

Central European Conference on Information and Intelligent Systems

CECIIS



28th
International Conference
2017

Organized by:
University of Zagreb
Faculty of Organization and Informatics

September 27th - 29th, 2017
Varaždin, Croatia

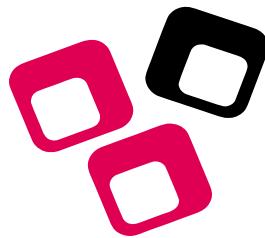
ISSN 1847-2001 (Print)
ISSN 1848-2295 (Online)

UDC 004:007

University of Zagreb
Faculty of Organization and Informatics

Central European Conference on Information and Intelligent Systems

CECIIS



28th International Conference

September 27th - 29th, 2017
Varaždin, Croatia

Varaždin, 2017.

Publisher

Faculty of Organization and Informatics, University of Zagreb
Pavlinka 2, HR-42000 Varaždin, Croatia

Contact

e-mail: ceciis@foi.hr
phone: +385 42 390 861
fax: +385 42 213 413
web: www.ceciis.foi.hr
fb: www.facebook.com/ceciis.foi

For Publisher

Neven Vrček (University of Zagreb, Faculty of Organization and Informatics)

Editors

Vjeran Strahonja (University of Zagreb, Faculty of Organization and Informatics)
Valentina Kirinić (University of Zagreb, Faculty of Organization and Informatics)

Editorial Board

Igor Balaban, University of Zagreb, Croatia
Nina Begičević Ređep, University of Zagreb, Croatia
Leo Budin, University of Zagreb, Croatia
Tonči Carić, University of Zagreb, Croatia
Ivica Crnković, Mälardalen University, Sweden
Blaženka Divjak, University of Zagreb, Croatia
Jasminka Dobša, University of Zagreb, Croatia
Matjaž Gams, Jožef Stefan Institute, Slovenia
Gordan Gledec, University of Zagreb, Croatia
Andrina Granić, University of Split, Croatia
Tihomir Hunjak, University of Zagreb, Croatia
Valentina Kirinić, University of Zagreb, Croatia
Marina Kláčmer Čalopa, University of Zagreb, Croatia
Melita Kozina, University of Zagreb, Croatia
Marjan Krašna, University of Maribor, Slovenia
Alen Lovrenčić, University of Zagreb, Croatia
Sandra Lovrenčić, University of Zagreb, Croatia

Ivan Luković, University of Novi Sad, Serbia
Ivan Magdalenić, University of Zagreb, Croatia
Aleksandar Marković, University of Zagreb, Croatia
Dunja Mladenić, Jožef Stefan Institute, Slovenia
Oliver Moravčik, Slovak University of Technology, Slovakia
Jan Paralič, Technical University of Košice, Slovakia
Elisabeth Pergler, Evolaris next level GmbH, Austria
Kornelije Rabuzin, University of Zagreb, Croatia
Wolf Rauch, University of Graz, Austria
Sonja Ristić, University of Novi Sad, Serbia
Zlatko Stapić, University of Zagreb, Croatia
William Steingartner, Technical University of Košice, Slovakia
Vjeran Strahonja, University of Zagreb, Croatia
Violeta Vidaček Hainš, University of Zagreb, Croatia
Mladen Vouk, North Carolina State University, USA
Neven Vrček, University of Zagreb, Croatia
Ksenija Vuković, University of Zagreb, Croatia

Publishing Board

Matija Kaniški (University of Zagreb, Faculty of Organization and Informatics)
Bernarda Kos (University of Zagreb, Faculty of Organization and Informatics)

All rights reserved. No parts of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise without the prior permission of the copyright owner.

CECIIS Proceedings have been indexed in the following databases: INSPEC, ProQuest (SciTech Premium Collection, ProQuest Technology Collection and ProQuest Advanced Technologies & Aerospace Database).

ISSN 1847-2001 (Print)

ISSN 1848-2295 (Online)



Creative Commons Licence

Central European Conference on
Information and Intelligent

Systems Proceedings is licensed under a Creative
Commons Attribution-NonCommercialNoDerivatives
4.0 International License.

