# Fifth Balkan Conference in Informatics BCI 2012

Novi Sad, Serbia, September 16-20, 2012

# Local Proceedings



Department of Mathematics and Informatics Faculty of Sciences, University of Novi Sad, Serbia 2012

#### **Volume Editors**

Zoran Budimac

University of Novi Sad

Faculty of Sciences, Department of Mathematics and Informatics

Trg Dositeja Obradovića 4, 21000 Novi Sad, Serbia

E-mail: zjb@dmi.uns.ac.rs

Mirjana Ivanović

University of Novi Sad

Faculty of Sciences, Department of Mathematics and Informatics

Trg Dositeja Obradovića 4, 21000 Novi Sad, Serbia

E-mail: mira@dmi.uns.ac.rs

Miloš Radovanović University of Novi Sad

Faculty of Sciences, Department of Mathematics and Informatics

Trg Dositeja Obradovića 4, 21000 Novi Sad, Serbia

E-mail: radacha@dmi.uns.ac.rs

Papers are copyrighted © 2012 by the authors. Copying permitted only for private and academic purposes. This volume is published and copyrighted by its editors. Local Proceedings also appeared in ISBN 978-86-7031-200-5, Faculty of Sciences, University of Novi Sad. The contents of the published papers express the opinions of their respective authors, not the volume publisher.

Typeset in LATEX and Microsoft Word by Miloš Radovanović, Doni Pracner, and the authors of individual papers.

# **Preface**

This volume accompanies the main Proceedings of the Fifth Balkan Conference in Informatics (BCI'12) published in the ACM International Conference Proceeding Series (Vol. 641), and contains short papers presented at the conference, as well as papers from workshops held in conjunction with the conference. BCI'12 was held during September 16–20, 2012, at the Department of Mathematics and Informatics, Faculty of Sciences, University of Novi Sad, Novi Sad, Serbia.

BCI'12 continues the BCI series of conferences previously held in Thessaloniki, Greece (2003), Ohrid, FYR Macedonia (2005), Sofia, Bulgaria (2007), and Thessaloniki, Greece (2009).

The main objective of the BCI series of conferences is to provide a forum for discussions and dissemination of research accomplishments and to promote interaction and collaboration among scientists from the Balkan countries and the rest of the world, and to encourage involvement of young researchers from the region.

The BCI'12 conference consisted of regular sessions with technical contributions (regular papers) reviewed and selected by an international program committee, as well as of invited talks presented by leading scientists. Three workshops were held in line with the main conference: 2nd Workshop on Applications of Software Agents (WASA'12), Workshop on Computational Linguistics and Natural Language Processing of Balkan Languages (CLoBL'12), and Workshop on Software Quality Analysis, Monitoring, Improvement, and Applications (SQAMIA'12). The majority of papers presented at the workshops are published in this local proceedings volume.

Traditionally, BCI conferences solicit submissions dealing with theory and/or applications in wide areas of ICT. This year's accepted papers span the topics of analysis of algorithms and problem complexity, artificial intelligence, computer applications in various domains, computer graphics, database and information systems, information storage and retrieval, languages and techniques, networks, operating systems, and software engineering.

In total, 142 papers were considered for presentation and publication in the proceedings of BCI'12, out of which 116 papers were submitted to the main conference, and 26 to the workshops. Fifty-five papers (38 full papers and 17 short papers) were accepted and published in the ACM proceedings, while this volume contains a total of 36 papers: 17 papers presented at the conference, and 19 workshop papers. All published papers were triple reviewed, and many papers received the attention of more than three reviewers. We would like to use this opportunity to thank all PC members and the external reviewers for submitting careful and timely opinions on the papers.

Also, we gratefully acknowledge the (co)chairs of the workshops held with BCI'12, Maria Ganzha, Marcin Paprzycki and Costin Badica (WASA'12), Cvetana Krstev and Katerina Zdravkova (CLoBL'12), and Marjan Heričko, Zoltan Horvath and Hannu Jaakkola (SQAMIA'12), for organizing the workshops and helping to greatly improve the quality and diversity of the conference.

We extend special thanks to the BCI'12 Organizing Committee of the Department of Mathematics and Informatics, Faculty of Sciences, especially to OC co-chairs Dejan Mitrović and Gordana Rakić for their hard work, diligence and dedication to making this conference the best it can be. Many thanks are also due to the BCI'12 proceedings publisher – ACM Press, especially Bernard Rous, Director of Publications, Tom Rodden, ICPS Editor-in-Chief, Craig Rodkin, Publications Operations Manager, and Deborah Cotton, Copyright & Permission Coordinator, for their support of our conference.

