product line strategy impacts service performance of the airline industry during COVID-19 pandemic. This study scraped airline data from multiple online sources, the results reveal that airlines simultaneously exercised product and service differentiation strategy by increasing quality differentiation in order to maintain market share. Furthermore, by utilizing passenger reviews data, text analysis technique provides information on the attributes of service that differentiate positive and negative comments. The results suggested that satisfied passengers are seeking for empathy and responsiveness services, while negative comments suggested frequent complaints of poor operations dimensions such as computer glitch and flight cancellations.

Keywords: Coronavirus, Simulation, Pandemic Control, Social Studies, Policymaking.

Web platform to manage medical resource in Covid-19 pandemic in Algeria

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ABSTRACT

The management distribution of medical needs in a medical emergency situation depends strongly on the collaboration between different state distributors or charitable associations to help medical teams to face a new pandemic such as Covid-19. This virus that is spreading in China and around the world requires more effort in underdeveloped countries like Algeria to face this biological disaster. In the case of Covid-19, the stock of protective clothing and equipment must be sufficient and easily accessible and can be mobilized 24/7. In this article, we propose a web-based platform for ensuring the various remote communications between the various emergency medical teams and the providers of medical needs. The aim is to facilitate the distribution of the necessary equipment for the care of infected patients with Covid-19 at the level of various concerned departments. Our study was proposed for a Hospital that deals with emergencies of Covid-19 in Algeria.

Keywords: Web platform, Stock management, Coronavirus Disease-19 (COVID-19), Interhospital pharmacy.

Managing Misinformation During Crisis: Pathways to Enhancing Digital Resilience and Mindfulness

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ABSTRACT

Misinformation and fake news can play a vital role in distorting decision making. This takes on special significance in times of crisis as individuals and organisations are confronted with cascading information where distinguishing fake news from reliable information becomes especially challenging. Identifying fake news sources in social media and studying their tactics to disseminate misinformation could constitute an essential step towards counteracting such influencers, enhancing mindfulness, and developing digital resilience strategies. This paper focuses on misinformation detection in a global crisis framework and explores the major conspiracy routes surrounding the COVID-19 crisis, i.e., the ‘5G Coronavirus’ conspiracy and the ‘Film your Hospital’ conspiracy. This is important to study because research has found that those who believe in misinformation are less likely to follow public health guidelines, with potentially serious implications for health management and policy. Social media channels play an important role because they provide a platform for conspiracy theorists and popular theories can rapidly cascade around the world in a matter of minutes. Therefore, this work draws upon social media analytics to examine potential patterns of fake news and misinformation that may be shared across these prisms with sabotaging ramifications. The paper concludes with suggested pathways to enhance digital resilience.

Keywords: COVID-19, Misinformation, Twitter, Digital Resilience, Mindfulness

Public Employment Services During Covid-19 Situation

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ABSTRACT

Covid-19 affected all aspects of our lives and labour market is no exception to this. Many firms are struggling and the number of unemployed people increased. As a result, the public employment services (PES) are facing many new problems, such as increased number of calls from unemployed jobseekers, no personal contact, application of intervention laws which made them to push their regular activities in the background, reduction of the majority of their trainings and receiving incomplete applications, which is a result of high digital illiteracy among unemployed people. In this paper, we present a decision model that may help both jobseekers, in seeking new occupations during covid-19, and public employment service's counsellors, at finding the best job option for unemployed jobseeker. We developed the decision support model using PAPRIKA method, and then we conducted a case study of an unemployed woman to demonstrate the usage of the decision support model in practice. We show that the developed decision model could result in more efficient work of PES counsellors, this means that they could help more people in lesser time and that they would gain more time for their other job activities.

Keywords: Decision Support Model, Public Employment Services, Covid-19.

Can You Be Mindful? The Effectiveness of Mindfulness Driven Interventions in Enhancing Digital Resilience to Fake News

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ABSTRACT

As the Covid-19 pandemic continues to unfold, a body of research continues to emerge. While this is a welcomed development, the unprecedented and far-reaching impact of fake news on the Covid-19 pandemic has been largely ignored. For example, there is currently no robust conceptual framework to help authorities to determine the factors that influence consumer susceptibility to fake news. This paper aims to fill this gap by drawing from academic literature, institutional reports, etc. to develop a conceptual framework to help policymakers and the wider society understand the factors that influence fake news sharing, particularly across social media platforms during the Covid-19 crisis. Building on source credibility theory (Hovland & Weiss, 1951) and construal level theory (Trope and Liberman, 2003, 2010), our research suggests that individuals tend to be susceptible to fake news shared via sources that are perceived to be credible and psychologically close than unfamiliar and psychologically distance sources. We also argue that such susceptibility to fake news can be reduced by building an individual's mindfulness and digital resilience.

