Lotfi A. Zadeh
Dan Tufiş
Florin Gheorghe Filip
Ioan Dziţac
(Eds.)

From Natural Language to Soft Computing: New Paradigms in Artificial Intelligence

Exploratory Workshop on NL-Computation
Băile Felix; Oradea, Romania, May 15-17, 2008

Editing House of Romanian Academy

2008

Editors:

1. **Lotfi A. Zadeh**, University of California- Berkeley, CA 94720-1776, USA, E-mail: zadeh@cs.berkeley.edu

2. **Dan Tufiş**, Research Institute for Artificial Intelligence of the Romanian Academy, Calea 13 Septembrie, No. 13, Casa Academiei, Rooms 1236 - 1245, Bucharest 050711, Romania, E-mail: tufis@racai.ro

3. **Florin Gheorghe Filip**, Romanian Academy, Bucharest, 125, Calea Victoriei, 010071 Bucharest-1, Romania, E-mail: ffilip@acad.ro

4. **Ioan Dziţac**, Agora University, Oradea, Romania Piaţa Tineretului, 8, Oradea - 410526, Bihor, România, E-mail: idzitac@univagora.ro

Descrierea CIP a Bibliotecii Naţionale a României

FROM NATURAL LANGUAGE TO SOFT COMPUTING: NEW PARADIGMS IN ARTIFICIAL INTELLIGENCE. EXPLORATORY WORKSHOP ON NL-COMPUTATION
(2008, Băile Felix)
From natural language to soft computing: new paradigms in artificial intelligence: exploratory workshop on NL-computation: International Conference on Computers, Communications and Control - ICCCC 2008: Băile Felix,
May, 15-17 / ed.: Lotfi A. Zadeh, Dan Tufiş, Florin Gh. Filip, Ioan Dziţac. - Bucureşti: Editura Academiei Române, 2008
Bibliogr.
Index.
ISBN 978-973-27-1678-6

I. Zadeh, Lotfi A. (ed.)
II. Tufiş, Dan (ed.)
III. Filip, Florin Gheorghe (ed.)
IV. Dziţac, Ioan (ed.)
V. International Conference on Computers, Communications and Control (2008: Băile Felix)

004(063)

Contents

From Natural Language to Soft Computing: New Paradigms in Artificial Intelligence 5
Editors

World Knowledge for Controllers by Fuzzy-Interpolative Systems 11
Marius M. Bălaş and Valentina E. Bălaş

A Survey on the Constant Time to Collision Techniques 22
Valentina E. Bălaş and Marius M. Bălaş

Non-Negative Matrix Factorization Methods and their Applications 32
Ioan Buciu and Ioan Naforniţă

A Multi-Agent Stigmergic Model for Complex Optimization Problems 51
Camelia Chira, Camelia M. Pintea and D. Dumitrescu

Conceptual Model of an Intelligent Supervising System for Evaluating Policies in the Operation of an Underground Mine 63
Felisa M. Cordova and Luis E. Quezada

Neuro-Fuzzy Modeling of Event Prediction using Time Intervals as Independent Variables 84
Simona Dziţac, Ioan Felea, Ioan Dziţac and Tiberiu Vesselenyi

Towards to Colony of Robots 100
Gastón Lefranc

Constructing Multi-dimensional Utility Function under Different Types of Preferences over the Fundamental Vector Attributes 129
Natalia Nikolova, Daniela Toneva, Sevda Ahmed and Kiril Tenekedjiev

Real Sets as Consistent Boolean Generalization of Classical Sets 150
Dragan G. Radojevic

Simulating NEPs in a Cluster with jNEP 172
Emilio del Rosal, Rafael Nuñez, Carlos Castañeda and Alfonso Ortega

Soft Computing for Intelligent Systems 185
Imre J. Rudas and János Fodor

New Parallel Programming Language Design:
A Bridge between Brain Models and Multi-Core/Many-Core Computers? 196
Gheorghe Stefanescu and Camelia Chira

Playing with Word Meanings 211
Dan Tufiş

An Extended Abstract of Workshop's Keynote Lecture:
"A New Frontier in Computation - Computation with Information
Described in Natural Language" 224
Lotfi A. Zadeh

Author index 226

APPENDIX 1
Slides of PowerPoint Presentation of Workshop's Keynote Lecture:
"A New Frontier in Computation - Computation with Information
Described in Natural Language" 227
Lotfi A. Zadeh