<http://creativecommons.org/licenses/by-nc-nd/4.0/>

Contents

Index of Authors	V
List of Reviewers	VII
Preface	IX

Data and Knowledge Bases

Marko Horvat A Brief Overview of Affective Multimedia Databases	3
Dražena Gašpar, Mirela Mabić, Tihomir Krtalić Integrating Two Worlds: Relational and NoSQL	11
Slavica Kordić, Sonja Ristić, Milan Čeliković, Vladimir Dimitrieski, Ivan Luković Reverse Engineering of a Generic Relational Database Schema Into a Domain-Specific Data Model	19
Ivan Srđić, Gordan Gledec Contextual Spellchecking Based on N-grams	29

Education and Learning Analytics

Karolina Dobi Barišić, Blaženka Divjak, Valentina Kirinić Validation of Survey of Preservice Teachers' Knowledge of Teaching and Technology in the Context of Croatian Educational System	37
Andrej Šorgo, Andreja Špernjak Digital Competence for Science Teaching	45
Aleksandra Sobodić, Igor Balaban, Mia Tomašević The Impact of Cultural Dimensions on Student's Use of E-Learning System	53
Igor Jugo, Božidar Kovačić A Method for Automatic Selection and Interpretation of Student Clustering Models According to Their Activity on E-Learning System	61
Alen Rajšp, Tina Beranić, Marjan Heričko, Paul Wu Horng-Jyh Students' Perception of Gamification in Higher Education Courses	69
Lourdes Guàrdia, Marcelo Maina, Albert Julià Digital Competence Assessment System: Supporting Teachers With the CRISS Platform	77
Mario Jadrić, Maja Ćukušić, Željko Garača Analysing Students' Behaviour Patterns in Online Assessment	83
Andrina Granić, Jelena Nakić, Maja Ćukušić Preliminary Evaluation of a 3D Serious Game in the Context of Entrepreneurship Education	91
Valentina Đurek, Nina Begičević Ređep, Blaženka Divjak Digital Maturity Framework for Higher Education Institutions	99

Emerging trends in ICT

Luka Hrgarek, Tatjana Welzer, Marko Hölbl Web Browser Data Collection and User Awareness Regarding Web Browser Data Exposure	109
Katarina Pažur Aničić, Maja Bedeniković, Nikolina Smetiško Which Are the Most Desired E-Competences of Future ICT Professionals?	115
Petar Djerasimović, Gordan Gledec An Overview of Identity Management Systems Usage	125

ICT Entrepreneurship and Innovation

Zrinka Lacković Vincek, Stjepan Dvorski, Ivana Dvorski Lacković A Literature Review on the Application of the Cloud Technology in Supply Chains	135
Tamara Šmaguc, Ksenija Vuković Institutional Field in the Republic of Croatia: Perspective of Entrepreneurs Pertaining to Computer Programming Activities	145
Dina Korent, Silvije Orsag Selected Structural and Business Indicators in Manufacturing, Trade and Information and Communication Activities in the Republic of Croatia	153
Bubanić Marijana, Detelj Kristina Cluster Analysis of Research and Development Expenditure in EU	161

Intelligent Information Systems

Andrej Šorgo, Kosta Dolenc, Boštjan Šumak, Vili Podgorelec, Sašo Karakatič, Marjan Heričko Proposal for Developing an Autonomous Intelligent and Adaptive E-Learning System (AIAES) for Education	169
Ana-Marija Stjepić Survey of the Determinations of Business Intelligence Systems Adoption in SMEs	177
Danijel Radošević, Ivan Magdalenić, Darko Andročec, Andrija Bernik, Matija Kaniški A Machine Translation Model Inspired by Code Generation	187
Markus Schatten, Bogdan Okreša Đurić, Igor Tomičić, Nikola Ivković, Mario Konecki, Jurica Ševa, Marko Maliković, Pietro Terna Large-Scale Multi-Agent Modelling of Massively Multi-Player On-Line Role-Playing Games – A Summary	193
Markus Schatten, Igor Tomičić, Bogdan Okreša Đurić A Review on Application Domains of Large-Scale Multiagent Systems	201
Bogdan Okreša Đurić, Igor Tomičić, Sven Vukelić Model Driven Game Quest Scenario Development for Massively Multi-Player Role-Playing Games: A Case Study	207
Nikola Zornić, Aleksandar Marković, Sava Čavoški Agent-Based Simulation Model for Real-Time Traffic Analyses	213

Quality of Software and Services

Radovan Vrana Acceptance of Open Peer Review by Scientific Publishers	221
Nadica Hrgarek Lechner, Vjeran Strahonja Quality Factors for Mobile Medical Apps	229
Nadica Hrgarek Lechner An Overview of Cybersecurity Regulations and Standards for Medical Device Software	237
Renata Mekovec, Nikolina Žajdela Hrustek, Igor Pihir On-Line Behaviour of Users With Different Privacy Concerns	251