Overall, this study contributes to the body of knowledge of fake news in crisis and combines key constructs from information management and mindfulness literature to propose a conceptual framework to help authorities and the public to identify factors that influence consumer susceptibility to fake news, antecedents to developing digital resilience as well as how mindfulness can be used to reduce consumer susceptibility to fake news. This, in turn, will help to mitigate the impact of fake news on society in crisis periods like Covid-19. The conceptual framework proposed in this working conference paper will be empirically adopting a qualitative approach supported by semi-structured interviews in the future.

Keywords: Fake News, Covid-19, Digital Resilience, Information Management, Mindfulness.

How the UK Gambling Industry Bets on Decision Support Systems - Advances and Trends Identified during the COVID-19 pandemic

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ABSTRACT

All industries have evolved due to the digital transformation and the gambling industry is no exception. The aim of this work is to explore the UK betting and gambling industry and uncover the advances and trends within the updated DSS domain that includes big data, artificial intelligence and machine learning. One of the key findings of this exploratory research work, is the paradox within the gambling industry that effective legislation requires efficient organisations. DSS can be instrumental in the effort to bring the correct balance within the betting and gambling ecosystem. In the process, there are quite a few discoveries to be made and lessons to be learned that will benefit academics and the industry alike. This is the main contribution of this study that can instigate further research to define DSS role within this paradox, and this is something that was never explored before.

Keywords: Decision Support Systems, Information Management Systems, Business Model Innovation, Sustainable Business Models, Betting and Gambling Industry.

V
West Time
Zone 2

Investigating oversampling techniques for fair machine learning models

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ABSTRACT

Applying machine learning in real-world applications may have various implications on companies, but individuals as well. Besides obtaining lower costs, faster time to decision and higher accuracy of the decision, automation of decisions can lead to unethical and illegal consequences. More specifically, predictions can systematically discriminate against a certain group of people. This comes mainly due to dataset bias. In this paper, we investigate instances oversampling to improve fairness. We tried several strategies and two techniques, namely SMOTE and random oversampling. Besides traditional oversampling techniques, we tried oversampling of instances based on sensitive attributes as well (i.e., gender or race). We demonstrate on real-world datasets (Adult and COMPAS) that oversampling techniques increase fairness, without greater decrease in predictive accuracy. Oversampling improved fairness up to 15% and AUPRC up to 3% with a loss in AUC of 2%.

Keywords: Data preprocessing, Oversampling, SMOTE, Algorithmic Fairness, Machine Learning.

A conceptual web-based maturity framework to aid business process management strategic decisions

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ABSTRACT

Process Orientation (PO) has gained more importance through the years, since it can help enterprises better deliver products and services with quality, speed and low cost. Business Process Management (BPM) has been the most widely used methodology to achieve PO. Nonetheless, many projects have shown failures with the implementation of the initiative. BPM Maturity Models (BPM-MM), "in theory", should help companies to be successful with their BPM initiatives. However, these models present challenges that inhibit their effective application by companies. In this article, it was assumed that the problem of assessing the BPM maturity level could be addressed in the light of the Multi-criteria Group Decision Making (MCGDM) approach, and that its properties can help to overcome the difficulties normally encountered by companies during the adoption of BPM-MM. Therefore, the purpose of this article is to present the requirements of a web-based group decision support system (web-based GDSS) to help companies implement and evolve their BPM initiatives in order to achieve PO. In summary, a system with the proposed characteristics is (1) flexible, i.e., it can adapt to different organizational contexts, (2) transparent, which allows it to be used easily, (3) intelligent, since it provides recommendations based on a machine learning algorithm and artificial intelligence techniques, and (4) holistic, since it can be applied to evaluate a single process, a company or the entire supply chain. Theoretically, this system would be able to help companies succeed with their BPM initiatives.

Keywords: Web-based GDSS; Business Process Management; BPM Maturity Evaluation.