APPENDIX 2
Pictures from EWNLC 2008 268

Zadeh L.A., Tufiş D., Filip F.G., Dziţac I.(Eds.),
From Natural Language to Soft Computing: New Paradigms in Artificial Intelligence,
Editing House of Romanian Academy, Bucharest, ISBN 978-973-27-1678-6, 2008, pp. 5-10

From Natural Language to Soft Computing: New Paradigms in Artificial Intelligence

Editors

Abstract: In this volume we publish some papers presented at the Exploratory Workshop on Natural Language Computation (EWNLC 2008), entitled "From Natural Language to Soft Computing: New Paradigms in Artificial Intelligence", during May 15-17, 2008, Baile Felix, Oradea, Romania. This workshop was financed by the Romanian Ministry of Education, Research and Youth/ National Authority for Scientific Research, based a project directed by Prof. dr. Dan Tufiş, corresponding member of Romanian Academy, Code of project: PO-01-Ed1-R0-F37, contract no. 8/ 2008. EWNLC 2008 was organized as satellite-event of conference ICCCC 2008[a] (General Chair: Prof. dr. Ioan Dziţac).

[a]International Conference on Computers, Communications & Control, founded by I. Dziţac, F.G. Filip & M.-J. Manolescu, http://www.iccc.univagora.ro

Keywords: Natural Language Computation (NL-Computation), Generalized Constraint Language (GCL), Granular Computing (GC), Generalized Theory of Uncertainty (GTU), Artificial Intelligence (AI).

Key Idea: "Computation with information described in natural language (NL) is closely related to Computing with Words. NL-Computation is of intrinsic importance because much of human knowledge is described in natural language. This is particularly true in such fields as economics, data mining, systems engineering, risk assessment and emergency management. It is safe to predict that as we move further into the age of machine intelligence and mechanized decision-making, NL-Computation will grow in visibility and importance." (Zadeh, 2007)

1 Introduction

The Exploratory Workshop "*From Natural Language to Soft Computing: New Paradigms in Artificial Intelligence*"(EWNLC 2008) was organized as satellite-event of ICCCC 2008 by Dr. Dan Tufiş - director of Institute of Artificial Intelligence of Romanian Academy - and Dr. Ioan Dziţac - Agora University of Oradea, and was addressed to the 30 participants, from Romania and other 6 countries, selected from over 100 participants at ICCCC 2008: scientific researchers, PhD and PhD students, from universities and research units. The selection of the participants was based on the analysis of the scientific experience and the capacity to actively participate to the debates of each of the 100 participants who submitted papers for ICCCC 2008. Some other criteria were also used: geographical distribution (Chile, France, Greece, Hungary, Romania (Arad, Bucuresti, Cluj-Napoca, Iasi, Oradea, Sibiu, Trgoviste), Serbia, US); repartition according to the age (experienced researchers - 24 PhDs and young researchers - 6 PhD candidates) and sex (half of the participants are women, both experienced and young researchers); the repartition among universities and other research centers; repartition based on the domain of expertise of

potential participants (electronics and telecommunications, computer science, artificial intelligence, economical informatics, automatics, mathematics, economy, communication sciences, robotics, medical informatics).

The main keynote speaker at EWNLC 2008 was Lotfi A. Zadeh, the founder of the Fuzzy Set Theory and Fuzzy Logic. In the last years professor Zadeh developed a theory concerning the representation of natural language like a computing language. One fundamental concept of this theory is "precisiation" of natural language, in the sense of transforming it in a precise, formal construct. The precisiated natural language (PNL) is the result of the transformations of natural language constructions into constructions of a Generalized Constraint Language (GCL). The expressive power of GCL is far greater than that of other AI languages (LISP, PROLOG) or other conventional logic-based meaning-representation languages (predicate logic, modal logic, a.s.o.). The main reason of this research is that most of the applications based on Natural Language Processing (semantic document categorisation, automatic text summarization, human-machine dialogue, machine translation) could be redefined in terms of GCL representations, with the advantage of a more precise processing of the perceptual information and of a more direct approach to the cognitive objectives of AI.

2 Scientific contents of the event

2.1 Objectives achieved

The most important objective reached during the workshop is that it opened the *way for an interdisciplinary collaboration between researchers in different countries* (Romania, USA, France, Serbia, Chile, Greece and Hungary), with different professional experience (scientific researchers, doctors and Ph.D. students from universities and research units), in order to apply in jointly international research projects. Specialists in the field of natural language processing and computation based on precisiated natural language (a concept introduced by prof. Zadeh) proposed new topics, discussed current and new research directions, and they made oral agreements for future collaboration in principle.