Finally, we thank our sponsors, the Provincial Secretariat for Science and Technological Development, and the Serbian Ministry of Education, Science and Technological Development, for supporting the organization of this event.

And last, but not least, we thank all the participants of BCI'12 for having made all work that went into BCI'12 worthwhile.

September 2012

Zoran Budimac Mirjana Ivanović Miloš Radovanović

# Conference Organization

#### **General Chair**

Mirjana Ivanović (Univ. of Novi Sad, Serbia)

## **Program Committee Chair**

Zoran Budimac (Univ. of Novi Sad, Serbia)

## **Program Committee**

Nevena Ackovska (Univ. of Ss. Cyril and Methodius, Skopje, FYR Macedonia)

Mayer Aladjem (Ben-Gurion Univ. of the Negev, Beer-Sheva, Israel)

Ali Al-Dahoud (Al-Zaytoonah Univ., Amman, Jordan)

Vasco Amaral (Univ. Nova de Lisboa, Lisboa, Portugal)

Zora Arsovski (Univ. of Kragujevac, Kragujevac, Serbia)

Erika Asnina (Riga Technical Univ., Riga, Latvia)

Costin Bădică (Univ. of Craiova, Craiova, Romania)

Marko Banek (Univ. of Zagreb, Zagreb, Croatia)

Dragana Bečejski-Vujaklija (Univ. of Belgrade, Belgrade, Serbia)

Alexandre Bergel (Univ. of Chile, Santiago de Chile, Chile)

Ivana Berković (Univ. of Novi Sad, Novi Sad, Serbia)

Arpad Beszedes (Univ. of Szeged, Hungary)

Maria Bielikova (Slovak, Univ. of Technology, Bratislava, Slovakia)

Holger Billhardt (Univ. Rey Juan Carlos, Mostoles, Spain)

Miklos Biro (Software Competence Center Hagenberg GmbH (SCCH), Austria)

Günther Blaschek (Johannes Kepler Univ., Linz, Austria)

Zoran Bosnić (Univ. of Ljubljana, Ljubljana, Slovenia)

Klaus Bothe (Humboldt Univ., Berlin, Germany)

Hans-Dieter Burkhard (Humboldt Univ., Berlin, Germany)

David Camacho (Univ. of Wisconsin, Madison, Canada)

Carlos Iván Chesñevar (Univ. Nacional del Sur, Bahía Blanca, Argentina)

Betim Çiço (Polytechnic Univ. of Tirana, Tirana, Albania)

Miroslav Ćirić (Univ. of Niš, Niš, Serbia)

Rebeca Cortazar (Univ. of Deusto, Bilbao, Spain)

Marco D'Ambros (Univ. of Lugano, Switzerland)

Weihui Dai (Fudan Univ., Shanghai, PR China)

Alex Delis (Univ. of Athens, Athens, Greece)

Ugur Demiray (Anadolu Univ., Eskisehir, Turkey)

Alexiei Dingli (Univ. of Malta Malta)

Christos Douligeris (Univ. of Piraeus, Piraeus, Greece)

Horatiu Dragomirescu (Bucharest Univ. of Economics, Romania)

Dimitris Dranidis (CITY College, Thessaloniki, Greece)

Marjan Družovec (Univ. of Maribor, Maribor, Slovenia)

George Eleftherakis (CITY International Faculty of the Univ. of Sheffield, Greece)

Avram Eskenazi (Bulgarian Academy of Sciences, Sofia, Bulgaria)

George Evangelidis (Univ. of Macedonia, Thessaloniki, Greece)

Bekim Fetaji (South East European Univ., Tetovo, FYR Macedonia)

Vladimir Filipović (Univ. of Belgrade, Belgrade, Serbia)

Giancarlo Fortino (Univ. of Calabria, Rende, Italy)

Maria Ganzha (Univ. of Gdansk, Gdansk, Poland)

Christos K. Georgiadis (Univ. of Macedonia, Thessaloniki, Greece)

Silvia Ghilezan (Univ. of Novi Sad, Novi Sad, Serbia)

George Gravvanis (Democritus Univ. of Thrace, Xanthi, Greece)

Marjan Gusev (Univ. of Ss. Cyril and Methodius, Skopje, FYR Macedonia)

Marjan Heričko (Univ. of Maribor, Maribor, Slovenia)

Nataša Hoić-Božić (Univ. of Rijeka, Rijeka, Croatia)

Zoltan Horvath (Eotvos Lorand Univ., Budapest, Hungary)

Ladislav Huraj (Univ. of Ss. Cyril and Methodius, Trnava, Slovakia)

Galina Ilieva (Univ. of Plovdiv, Plovdiv, Bulgaria)