Software Engineering

Paula Kokić, Boris Tomaš Enhanced Drone Swarm Localization Using GPS and Trilateration Based on RF Propagation Model	259
Daniel Strmečki, Ivan Magdalenić Towards an Ontological Model for Modelling and Automatic Code Generation of Complete Web Information Systems	265
Miroslav Stefanović, Đorđe Pržulj, Darko Stefanović, Miloš Vukmanović, Sonja Ristić OCL Specification of Inter-Register Integrity Constraints in Land Administration Systems	273

Strategic Planning and Decision Making

Antonia Bralić Social Network Analysis of Country Participation in Horizon 2020 Programme	285
Dario Šebalj, Josip Mesarić, Davor Dujak Predicting Natural Gas Consumption – A Literature Review	293
Aleksandar Hatzivelkos The Mathematical Look at a Notion of the Compromise and its Ramifications	301
Aleksander Janeš, Nikola Kadoić, Nina Begičević Ređep The ANP Representation of the BSC	309

Author Guidelines	317
CECIIS 2017 Sponsors	323
CECIIS 2017 Program and Organizing Committees' Members and Research Tracks' Chairs	331

Index of Authors

- Andročec, Darko, 187
Balaban, Igor, 53
Bedeniković, Maja, 115
Begičević Ređep, Nina, 99, 309
Beranič, Tina, 69
Bernik, Andrija, 187
Bralić, Antonia, 285
Čavoški, Sava, 213
Čeliković, Milan, 19
Ćukušić, Maja, 83, 91
Dimitrieski, Vladimir, 19
Divjak, Blaženka, 37, 99
Djerasimović, Petar, 125
Dobi Barišić, Karolina, 37
Dolenc, Kosta, 169
Dujak, Davor, 293
Đurek, Valentina, 99
Dvorski Lacković, Ivana, 135
Dvorski, Stjepan, 135
Garača, Željko, 83
Gašpar, Dražena, 11
Gledec, Gordan, 29, 125
Granić, Andrina, 91
Guàrdia, Lourdes, 77
Hatzivelkos, Aleksandar, 301
Heričko, Marjan, 69, 169
Hölbl, Marko, 109
Horng-Jyh, Paul Wu, 69
Horvat, Marko, 3
Hrgarek Lechner, Nadica, 229, 237
Hrgarek, Luka, 109
Ivković, Nikola, 193
Jadrić, Mario, 83
Janeš, Aleksander, 309
Jugo, Igor, 61
Julia, Albert, 77
Kadoić, Nikola, 309
Kaniški, Matija, 187
Karakatič, Sašo, 169
Kirinić, Valentina, 37
Kokić, Paula, 259
Konecki, Mario, 193
Kordić, Slavica, 19
Korent, Dina, 153
Kovačić, Božidar, 61
Kristina, Detelj, 161
Krtalić, Tihomir, 11
Lacković Vincek, Zrinka, 135
Luković, Ivan, 19
Mabić, Mirela, 11
Magdalenić, Ivan, 187, 265
Maina, Marcelo, 77
Maliković, Marko, 193
Marijana, Bubanić, 161
Marković, Aleksandar, 213
Mekovec, Renata, 251
Mesarić, Josip, 293
Nakić, Jelena, 91
Okreša Đurić, Bogdan, 193, 201, 207
Orsag, Silvije, 153
Pažur Aničić, Katarina, 115
Pihir, Igor, 251
Podgorelec, Vili, 169
Pržulj, Đorđe, 273
Radošević, Danijel, 187
Rajšp, Alen, 69
Ristić, Sonja, 19, 273
Schatten, Markus, 193, 201
Šebalj, Dario, 293
Ševa, Jurica, 193
Šmaguc, Tamara, 145
Smetiško, Nikolina, 115
Sobodić, Aleksandra, 53
Šorgo, Andrej, 45, 169
Špernjak, Andreja, 45
Srđić, Ivan, 29
Stefanović, Darko, 273
Stefanović, Miroslav, 273
Stjepić, Ana-Marija, 177
Strahonja, Vjeran, 229
Strmečki, Daniel, 265
Šumak, Boštjan, 169
Terna, Pietro, 193
Tomaš, Boris, 259
Tomašević, Mia, 53
Tomičić, Igor, 193, 201, 207
Vrana, Radovan, 221
Vukelić, Sven, 207
Vukmanović, Miloš, 273
Vuković, Ksenija, 145
Welzer, Tatjana, 109
Žajdela Hrustek, Nikolina, 251
Zornić, Nikola, 213