A user interface design for consistent pairwise comparisons

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ABSTRACT

Decision Makers generally reason on several criteria, aiming to obtain a total or partial order of several alternatives. MultiCriteria analysis is based on the assumption that such ordering exists. Decision Makers are supported by several kinds of approaches or tools. One approach consists in comparing the criteria two by two, i.e., pairwise comparison, in order to find the relative importance of each criterion. This relative importance, called weight of criteria, is then used in order to find the final order of alternatives. One methodology, developed by Saaty, called Analytical Hierarchical Process (AHP) (1), is based on this principle of pairwise comparison. Having the weight of criteria, the decision makers have then to compare the alternatives two by two for each criteria. Pairwise comparisons are simple to use; however, as the number of items to compare increases, so do the effort of conducting all comparisons and the probability of introducing inconsistencies. In this article present an innovative approach to conduct pairwise comparisons based on a UI widget that resembles an interactive data plot. It uses the transitivity property of a consistent comparison matrix to infer comparisons. Our hypothesis is that this new approach is more efficient (as it reduces the number of actions the user must conduct to compare all items), more effective (as it limits the sources of inconsistencies), and yields better user satisfaction. Experimental evaluation is currently underway to compare the proposed widget to the more traditional questionnaire view, with focus on usability in terms of perceived ease of use, efficiency and efficacy.

Keywords: Pairwise comparisons, Consistency, Transitivity, UI design, Usability, AHP.

Using the FITradeoff Method to support a Compliance Program in a Brazilian Organization

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ABSTRACT

This article presents a practical case of a decision problem involving the compliance program, considering that the demand for this program has grown over the last few years in Brazil. In this problem, conflicting objectives were identified, measured by four criteria. In addition, twenty-one alternatives were evaluated. These alternatives represent actions that a company could take to improve its performance in relation to the compliance program. The multicriteria problem was solved using the FITradeoff method for sorting problems by combining decomposition elicitation and holistic evaluation. The method is operated through a decision support system (DSS), which allows the graphical visualization of the ranking at each interaction showing the dominance relationships between the alternatives. As a final result, a ranking with 14 levels was obtained. Thus, the alternative of hiring a Compliance officer occupied the first level of the ranking, followed by the alternative of periodically monitoring complaints that reach the reporting channels.

Keywords: Multi-Criteria Decision-Making/Aiding (MCDM/A), FITradeoff Method, Ranking problematic, Compliance Program.

A Neuroscience Experiment to investigate the Selection decision process versus the Elimination decision process in the FITradeoff Method

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ABSTRACT

The FITradeoff method is a method used to elicit scaling constants in multi-criteria decision-making problems in the context of Multi-Attribute Value Theory. This method permits that decision-makers express preferences during the elicitation by decomposition and the holistic evaluation. During the holistic evaluation, some graphical and tabular visualizations are presented to represent the problems. In this context, this study is performed to investigate how decision-makers select the best alternative in those visualizations and how they eliminate the worst alternative in those visualizations. Thus, a neuroscience experiment has been constructed to investigate the cognitive decision process during the selection versus the elimination phases. The FITradeoff Decision Support system, permits decision-makers to select the best alternative in those visualizations, but it is not possible to eliminate the worst alternative. Therefore, the aim of this experiment is to investigate the elimination decision process in order to improve the FITradeoff method. In total, forty-six (46) postgraduate management engineering students took place in the experiment, which hold in the NSID lab in the Federal University of Pernambuco, Recife Brazil. Therefore, based on the initial results, suggestions can be done to perform more detailed studies in order to generate insights to the analyst in the advising process with the decision-maker, and to improve the design of the FITradeoff Decision Support System.

Keywords: FITradeoff Method, Holistic Evaluation, Selection Decision Process, Elimination Decision Process, Neuroscience Experiment.

Simulation Model to Assess Hospitals Infrastructure for COVID-19

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ABSTRACT

The COVID-19 pandemic has become a significant public health problem worldwide with different challenges. Thus, this work aims to propose a systems simulation model to estimate the impact of COVID-19 on the demand of a hospital's physical infrastructure. The infrastructure considered for the simulation is hospital wards and ICU bed occupancy. The model was based on simulations using Queueing Theory and Arena[®] software. We performed a numerical application in a Brazilian city based on real data to test the proposed model. The results showed that the model could predict the demand for hospital wards and ICU beds, providing support to decision-makers with information that allows them to estimate the use of a hospital's physical infrastructure. The idea is to save the most considerable amount of lives resulting from COVID-19, decreasing the chance of a health system collapse.