Mirjana Ivanović (Univ. of Novi Sad, Novi Sad, Serbia)

Dragan Janković (Univ. of Niš, Niš, Serbia)

Gordan Ježić (Univ. of Zagreb, Zagreb, Croatia)

Ioan Jurca ("Politehnica" Univ. of Timisoara, Timisoara, Romania)

Damir Kalpić (Univ. of Zagreb, Zagreb, Croatia)

Nikitas Karanikolas (Technological Educational Institute of Athens, Greece)

Petros Kefalas (South East European Research Center, Athens, Greece)

Margita Kon-Popovska (Univ. of Ss. Cyril and Methodius, Skopje, FYR Macedonia)

Eugenia Kovatcheva (Univ. of Sofia, Sofia, Bulgaria)

Božo Krstajić (Univ. of Montenegro, Podgorica, Montenegro)

Vladimir Kurbalija (Univ. of Novi Sad, Novi Sad, Serbia)

Alp Kut (Eylül Univ., Izmir, Turkey)

Ljubomir Lazić (Univ. of Novi Pazar, Novi Pazar, Serbia)

Ivan Luković (Univ. of Novi Sad, Novi Sad, Serbia)

Dragan Maćoš (Beuth Univ. of Applied Sciences, Berlin, Germany)

Nicolae Magariu (Moldova State Univ., Chişinău, Moldova)

Yannis Manolopoulos (Aristotle Univ., Thessaloniki, Greece)

Elio Masciari (Univ. of Calabria, Rende, Italy)

Dragan Mašulović (Univ. of Novi Sad, Novi Sad, Serbia)

Boris Milašinović (Univ. of Zagreb, Zagreb, Croatia)

Anastas Mishev (Univ. of Ss. Cyril and Methodius, Skopje, FYR Macedonia)

Nenad Mitić (Univ. of Belgrade, Belgrade, Serbia)

Matthew Montebello (Univ. of Malta, Malta)

Mikolaj Morzy (Poznań Univ. of Technology, Poznań, Poland)

Hanspeter Mössenböck (Johannes Kepler Univ., Linz, Austria)

Simona Motogna (Univ. of Cluj, Cluj, Romania)

Pavol Navrat (Slovak Univ. of Technology, Bratislava, Slovakia)

Viorel Negru (Univ. of West Timisoara, Timisoara, Romania)

Mykola Nikitchenko (Univ. of Kyiv, Kyiv, Ukraine)

Roumen Nikolov (Univ. of Sofia, Sofia, Bulgaria)

Nikolaos S. Papaspyrou (National Technical Univ. of Athens, Athens, Greece)

Marcin Paprzycki (Polish Academy of Sciences, Warsaw, Poland)

Iraklis Paraskakis (South-East European Research Center, Athens, Greece)

Dana Petcu (Univ. of Timisoara, Timisoara, Romania)

Tomáš Pitner (Masaryk Univ., Brno, Czech Republic)

Elvira Popescu (Univ. of Craiova, Craiova, Romania)

Zoltan Porkolab (Eotvos Lorand Univ., Budapest, Hungary)

Boris Rachev (Varna Technical Univ., Varna, Bulgaria)

Miloš Racković (Univ. of Novi Sad, Novi Sad, Serbia)

Miloš Radovanović (Univ. of Novi Sad, Novi Sad, Serbia)

Daniel Riesco (National Univ. of San Luis, San Luis, Argentina)

Ladislav Samuelis (Technical Univ. of Košice, Košice, Slovakia)

Spiros Skiadopoulos (Univ. of Peloponnese, Tripolis, Greece)

Demosthenes Stamatis (Alexander TEI, Thessaloniki, Greece)

Milena Stanković (Univ. of Niš, Niš, Serbia)

Bela Stantic (Griffith Univ., Brisbane, Australia)

Leonid Stoimenov (Univ. of Niš, Niš, Serbia)

Stanimir Stoyanov (Univ. of Plovdiv, Plovdiv, Bulgaria)

Sergey Stupnikov (Russian Academy of Sciences, Moscow, Russia)

Srdjan Škrbić (Univ. of Novi Sad, Novi Sad, Serbia)

Dušan Tošić (Univ. of Belgrade, Belgrade, Serbia)

Athena Vakali (Aristotle Univ., Thessaloniki, Greece)

Anca Vasilescu (Univ. of Brasov, Brasov, Romania)

Michael Vassilakopoulos (Univ. of Central Greece, Lamia, Greece)

Michalis Vazirgiannis (Athens Univ. of Economics and Business, Athens, Greece)