Another achieved objective was the identification and strengthening of an ISI Journal (International Journal of Computers, Communications and Control - IJCCC) for the dissemination of future research results in the domain of the workshop.

The papers presented at the workshop were very interesting and appreciated, so that, together with the members of the program committee members of the workshop, we decided, besides publishing the abstracts and/or their reduced forms in the ICCCC 2008 volumes, to prepare a distinct volume, to be published by the Romanian Academy Publishing House. This volume will include the extended versions of the key lectures, along with other papers selected from ICCCC 2008, with topics related to the workshop, in an extended form. Professor Zadeh was very pleased and agreed to participate to the editing this volume.

2.2 General topics

Natural Language Computation

• Lotfi A. ZADEH, University of California, USA
• Vasile BALTAC, SNSPA Bucharest, Romania
• Boldur BĂRBAT, Lucian Blaga University of Sibiu, Romania
• Pierre BORNE; Ecolle Centrale de Lille, France
• Dan TUFIŞ, Institute for Research in Artificial Intelligence, Romanian Academy

Intelligent Systems

• Florin FILIP, Romanian Academy, Romania
• Stephan OLARIU, Old Dominion University, USA
• Athanasios STYLIADIS, ATEI Thessaloniki, Greece
• Janos FODOR, Budapest Tech, Hungary

Artificial Intelligence

• Ioan BUCIU; University of Oradea, Romania
• Gaston LEFRANC, Pontifical Catholic University of Valparaiso, Chile
• Gheorghe PĂUN, Institute for Mathematics of the Romanian Academy & University of Seville
• Dragan RADOJEVIC, Institute "Mihailo Pupin" from Belgrade, Serbia
• Gheorghe ŞTEFĂNESCU, University of Bucharest

2.3 Conclusions / results

The keywords of the workshop were: *natural language computation, language based on generalized constraints, granular calculation, generalis theory of uncertainty, soft computing and artificial intelligence.*

The imprecision of natural language is one of the main difficulties in the intelligent man-machine interaction. Prof. Lotfi Zadeh has proposed a theory that treats exactly this problem, as well as an extremely powerful calculation formalism, built on the very imprecise natural language constructions.

The abstracts of the presented lectures, respectively a part of the full text of the key lectures have been or are in course to be published in:

• Ioan Dziţac, Simona Dziţac, Loredana Galea, Horea Oros (eds.), *Abstracts of ICCCC Papers: ICCCC 2008*, ISSN 1844 - 4334, p. 88

• Ioan Dziţac, Florin Gheorghe Filip, Mişu-Jan Manolescu (eds.), - *Proceedings of ICCCC 2008*, in *International Journal of Computers, Communications and Control* (IJCCC), Vol.

I (2006), supplementary issue, ISSN 1841-9836, 548 p.

• Lotfi A. Zadeh, Dan Tufiş, Florin Gheorghe Filip, Ioan Dziţac (eds.), *From Natural Language to Soft Computing: New Paradigms in Artificial Intelligence* , Editing House of Romanian Academy, ISBN: 978-973-27-1678-6, 2008 (this volume).

2.4 Contributions to the development of future directions in the domain of natural language computation

Some of the workshop participants were members of the Editorial Board of the "International Journal of Computers, Communications and Control" - IJCCC Journal edited by Agora University and recently listed by CNCSIS in category A journals (ISI journal), more precisely:

• Florin Gheorghe Filip (Founder and Editor in Chief);
• Ion Dziţac (founder and Associate Editor in Chief);
• Mişu-Jan Manolescu (Founder and Managing Editor);
• Ioan Buciu (Associate Executive Editor);
• Pierre Borne (Associate Editor);
• George Păun (Associate Editor);
• Dan Tufiş (Associate Editor);
• Athanasios Styliadis (Associate Editor);
• Horea Oros (Editorial Secretary).

During the workshop, two very important decisions on how to increase the quality and specificity of the IJCCC journal have been taken:

• Granting a larger area to the topic of natural language computation;
• Cooptation in the IJCCC Editorial Board, as Associate Editors, of two of the workshop participants, currently in the United States: Stephan Olariu (Norfolk) and Lotfi A. Zadeh (San Francisco).