List of Reviewers

Zoran Babić, Croatia
Mihaela Banek Zorica, Croatia
Marko Bohanec, Slovenia
Goran Bubaš, Croatia
Marijan Cingula, Croatia
Jasmin Ćosić, Bosnia and Herzegovina
Maja Ćukušić, Croatia
Boris Delibašić, Serbia
Sabina Đonlagić Alibegović, Bosnia and Herzegovina
Ivan Dunder, Croatia
Marcelo Fabián Maina, Spain
Sandro Gerić, Croatia
Andrina Granić, Croatia
Lourdes Guardia, Spain
Goran Hajdin, Croatia
Emil Iacob, USA
Alessio Ishizaka, USA
Nikola Ivković, Croatia
Aleksander Janeš, Slovenia
Leonardo Jelenković, Croatia
Elmar Krainz, Austria
Marjan Krašna, Slovenia
Michael Lang, Ireland
James Lapalme, Canada
Robert Leskovar, Slovenia
Marcel Maretić, Croatia
Renata Mekovec, Croatia
Dunja Mladenich, Slovenia
Matija Novak, Croatia
Tihomir Orehovački, Croatia
Dijana Oreški, Croatia
Ján Paralič, Slovakia
Mirjana Pejić-Bach, Croatia
Julija Perić, Croatia
Ruben Picek, Croatia
Igor Pihir, Croatia
Dijana Plantak Vukovac, Croatia
Kiril Postolov, Macedonia
Danijel Radošević, Croatia
Sonja Ristić, Serbia
Daniel Rodriguez, Spain
Nataša Rupčić, Croatia
Markus Schatten, Croatia
Jane Sinclair, UK
Mario Spremić, Croatia
William Steingartner, Slovakia
Wim Van Petegem, Belgium
Borut Werber, Slovenia
Mario Žgela, Croatia
Miran Zlatović, Croatia

Preface

During the twenty-eight-year period of the annual conference, the Central European Conference on Information and Intelligent Systems (CECIIS) has become one of the most important conferences in the area of applied information science in Central Europe. International participants, program committee and reviewers were a prerequisite for referring the Conference's Proceedings to prominent bases. The conference and accompanying events are certainly the most significant scientific event organized by the Faculty of Organization and Informatics at the University of Zagreb.

The main aim of CECIIS is to foster the cooperation among researchers involved in the development and application of methods and techniques in the field of information and intelligent systems. These Proceedings of CECIIS 2017 contain 38 scientific papers that were double-blind peer reviewed by two independent reviewers and approved by the international Program Committee within eight research tracks: Data and Knowledge Bases, Education and Learning Analytics, Emerging Trends in ICT, ICT Entrepreneurship and Innovation, Intelligent Information Systems, Quality of Software and Services, Software Engineering, Strategic Planning and Decision Making. The poster and presentation section for students is also a part of CECIIS, with student poster abstracts published separately on-line. After the conference, the selected papers will be further reviewed by two independent international reviewers with the possibility of being extended and included in the Journal of Organizational and Information Sciences (JIOS), the international scientific journal published by the Faculty of Organization and Informatics.

The special value of this year's conference is featured by outstanding invited lecturers, researchers who have left a deep mark in the scientific and professional areas they deal with. Within the CECIIS 2017 the following three invited lectures were presented:

Bran Selić (Malina Software Corp., SAD), On the Engineering of Software-Based Systems for the 21st century;
Sokratis K. Katsikas (NTNU - Norwegian University of Science and Technology, Norway), Security and Privacy Challenges in Intelligent Information Systems.

Furthermore, several parallel events were held:

e-Schools Day - presentations and workshops of the project "e-Schools: Establishing a System for Developing Digitally Mature Schools (pilot project)";

presentation of projects e-Schools, DIGITRANS and CRISS;

Workshop on Data Analysis;

as well as CECIIS 2017 conference sponsors' events.

An important part of the CECIIS 2017 conference is the panel discussion entitled "Academy-Industry Cooperation: Applied Research in ICT", which has brought together prominent researchers, managers of major ICT companies and policy makers. We would like to express kindly gratitude to all the authors, presenters, reviewers, session chairs, attendees, organizers of parallel events and, above all, our invited speakers for their contributions. We acknowledge that the organizational and supporting assistance and hosting of the Faculty of Organization and Informatics was crucially important for the overall success of the Conference. We would like to extend our appreciation to the Program and Organizing Committee members.

Finally, we are most grateful to all our industrial partners and sponsors for their support.