Keywords: COVID-19, Simulation model, Queueing Theory, Hospitals Infrastructure.

VI

**Machine Learning
and Artificial
Intelligence**

Using AI to Advance Factory Planning: A Case Study to Identify Success Factors of Implementing an AI-Based Demand Planning Solution

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ABSTRACT

Rational planning decisions are based upon forecasts. Precise forecasting has therefore a central role in business. The prediction of customer demand is a prime example. This paper introduces recurrent neural networks to model customer demand and combine the forecast with uncertainty measures to derive decision support of the demand planning department. It identifies and describes the keys to the successful implementation of an AI-based solution: bringing together data with business knowledge, AI methods and user experience, and applying agile software development practices.

Keywords: Agile Software Development, AI Project Success Factors, Deep Learning, Demand Forecasting, Forecast Uncertainty, Neural Networks, Supply Chain Management.

Improving fairness in machine learning models with instance weighting

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ABSTRACT

A rising concern in algorithmic decision-making models is unwanted discrimination or unfairness in decision-making. More specifically, due to automation of the decision-making process, one can produce an unethical and illegal decision, leading to legal consequences. In this paper, we investigate different strategies for instance weighting to improve fairness of the predictive models. First, we propose a strategy where instances for which sensitive attribute (i.e. gender) can be identified from other input attributes are given a lower weight. Further, we propose instance weighting strategies based on outcome and sensitive attributes contingency tables, i.e. we derive instance weights using expected and observed counts in the contingency table. We demonstrated the effectiveness of proposed strategies on the Adult dataset using naïve Bayes, logistic regression, and random forest algorithms. The results show that the proposed strategies achieve an increase in fairness up to 15% with a loss of predictive accuracy of up to 2%.

Keywords: Algorithmic Fairness, Algorithmic Decision-Making, Instance Weighting, Adult Dataset

Towards Detecting Drifts in Political Events with Higher-Order Networks

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ABSTRACT

Listening to and recording political events with a systematic approach and structured event data is a challenge that is being pursued since many decades. The current great availability of political event databases allows us to capture interactions between countries or international organizations as event sequences that encapsulate the longitudinal evolution of the underlying phenomenon. In previous works, we proposed a method to transform such event sequences into a process-oriented network, to escape the limiting assumptions of sequences. In this work, we make one step further and try to detect the dynamic evolution of the implied process by detecting drifts in it.

After transforming the event database by aggregating the events per a case identifier, we identify rules that describe higher-order dynamics. These higher-order dynamics are reflected with new (higher-order) activities in the event log. Then, the log is split into several time windows, and a process map is discovered per time window. The longitudinal evolution is assessed by calculating the pairwise distances of the marginal process maps. Using a simulated process model, we show that when higher-order networks are used, the drifts become more identifiable, however further experiments are needed to validate the method and to highlight the circumstances under which the use of higher-order networks is beneficial.

Keywords: Drift Detection, Process Mining, Higher-order networks, Event analytics.

Comparative Sentiment Analysis of COVID-19: A Machine Learning Approach

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ABSTRACT

We present a procedure based on the combination of machine learning techniques, in particular sentiment analysis, with multivariate statistical analysis methods, which allows evaluating the mental state or mood of a country from the analysis of written texts. Sentiment analysis or “opinion mining” allows the quantitative analysis of the text by extracting subjective information from an examination of the polarity, i.e., the positive or negative connotation of the language used. The proposed procedure consists in analyzing initially a collection of benchmark texts with a common feature: all the stories are tales describing sad situations. Following, several texts from the press or Internet describing news concerning the effect of the COVID-19 pandemic are examined in two EU countries: Spain and Germany.

Keywords: Machine Learning, Text Mining, Sentimental Analysis, Artificial Intelligence, Multivariate Statistical Analysis

A flying fox algorithm for global optimization

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ABSTRACT

The aim of this paper is to introduce a new global optimization method, inspired from the behavior of flying foxes, called as Flying Foxes Optimization (FFO). The proposed algorithm is evaluated using some commonly used test functions and a real-world discrete flow-shop scheduling problem. The performance of FFO is compared to that of three state-of-the-art metaheuristics. The comparison results demonstrate that the proposed approach constitutes an attractive alternative for global optimization.

