

# Lecture Notes in Artificial Intelligence 7366

Subseries of Lecture Notes in Computer Science

LNAI Series Editors

Randy Goebel

*University of Alberta, Edmonton, Canada*

Yuzuru Tanaka

*Hokkaido University, Sapporo, Japan*

Wolfgang Wahlster

*DFKI and Saarland University, Saarbrücken, Germany*

LNAI Founding Series Editor

Joerg Siekmann

*DFKI and Saarland University, Saarbrücken, Germany*

Huaguang Zhang Amir Hussain Derong Liu  
Zhanshan Wang (Eds.)

# Advances in Brain Inspired Cognitive Systems

5th International Conference, BICS 2012  
Shenyang, China, July 11-14, 2012  
Proceedings

## Series Editors

Randy Goebel, University of Alberta, Edmonton, Canada  
Jörg Siekmann, University of Saarland, Saarbrücken, Germany  
Wolfgang Wahlster, DFKI and University of Saarland, Saarbrücken, Germany

## Volume Editors

Huaguang Zhang  
Zhanshan Wang  
Northeastern University  
College of Information Science and Engineering  
Shenyang 110004, P.R. China  
E-mail: zhanghuaguang@mail.neu.edu.cn; zhanshan\_wang@163.com

Amir Hussain  
University of Stirling  
Dept. of Computing Science and Mathematics  
Stirling FK9 4LA, Scotland, UK  
E-mail: ahu@cs.stir.ac.uk

Derong Liu  
Institute of Automation, Chinese Academy of Sciences  
State Key Laboratory of Management and Control for Complex Systems  
Beijing 100190, P.R. China  
E-mail: derong.liu@ia.ac.cn

ISSN 0302-9743 e-ISSN 1611-3349  
ISBN 978-3-642-31560-2 e-ISBN 978-3-642-31561-9  
DOI 10.1007/978-3-642-31561-9  
Springer Heidelberg Dordrecht London New York

Library of Congress Control Number: 2012940661

CR Subject Classification (1998): I.2.11, I.2, H.3, I.4, H.4, F.1, F.2.2, I.5

LNCS Sublibrary: SL 7 – Artificial Intelligence

© Springer-Verlag Berlin Heidelberg 2012

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer. Violations are liable to prosecution under the German Copyright Law.

The use of general descriptive names, registered names, trademarks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

*Typesetting:* Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

# Preface

BICS 2012—the 5th International Conference on Brain-Inspired Cognitive Systems—was held in Shenyang, China, as a sequel of BICS 2004 (Stirling, Scotland, UK), BICS 2006 (Lesvos, Greece), BICS 2008 (Sao Luis, Brazil), and BICS 2010 (Madrid, Spain). BICS has now become a well-established conference series on brain-inspired cognitive systems around the world, with growing popularity and increasing quality. As the biggest city in northeastern China, Shenyang is now an important political, industrial, and cultural center, and serves as the transportation and commercial hub of northeastern China. All participants of BICS 2012 had a technically rewarding experience as well as memorable experiences in this great city.

This book constitutes the proceedings of BICS 2012. The conference aimed to provide a high-level international forum for scientists, engineers, and educators to present the state of the art of brain-inspired cognitive systems research and applications in diverse fields. The conference featured plenary lectures given by world-renowned scholars, regular sessions with broad coverage, and some special sessions focusing on popular and timely topics.

The conference received a total of 116 submissions from more than 200 authors in 19 countries and regions across four continents. Based on rigorous reviews by the Program Committee members and reviewers, 46 high-quality papers were selected for publication in the conference proceedings. We would like to express our sincere gratitude to all reviewers of BICS 2012 for the time and effort they generously gave to the conference. We are very grateful to the Institute of Automation of the Chinese Academy of Sciences, the University of Stirling, the Chinese University of Hong Kong, the University of Illinois at Chicago, and the National Natural Science Foundation of China for their financial support. We would also like to thank the publisher, Springer, for cooperation in publishing the proceedings in the prestigious series of *Lecture Notes in Artificial Intelligence*.