Goran Velinov (Univ. of Ss. Cyril and Methodius, Skopje, FYR Macedonia)

George Vouros (Univ. of the Aegean, Samos, Greece)

Valentino Vranić (Slovak Univ. of Technology, Bratislava, Slovakia)

Tatjana Welzer (Univ. of Maribor, Maribor, Slovenia)

Stelios Xinogalos (Univ. of Macedonia, Thessaloniki, Greece)

Fei Yu (Jiangsu Provincial Key Laboratory of Computer Information Processing Technology, Suzhou, PR China)

Katerina Zdravkova (Univ. of Ss. Cyril and Methodius, Skopje, FYR Macedonia)

Wolf Zimmermann (Univ. of Halle, Halle, Germany)

Aleš Živkovič (Univ. of Maribor, Maribor, Slovenia)

#### **Additional Reviewers**

Mario Beron Balazs Dezso Filip Nguyen Ana Sović

Barbora Bühnová Richard Oliver Legendi Daniel Pop Alejandro Stankevicius Adonis Bogris Leonardo de - Matteis Sonja Ristić Nenad Teofanov

Pablo Davicino Dejan Mitrović Alejandro Sanchez

## Organizing Committee (Univ. of Novi Sad, Serbia)

Mirjana Ivanović, Chair Dejan Mitrović, Co-Chair Gordana Rakić, Co-Chair

#### Members

Živana Komlenov Doni Pracner Miloš Radovanović Jovana Vidaković Ivan Luković Davorka Radaković Saša Tošić Djurica Salamon

#### **Organizing Institution**

Department of Mathematics and Informatics, Faculty of Sciences, University of Novi Sad, Serbia

# Organization of Workshops

# Workshop on Computational Linguistics and Natural Language Processing of Balkan Languages – CLoBL 2012

#### **Program Chairs**

 ${\bf Cvetana~Krstev}~({\it Faculty~of~Philology},~{\it Univ.~of~Belgrade},~{\it Serbia})$ 

Katerina Zdravkova (Faculty of Computer Science and Engineering, Univ. of Ss. Cyril and Methodius, Skopje, FYR Macedonia)

#### Program Committee Members

Galia Angelova (Bulgarian Academy of Sciences, Sofia, Bulgaria)

Tomaž Erjavec (Jožef Stefan Institute, Ljubljana, Slovenia)

Arbana Kadrui (South-East European Univ., Tetovo, FYR Macedonia)

Svetla Koeva (Bulgarian Academy of Sciences, Sofia, Bulgaria)

Ruslan Mitkov (Univ. of Wolverhampton, United Kingdom)

Marko Tadić (Faculty of Philosophy, Univ. of Zagreb, Croatia)

Dan Tufis (Faculty of Computer Science, Alexandru Ioan Cuza Univ. of Iasi, Romania)

Duško Vitas (Faculty of Mathematics, Univ. of Belgrade, Serbia)

#### Organizing Committee

Katerina Zdravkova, Chair (Faculty of Computer Science and Engineering, Univ. of Ss. Cyril and Methodius, Skopje, FYR Macedonia)

# Workshop on Software Quality Analysis, Monitoring, Improvement, and Applications – SQAMIA 2012

#### Program Co-Chairs

Zoran Budimac (Univ. of Novi Sad, Serbia) Marjan Heričko (Univ. of Maribor, Slovenia)

Zoltan Horvath (Eotvos Lorand Univ., Budapest, Hungary)

Hannu Jaakkola (Tampere Univ. of Technology, Pori, Finland)

#### Additional Reviewers

Selected from BCI PC members.

#### Organizing Committee (Univ. of Novi Sad, Serbia)

Gordana Rakić, Chair Miloš Savić

# 2nd Workshop on Applications of Software Agents - WASA 2012

#### Program Chairs

Mirjana Ivanović (Univ. of Novi Sad, Serbia) Maria Ganzha (Univ. of Gdansk and IBS PAN, Poland)

#### Program Co-Chairs

Costin Bădică (Univ. of Craiova, Romania) Marcin Paprzycki (IBS PAN and WSM, Poland)

#### **Program Committee Members**

Zoran Budimac (Univ. of Novi Sad, Serbia)

Paolo Bresciani (FBK, Italy)

Giacomo Cabri (Univ. of Modena, Italy)

Adina Magda Florea (Univ. Politehnica of Bucharest, Romania)

Giancarlo Fortino ( $Univ.\ of\ Calabria,\ Italy)$ 

Matjaz Gams (Jozef Stefan Institute, Slovenia)

Galina Ilieva (Univ. of Plovdiv "Paisii Hilendarsky," Bulgaria)

 ${\bf Gordan\ Jezic\ (\it Univ.\ of\ \it Zagreb,\ \it Croatia)}$ 

Mario Kusek (Univ. of Zagreb, Croatia)

Marin Lujak (Univ. Rey Juan Carlos, Spain)

Viorel Negru (West Univ. of Timisoara, Romania)

Andrea Omicini (Univ. of Bologna, Italy)

Agostino Poggi (Univ. of Parma, Italy)

Denis Trcek (Univ. of Ljubljana, Slovenia)

George Vouros (Univ. of Piraeus, Greece)

## Additional Reviewers

Selected from BCI PC members.