Keywords: Flying Fox Optimization, Nature-inspired algorithm, Global optimization, Metaheuristic, Hybrid optimization

Automated physical document interpretation and validation via artificial intelligence

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ABSTRACT

Identity validation and data gathering through physical documents (papers and cards) is still widely adopted in several sectors including retail banking, insurance, and public administration. Those tasks generally consist in manually transcribing relevant fields from physical documents to a dedicated software application. This is due to many reasons such as the sensitive nature of these operations and the lack of suitable digital alternatives; however, this process remains time consuming, expensive, and prone to human error. For these reasons, there is still a strong need for automating physical document interpretation and data extraction, mainly in the instances where documents could rapidly be digitised (scanned). Therefore, we devised an innovative A.I. based pipeline for automatically acquire, process, and validate digitised documents and the related manually extracted fields. Our solution constitutes a support layer for the human agents enabling faster document processing and drastically reduce errors in the operations. The proposed pipeline leverages Cloud infrastructure for scalability, employing several A.I. techniques from Computer Vision to Convolutional Neural Networks. Despite the accuracy may vary depending on document type and the specific field to recognize, we observed promising experimental results. On average, it reached 92.6% accuracy for document recognition tasks and 81.1% for the field extraction tasks. Furthermore, we foresee a significant reduction in operational time and errors.

Keywords: Document Processing, Document OCR, Intelligent data capture, Machine learning, Document validation, Object detection, Computer Vision.

What do customers comment on? Using Latent Dirichlet Allocation to evaluate service levels in online food delivery

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ABSTRACT

As the online food delivery (OFD) industry evolves and becomes easier to order food via a website or an app, individuals' preferences regarding service and delivery expectations have shifted, especially during the COVID-19 pandemic. Online reviews, as a form of electronic word-of-mouth (e-WOM), have great importance both for understanding consumers attitudes as well as service quality patterns. In this study, we use Latent Dirichlet allocation on a large dataset of online reviews concerning food delivery in order to evaluate customer's discourse and comments on a restaurant's food quality as well as delivery service, etc. Using Bayesian inference we estimate topics reflecting different levels of satisfaction (star rating) and model how the prevalence of these topics fluctuates over a period covering the before and after of COVID-19 UK lockdown periods. Our results reveal topics related with ordering and delivery issues become more popular, which may result from the rapidly increasing orders and surge on demand. Our findings could provide several managerial insights on improving customer satisfaction and being responsive to the pandemic for small businesses and restaurant owners shifting to online channels.

Keywords: Online food delivery, Online reviews, Latent Dirichlet Allocation, Structural Topic Modelling.

VII

**Decision Support
Systems and
Technologies**

A case study initiating discrete event simulation as a tool for decision making in I4.0 manufacturing

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ABSTRACT

Smart manufacturing factories need to handle increased uncertainty by becoming more responsive and more flexible to reconfigure. Advances in technology within industry 4.0 can provide acquisition of large amounts of data, to support decision making in manufacturing. Those possibilities have brought anew attention to the applicability of discrete event simulation for production flow modelling when moving towards design of logistics systems 4.0. This paper reports a study investigating challenges and opportunities for initiation of discrete event simulation, as a tool for decision making in the era of industry 4.0 manufacturing. The research has been approached through action research in combination with a real case study at a manufacturing company in the energy sector. The Covid-19 pandemic fated that adjusted and new ways of communication, collaboration, and data collection, in relation to the methods, had to be explored and tried. Throughout the study, production data, such as processing times, have been collected and analyzed for discrete event simulation modelling. The complexity of introducing discrete event simulation as a new tool for decision making is highlighted, where we emphasize the human knowledge and involvement yet necessary to understand and to draw conclusions from the data. The results also demonstrate that the data analysis has given valuable insights into production characteristics, that need addressing. Thus, revealing opportunities for how the initiative of introducing discrete event simulation as an anew tool in the wake of industry 4.0, can act as a catalyst for improved decision making in future manufacturing.

Keywords: Discrete Event Simulation, Decision Support Systems in Manufacturing, Industry 4.0.

A Web-Platform for Process Modelling and Simulation: Supporting Operational Decisions for Energy Systems

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ABSTRACT

The presented work is currently being developed by SimTech to finalize for market uptake a web version of its IPSEpro process modelling and simulation environment, as a complete SaaS (software as a service) solution for process design within a Web-Platform. Cloud-based systems have changed the workflow patterns in many areas and make collaboration easier and more efficient. The tool described in this paper, here addressed as IPSEpro-Web, is a flexible cloud-based simulation platform that supports collaborative work and operational decisions on process models, simulation, and optimization of various types of energy systems, including renewable energy, and power plants, making it much more accessible than traditional solutions to work on projects, focusing also on their different validation phases. The current paper describes relevant parts of the IPSEpro-Web implementation and its potential applications, with focus on the decision support insights that it can provide to the end-users.