3 Information on the event organization

3.1 Identifying the opportunity, the organizing institution and the workshop theme

The opportunity to organise an exploratory workshop was identified on a CNSIS web page, http://www.cncsis.ro/PN2_idei_2008_wexplor.php by the ICCCC 2008 organizers (I. Dziţac, and F.G. Filip and M.-J. Manolescu). They sent an invitation to the Research Institute for Artificial Intelligence of the Romanian Academy (ICIA-AR) to organize such a workshop as a satellite event of ICCCC 2008 on a topic of great interest today.

The director of the institute, Dr. Dan Tufiş, proposed the theme "From Natural Language to Soft Computing: New Paradigms in Artificial Intelligence" which was imme-

diately agreed by the ICCCC 2008 organizers, the Agora University and the Romanian Academy Forum for the Knowledge Society.

3.2 Aspects of preliminary management and marketing

The project proposal for organizing the workshop was written by dr. Dan Tufiş in collaboration with dr. Ioan Dziţac, cf. Collaboration Agreement 300/25.03.2008.

There were identified the relevant lecturers and they were invited to participate. One of the initially invited key lecturer, prof. H.-N. Teodorescu, could not participate in the end, but dr. Gheorghe Păun and prof. Gheorghe Ştefănescu have accepted to deliver invited lectures.

Besides the 14 experts, we selected 16 participants out of the ICCC2008 who explicitly expressed their interest in the workshop topics. From these, prof. dr. Marius Guran, prof. dr. Ştefan Iancu and drd. Văleanu Emma, could not participate and they were replaced by prof. dr. Grigore Albeanu, prof. dr. Adriana Manolescu and drd. Ciprian Popescu, whose profile were similar to that of the initial participants.

Initial contacts were established and a permanent connection was kept with the key-lecturers through letters, e-mail, fax and telephone.

The event was mediatised through posters, media, programs, and web pages:

- http://www.iccc.univagora.ro/?page=workshop
- http://www.cncsis.ro/mai2008i.php
- http://www.racai.ro/events/events.html
- http://www.academiaromana.ro/forum_info/fpsc_anunturi.htm

The agreements and conventions for accommodation and meals were established with the Termal Hotel, Felix Spa (through the Agora University).

The agreements for publishing and printing were established with the Publishing House of the Agora University, the Publishing House of the Romanian Academy and the Metropolis Ltd. Printing House.

3.3 During the event

On May 14, 2008, the participants were met at the Hotel Termal in Felix Spa.On May 15, 2008, the opening ceremony took place, having the members of the presidium as speakers: in picture 3, from left to right: Dan Tufiş, Ioan Dziţac, Lotfi A. Zadeh, Mişu Manolescu and Florin Gheorghe Filip. On this occasion the vice president of the Romanian Academy F.G. Filip handed to Lotfi A. Zadeh a Diploma of Excellence for his entire contribution to the development of the scientific field of Artificial Intelligence, on behalf of the Section of Science and Information Technology of the Romanian Academy.

After the opening ceremony, the scientific part of the workshop, according to the final program, was opened by the lecture "*A New Frontier in Computation - Computation Described in Natural Language*", given by professor Zadeh.

After the presentation of other six key-lectures (Baltac, Borne; Filip, Fodor, Olariu, Păun), the participants were offered a Romanian evening, with traditional Romanian

dishes and a folk show delivered by the band "Nuntaşii Bihorului".

On May 16, 2008, other seven key-lectures were presented (Bărbat, Lefranc, Radojevic, Ştefănescu, Tufiş, Buciu and Styliadis).

On May 17, 2008, a roundtable was moderated by I. Dziţac, F.G. Filip, M.-J. Manolescu, D. Tufiş, L.A. Zadeh. Besides the members of the presidium, the following participants addressed to the public: B. Bărbat, A. Styliadis, I. Moisil, G. Păun, S. Olariu, V. Baltac, G. Lefranc, S. Dziţac, V. Judeu, T. Vesselenyi, M. Văleanu and others. On this occasion a new orientation of the IJCCC journal's editorial policy was discussed and two highly reputed scholars, prof Olariu and prof. Zadeh, accepted to join in the IJCCC Editorial Board.

During the afternoon a meeting was held with all the workshop participants and various networks of collaboration have been set up, their main connection point being the IJCCC journal.

On May 18, after 4 nights of accommodation at Hotel Termal, the participants have left the Felix Spa with many new experiences and pleasant memories, as proved by the many thankful messages received from the participants after their returning home.

Oradea, May, 2008
Editors