#### Organizing Committee (Univ. of Novi Sad, Serbia)

Mirjana Ivanović, Chair

Dejan Mitrović, Secretary

Zoran Budimac

Doni Pracner

Gordana Rakić

Saša Tošić

## **Sponsoring Institutions of BCI 2012**

BCI 2012 was partially financially supported by:

Provincial Secretariat for Science and Technological Development, Autonomous Province of Vojvodina, Republic of Serbia Ministry of Education, Science and Technological Development, Republic of Serbia

# Table of Contents

# Main Conference Papers

Analysis of Algorithms and Problem Complexity, Computer Graphics	
o The Evaluation of Performance in Flow Label and Non Flow Label Approach Based on IPv6 Technology Ariana Bejleri, Igli Tafaj, Ermal Beqiri, Julian Fejzaj and Aleksander Biberaj	1
$\circ$ Logical Representation of Dependencies of Items and the Complexity of Customer Sets	5
o The Teaching of Geography Using Dynamic Geometry Software	11
Computer Applications in Different Domains	
$\circ <$ L ETAP> Model for an Adaptive Tutoring System	
o Program Assessment via a Capstone Project	21
Information Storage and Retrieval	
o Applying MDA in Developing Intermediary Service for Data Retrieval	25
o Cloud Computing Interoperability Approaches – Possibilities and Challenges	
o Data Model for Consortial Circulation in Libraries	35
Languages and Techniques, Operating Systems	
o A Review of Disc Scrubbing and Intra Disc Redundancy Techniques for Reducing Data Loss in Disc File System Genti Daci and Aisa Bezhani	ns 40
o Protection of Web Applications Using Aspect Oriented Programming and Performance Evaluation	
o Robust Mouldable Scheduling Using Application Benchmarking for Elastic Environments	
o Fuzzy XML with Implementation	58
Networks	
o Analyses of QoS Routing Approach and the Starvation's Evaluation in LAN	63
o Implementation and Evaluation of a Sleep-Proxy for Energy Savings in Networked Computers	68
Sofware Engineering	
o An Evaluation of Java Code Coverage Testing Tools	72
o User-Friendly Menu for New-Age Mobile Phones	
o Layout Proposal for One-Handed Device Interface	81
Computational Linguistics and Natural Language Processing of Balkan Language – CLoBL 2012	es
<ul> <li>Syntactic Translation Patterns from a Parallel Treebank</li> <li>Mihaela Colhon</li> </ul>	85
$\circ$ Automatic Recognition of Composite Verb Forms in Serbian	89
Serbian Text Categorization Using Byte Level n-Grams     Jelena Graovac	93

• Recognition and Normalization of Temporal Expressions in Serbian Texts
o An Approach to Development of Bilingual Lexical Resources
o Information Extraction from the Weather Reports in Serbian
<ul> <li>An Authorship Attribution for Serbian</li></ul>
Workshop on Software Quality Analysis, Monitoring, Improvement, and Applications – SQAMIA 2012
<ul> <li>ISO Software Quality Standards and Certification</li></ul>
o Analyzing Structural Software Changes: A Case Study
o Agile Software Testing Technologies in a Large Scale Project
$\circ$ Security Analysis Regarding Cross-Site Scripting on Internet Explorer
<ul> <li>Notes on the Parallels Between Biological and Software Evolution</li> <li>Ladislav Samuelis</li> </ul>
2nd Workshop on Applications of Software Agents – WASA 2012
o Glider Agent 2.0 – Agent-Based Glider Pilot Support System for Android Devices
o Applying Saaty's Multicriterial Decision Making Approach in Grid Resource Management
o New Outlook on Agent-Based Travel Support Systems
<ul> <li>Using Jason to Develop Declarative Prototypes of Automated Negotiations</li> <li>Alex Muscar, Laura Surcel and Costin Bădică</li> </ul>
o Method for Optimizing Communication Costs in ACODA Using Simulated Annealing
o Service Agents for Calendar Exchange
o Developing Software Agents Using Enterprise JavaBeans
Author Index