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Computer Information Systems and Industrial Management

16th IFIP TC8 International Conference, CISIM 2017
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Proceedings

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Preface

CISIM 2017 was the 16th of a series of conferences dedicated to computer information systems and industrial management applications. The conference was supported by IFIP TC8 Information Systems. This year it was held during June 16–18, 2017, in Białystok, Poland, at the Faculty of Computer Science of Białystok University of Technology.

In all, 85 papers were submitted to CISIM by researchers and scientists from a number of reputed universities in the Czech Republic, France, Germany, Hungary, India, Italy, Japan, Lithuania, Luxembourg, Malaysia, New Zealand, Poland, Portugal, South Korea, Tunisia, and USA. Most of the papers were of high quality. Each paper was assigned to at least two reviewers initially, and the accept decision was taken after receiving two positive reviews. In the case of conflicting decisions, another expert's review was sought for the respective papers. In total, about 200 reviews were collected from the referees for the submitted papers. In order to maintain the guidelines of Springer's Lecture Notes in Computer Science series, the number of accepted papers was limited. Furthermore, a number of electronic discussions were held between the Program Committee (PC) chairs and members to decide about papers with conflicting reviews and to reach a consensus. After the discussions, the PC chairs decided to accept for publication in the proceedings book the best 60 of the total submitted papers.

The main topics covered by the chapters in this book are biometrics, security systems, multimedia, classification and clustering, industrial management. Besides these, the reader will find interesting papers on computer information systems as applied to wireless networks, computer graphics, and intelligent systems.

There also was a Special Session on Engineering of Enterprise Software Products (organizers: Prof. Nabendu Chaki and Dr. Anirban Sarkar from University of Calcutta and National Institute of Technology Durgapur in India).

We are grateful to the four esteemed speakers for their keynote addresses. The authors of the keynote talks were Profs. Nabendu Chaki, University of Calcutta, India; Young Im Cho, Seoul University, South Korea; Mario Koeppen, Kyushu Institute of Technology, Japan; Witold Pedrycz, University of Alberta, Canada; Kenneth Regan, University at Buffalo (SUNY), USA. All the keynote abstracts are published in the proceedings.

We would like to thank all the members of the PC and the external reviewers for their dedicated efforts in the paper selection process, particularly Profs. Kateřina Slaninová, Debduitta Barmanroy, Jan Martinovič, and Pavel Moravec. We also thank the honorary chairs of the conference, Profs. Witold Pedrycz and Ryszard Tadeusiewicz. Special thanks are extended to the members of the Organizing Committee, both international and the local, and the team at Springer for their great efforts to make the conference a success. We are also grateful to Andrei Voronkov, whose EasyChair system eased the submission and selection process and greatly supported the compilation of the

proceedings. The proceedings editing was managed by Jiří Dvorský (Technical University of Ostrava, Czech Republic), to whom we are indeed very grateful.

We hope that the reader's expectations will be met and that the participants enjoyed their stay in the beautiful city of Białystok.

June 2017

Khalid Saeed
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Keynotes

Enterprise Modelling and Requirements Engineering Using i* Framework

Nabendu Chaki

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Abstract. Goal Modelling techniques are used to identify and detect errors, conflicts, or issues that may arise in the later phases of the life-cycle. Early detection of errors between project goals helps in reducing the cost to a great extent. In our efforts to assess the advantages of applying model checking on goal models, we have used i* framework and developed the i*ToNuSMV tool.

The i* is one of the most complex multi-agent modelling frameworks. We have used it for requirements engineering. Actors and inter-dependencies between the Actors are said to be intentional for the i* framework. The i*ToNuSMV tool acts as a POC for the proposed Semantic Implosion Algorithm where we can feed i* models and temporal specifications as input and check whether the specifications are satisfied by the model.

The NuSMV model verifier runs in the back end to verify the specification and generates a counterexample if it fails to satisfy. The goal model reconciliation framework has been supplemented with an implementation road-map. Goal models and process models have completely different objectives and characteristics. The most crucial differential characteristic being the sequence-agnostic nature of goal models. In this perspective, it becomes necessary to spell out a mechanism for semantic effect annotation of goal models, and how these effects can be reconciled over the entire enterprise for performing different kinds of analysis.

The main motivation is to help designers and developers identify and rectify errors in the requirements phase itself, before the requirements are formally documented and specified.