We believe that inside these covers you will find relevant and interesting papers in the field of information and intelligent systems. We also look forward to your participation in one of many CECIIS conferences to come.

September, 2017

On the behalf of the
Program and Organizing Committees

Vjeran Strahonja and Valentina Kirinić

CECIIS 2017 Sponsors



Ministarstvo znanosti i obrazovanja RH

INFODOM

ORACLE®

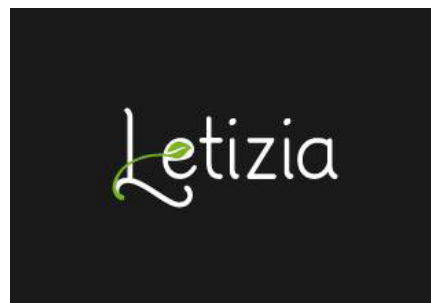


Varaždinska županija

Dobro došli
 **Zagrebačka banka**
UniCredit Group

CECIIS 2017 is supported by:

Vindija



CECIIS 2017 Program Committee

Vjeran Strahonja, Program Committee Chair, University of Zagreb, Croatia

Nina Begičević Ređep, University of Zagreb, Croatia

Leo Budin, University of Zagreb, Croatia

Tonči Carić, University of Zagreb, Croatia

Ivica Crnković, Mälardalen University, Sweden

Blaženka Divjak, University of Zagreb, Croatia

Jasminka Dobša, University of Zagreb, Croatia

Matjaž Gams, Jožef Stefan Institute, Slovenia

Gordan Gledec, University of Zagreb, Croatia

Andrina Granić, University of Split, Croatia

Valentina Kirinić, University of Zagreb, Croatia

Melita Kozina, University of Zagreb, Croatia

Marjan Krašna, University of Maribor, Slovenia

Alen Lovrenčić, University of Zagreb, Croatia

Sandra Lovrenčić, University of Zagreb, Croatia

Ivan Luković, University of Novi Sad, Serbia

Aleksandar Marković, University of Zagreb, Croatia

Dunja Mladenich, Jožef Stefan Institute, Slovenia

Oliver Moravčik, Slovak University of Technology, Slovakia

Jan Paralič, Technical University of Košice, Slovakia

Elisabeth Pergler, Evolaris next level GmbH, Austria

Wolf Rauch, University of Graz, Austria

Sonja Ristić, University of Novi Sad, Serbia

William Steingartner, Technical University of Košice, Slovakia

Violeta Vidaček Hainš, University of Zagreb, Croatia

Mladen Vouk, North Carolina State University, USA

Neven Vrček, University of Zagreb, Croatia

Ksenija Vuković, University of Zagreb, Croatia

Honorary Members - Former Program Committee Chairs

Boris Aurer, University of Zagreb, Croatia

Tihomir Hunjak, University of Zagreb, Croatia

Mirko Maleković, University of Zagreb, Croatia

Miroslav Žugaj, University of Zagreb, Croatia

CECIIS 2017 Organizing Committee

Valentina Kirinić, Organizing Committee Chair, University of Zagreb, Croatia

Ivana Dvorski Lacković, University of Zagreb, Croatia

Darko Grabar, University of Zagreb, Croatia

Matija Kaniški, University of Zagreb, Croatia

Nela Kivač, University of Zagreb, Croatia

Izabela Oletić Tušek, University of Zagreb, Croatia

Irina Rinkovec, University of Zagreb, Croatia

Petra Vondra, University of Zagreb, Croatia

CECIIS 2017 Research Tracks' Chairs

Data and Knowledge Bases: Alen Lovrenčić, Mirko Maleković and Kornelije Rabuzin, University of Zagreb, Croatia

Education and Learning Analytics : Blaženka Divjak and Igor Balaban, University of Zagreb, Croatia

Emerging trends in ICT: Neven Vrček and Sandra Lovrenčić, University of Zagreb, Croatia

ICT Entrepreneurship and Innovation: Ksenija Vuković and Marina Klačmer Čalopa, University of Zagreb, Croatia

Intelligent Information Systems: Jasminka Dobša and Ivan Magdalenich, University of Zagreb, Croatia

Quality of Software and Services: : Valentina Kirinić and Melita Kozina, University of Zagreb, Croatia

Software Engineering: : Vjeran Strahonja and Zlatko Stapić, University of Zagreb, Croatia

Strategic Planning and Decision Making: Nina Begičević Ređep and Tihomir Hunjak, University of Zagreb, Croatia



ISSN 1847-2001 (Print)
ISSN 1848-2295 (Online)