Keywords: IPSEpro-Web, Operational Decision Support, Process Modelling, Process Simulation, Process Optimization, Collaborative work, Cloud-based systems, SaaS, Web-platform, Energy Systems.

Decision Support Systems to Improve Project Sustainability in the Construction Sector

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ABSTRACT

Project sustainability in the construction sector has its own unique challenges that come from the very nature of this industry. This relates to the difficulty in collecting data and effectively analysing them to generate valuable insight. To assist with project management, decision support systems (DSSs) have become a useful tool to help manage and improve sustainability. The aim of this paper is to present the current state of research into DSSs in the construction sector and to define potential avenues for future research in the field. This paper examines the application of artificial intelligence (AI) and data analytics (DA) in developing DSSs with a focus on project sustainability. While most studies emphasise the two dimensions, economic and environmental, future opportunities on the social sustainability are highlighted. These include research about the use of AI for improving workplace safety and personnel management.

Keywords: Decision Support System, Data Analytics, Artificial Intelligence, Construction, Sustainability

A DSS for Technological Competitiveness evaluation in the Automotive Components Industry

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ABSTRACT

This poster presents a decision support system (DSS) for evaluating the Technological Competitiveness (TC) of a firm in terms of its technological and operational potential. This tool (TC) will be employed to confirm the suitability of diversification processes. The DSS, based on the Analytic Hierarchy Process (AHP) with absolute measurements, uses a hierarchical model with 5 levels, 25 attributes and 73 indicators (30 for technological potential and 43 for operational potential). The main contributions of the DSS are its ability to provide (i) decision-making support to managers for a diversification process, (ii) a confirmation of the existence of key technologies, as a basis of the diversification process, and (iii) an identification of the strengths and weaknesses associated with products, processes and people for improving industrial practice.

Keywords: DSS, Multicriteria Evaluation, AHP, Technological Competitiveness, Technological Diversification.

ERP and Time Management: A recommender system

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ABSTRACT

Most of today's companies use management software to support their staff organizing their activity. In this context, this software makes it possible to centralize company data, and to extract useful information from it for users in order to make decisions, such as the organization of their working time. However, the amount of available data is too large for a user to be analyzed on their own. Thus, it is likely that the user will not take the most satisfactory decision according to the criteria imposed by the managers, and the real-time evolution of the activity of the company. In this article, we present a recommender system that takes into account the activity of the company, the managers' criteria, as well as the end-user own criteria in order to guide him in his activities. It can be used for any type of activity sector as soon as data are available. The recommender system is an additional module for an existing ERP. The Human-Computer Interface (HCI) is presented, as well as a database. The system is operable and fully customizable.

Keywords: Recommender System, Time Management, ERP, TAM.

Decision Support System based on Continuous Resilience Assessment and Monitoring

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ABSTRACT

Ensuring the continuous functioning of any organization, despite the increasing number of disruptions like natural disasters, terrorist attacks, or internal failure, depends, among other things, on the continuous assessment, monitoring, and management of resilience. Resilience is the capacity of a system to recover, in a minimum time, with minimum costs (financial, human, workload, etc.) a certain functioning capacity. Resilience assessment methodologies are nowadays used as decision support systems to prepare stakeholders for future crisis management situations (1) retrospectively, by assessing past levels of resilience in the aftermath of the crisis or (2) prospectively, by simulating possible crisis-like scenarios. However, continuous monitoring and assessment of resilience is generally out of the scope or limited to raw data representation, lacking effective filtering, interpretation, or integration in the evolving context of organizations. This paper revisits a previous work on “continuous and multidimensional assessment of resilience based on functionality analysis for interconnected systems”. The result is a complementary methodology for continuous resilience assessment and monitoring based on multiple data-sources and stakeholders. The novelty is (1) in the context of use of the methodology, (2) in the way the functionality analysis model is obtained and (3) in the way the resilience is continuously assessed.

Keywords: Functionality, Data, Resilience, Infrastructure, Sensor, Road, Decision, Simulation, Monitoring.

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