Development of Knowledge Base Sharing Technologies for Cloud Service Robot

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Abstract. Businesses related to artificial intelligence are forming ecosystems in areas such as the development of core technologies and the efficiency of jobs in enterprises. These technologies are expected to achieve sustained growth in the future. In the future, deep learning will be differentiated according to the level of practical use for each applicable field, and research and development will be needed from a long-term perspective. In terms of existing technologies, deep learning is an artificial neural network model, a field of machine learning, and is used for information collection, classification, prediction, recognition, and control functions in almost all industries including business. In terms of product specificity, it will be used to build robotic industry ecosystem such as infrastructure of cloud sourcing based on knowledge and intelligence data of robot in future by developing knowledge base sharing technology of service robot. In terms of commercialization status, deep learning technology is being used in speech recognition, image processing, autonomous driving car, artificial intelligence computer, virtual personal assistant, etc. Currently, the cloud robot industry does not have a common interface or communication standard between robots, unlike other computing industries. Since the operating system uses various operating systems such as Windows, Linux, RTOS, and Android, technology development is slowing down. Therefore, it is necessary to standardize not only the operating system but also the robot application, the common interface and the communication standard in order to promote the robot industrial technology and activate the robot software market. Currently, there are VVNS robot software frameworks such as OPRoS (Open Platform for Robotics Services) in Korea and ROS (Robot Operation System) in USA. The interfaces of application programs are standard of RoIS (Robot Interaction Service) and RLS (Robot Localization Service). However, since it is still in the development stage, it is necessary to build a common infrastructure that is more widespread and to standardize and globalize it. In this presentation, we will present technologies and standardization methods for knowledge base sharing in cloud service robots.

Social Optimization: Framework, Algorithms and Applications

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Abstract. The efficient design, management and control of today's technological systems and solutions is to an increasing degree characterized by societal aspects. This also applies to the classical task of optimization as it appears now in new domains like group decision making, fair distribution, equity of resource sharing and we can find among the application domains communication networks, cloud computing, risk assessment, pattern recognition, computational security, collaborative and recommendation systems. These tasks can often not be expressed by simple function evaluations anymore. Relational mathematics, which is studied in mathematical economics and social choice theory, provides a rich and general framework and appears to be a natural and direct way to express corresponding optimization goals, to represent user preferences, to justify fairness criterions, or to valuate utility. The talk will have two main parts. In the first part, basic approaches from mathematical economics to the problemacy of fairness (in distribution and allocation) are recalled. It is followed by the presentation of a set of relations that are able to represent various aspects of fairness along with their motivation. Starting with the "classical" fairness relations maxmin fairness, proportional fairness and lexicographic maxmin, we can recover their mutual relationships and their design flexibility in order to define further relations, with regard to e.g. multi-resource problems, ordered fairness, self-weighted fairness, collaborative fairness, and fuzzy fairness. In the second part, we want to illustrate and demonstrate the application of these concepts to basic data processing and optimization tasks, especially in data mining, multi-agent systems, pattern recognition and performance comparison of metaheuristic algorithms. In this part we will also mention the tractability of larger-scaled problems by presenting algorithmic approaches by meta-heuristic algorithms derived from well-known evolutionary multi-objective optimization algorithms, as a side note also show that the No-Free-Lunch theorems do not apply to the proposed relational optimization.

Data Analytics: Selected Insights into Data Quality, Associations, and Information Granules

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Abstract. Data are the blood life of today's society. The diversity of data is enormous. The quality of data including their comprehensive and multifaceted characterization becomes of paramount importance and is central to further data analysis and processing.

In this presentation, we cover a suite of selected insights into data quality and elaborate on their quantification. The two central issues involving coping with incomplete data (invoking data imputation) and imbalanced data are discussed.

In addressing these issues and delivering algorithmically sound solutions, we advocate a central role of information granularity being played in dealing with the two above stated problems and yielding the results quantified in terms of information granules. With this regard to make the presentation self-contained, we include selected prerequisite material on Granular Computing, especially a discussion on designing information granules.

Revealing interpretable and conceptually stable associations (relationships) within data form another central item on the agenda of data analytics. We show how granular mappings engaging granular parameter spaces are developed and assessed. Associative relationships constructed in terms of granular bidirectional and multidirectional associative memories are investigated. We also develop granular autoencoders and stacked granular autoencoders.

Chess and Informatics

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Abstract. Computer chess began as a field to investigate human cognition and the creation of artificial intelligences. It became instead a grand race to get the most out of computer hardware and software for brute-force searches that evolved into incredibly smart algorithmics. A modern program on a smartphone has been shown to trounce programs of a dozen years ago running on muscle machines with 50 times the power. Machines defeated the human champion at chess two decades ago and have now come to dominate us via deep learning at Go, our deepest hallowed game. The programs are arbiters of quality and optimality of move choices and strategy decisions whose authority is beyond almost all doubt. Paradoxically, this level of singularity may finally enable some of the original AI aims to be realized. Deep analysis of chess positions from human games reveals new kinds of ‘laws of nature’ and regularities of human performance. Several laws from mine and others’ research will be exhibited and targeted to probe deeper problems of how we think, when and why we stop thinking, and how we process information.

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