Huaguang Zhang  
Amir Hussain  
Derong Liu  
Zhanshan Wang

# **BICS 2012 Organization**

## **General Chair**

Derong Liu, China

## **Advisory Committee Chairs**

Ruwei Dai, China

Aike Guo, China

## **Steering Committee Chair**

Huaguang Zhang, China

## **Organizing Committee Chairs**

Bhaskar DasGupta, USA

Jun Wang, Hong Kong

## **Program Chairs**

Amir Hussain, UK

Robert Kozma, USA

Leslie Smith, UK

Liang Zhao, Brazil

## **Plenary Sessions Chair**

Marios Polycarpou, Cyprus

## **Special Sessions Chairs**

Sanqing Hu, China

Stefano Squartini, Italy

## **Finance Chair**

Dongbin Zhao, China

## **Publicity Chairs**

Song Ci, USA

Qinglai Wei, China

Erik Cambria, Singapore

## **European Liaisons**

John Taylor, UK

Anna Esposito, Italy

Mohamed Chetouani, France

Giacomo Indiveri, Switzerland

Stefan Wermter, Germany

## **Publications Chairs**

Jinhu Lu, China

El-Sayed El-Alfy, Saudi Arabia

David Gamez, UK

## **Registrations Chair**

Zeng-Guang Hou, China

## **Local Arrangements Chair**

Zhanshan Wang, China

## **Electronic Review Chair**

Tao Xiang, China

## **Conference Secretariat**

Ding Wang, China

## **Program Committee**

Yousef A. Alotaibi, Saudi Arabia

Shun-ichi Amari, Japan

Peter Andras, UK

Hughues Bersini, Belgium

John Bishop, UK

Roman Borisyuk, UK

Steven Bressler, USA

Fabricio Breve, Brazil

Erik Cambria, Singapore

Jordi Soléi Casals, Spain

Goutam Chakraborty, Japan

Zengqiang Chen, China

Mohamed Chetouani, France

Damien Coyle, UK

Jim Crutchfield, USA  
Vassilis Cutsuridis, UK  
Keshav Dahal, UK  
Rodney Douglas, Switzerland  
Peter Erdi, USA  
Anna Esposito, Italy  
Marcos Faundez-Zanuy, Spain  
Simone Fiori, Italy  
Hiroshi Fujii, Japan  
Takeshi Furuhashi, Japan  
Carlos Gonzalez, Spain  
Claudius Gros, Germany  
Stephen Grossberg, USA  
Kevin Gurney, UK  
Hani Hagraas, UK  
Pentti Haikonen, Finland  
Stephen Hanson, USA  
Derek Harter, USA  
Haibo He, USA  
Emilio Del Moral Hernandez, Brazil  
Dewen Hu, China  
Giacomo Indiveri, Switzerland  
Marwan Jabri, USA  
João Bertini Jr., Brazil  
Li-Wei Ko, Taiwan  
Hongliang Li, China  
Kang Li, UK  
Xuelong Li, UK  
Yuanqing Li, China  
Hualou Liang, USA  
Xiaoming Liang, Brazil  
Ju Liu, China  
Shulan Lu, USA  
Shuxian Lun, China  
Jianhua Ma, Japan  
Tiedong Ma, China  
William Marslen-Wilson, UK  
Eduardo Massad, Brazil  
Xiangping Meng, China  
Vincent C. Müller, Greece  
Tadahiko Murata, Japan  
Jay Myung, USA  
Takashi Omori, Japan  
Leonid Perlovsky, USA  
Francesco Piazza, Italy  
Jose Principe, USA

Marko Puljic, USA  
Marcos Quiles, Brazil  
Nicla Rossini, Italy  
Raza Samar, Pakistan  
Jurgen Schmidhuber, Germany  
Björn Schuller, Germany  
Anil Seth, UK  
Shihab Shamma, USA  
Zdeněk Smékal, Czech Republic  
Qiankun Song, China  
Stefano Squartini, Italy  
Qiuye Sun, China  
Ron Sun, USA  
Hideyuki Takagi, USA  
Azzam Taktak, UK  
Jianhua Tao, China  
John Taylor, UK  
Emmanuelle Tognoli, USA  
Isabel Trancoso, Portugal  
Ichiro Tsuda, Japan  
Minoru Tsukada, Japan  
Don Tucker, USA  
Geoff Underwood, UK  
David Vernon, United Arab Emirates  
Sethu Vijayakumar, UK  
Ding Wang, China  
Jhing-Fa James Wang, Taiwan  
Rubin Wang, China  
Zhanshan Wang, China  
Zhiliang Wang, China  
Kevin Warwick, UK  
Thomas Wennekers, UK  
Luda Werbos, USA  
Stefan Wermter, Germany  
Dedong Yang, China  
Dongsheng Yang, China  
Erfu Yang, UK  
Dezhong Yao, China  
Yuan Yuan, UK  
Zhigang Zeng, China  
Jun Zhang, China  
Li Zhang, UK  
Qiangfu Zhao, Japan  
JunMei Zhu, Germany  
Tom Ziemke, Sweden

# Table of Contents

## Biologically Inspired Systems

COGPARSE: Brain-Inspired Knowledge-Driven Full Semantics Parsing: Radical Construction Grammar, Categories, Knowledge-Based Parsing & Representation .....	1
<i>Daniel J. Olsher</i>	
Sentic Neural Networks: A Novel Cognitive Model for Affective Common Sense Reasoning .....	12
<i>Thomas Mazzocco, Erik Cambria, Amir Hussain, and Qiu-Feng Wang</i>	
Individual Differences in Working Memory Capacity and Presence in Virtual Environments .....	22
<i>Terry G. Rawlinson, Shulan Lu, and Patrick Coleman</i>	
An Ontology Driven and Bayesian Network Based Cardiovascular Decision Support Framework .....	31
<i>Kamran Farooq, Amir Hussain, Stephen Leslie, Chris Eckl, Calum MacRae, and Warner Slack</i>	
Semantically Inspired Electronic Healthcare Records .....	42
<i>Kamran Farooq, Amir Hussain, Stephen Leslie, Chris Eckl, Calum MacRae, and Warner Slack</i>	
A CSP-Based Orientation Detection Model .....	52
<i>Hui Wei and Zheng Dong</i>	
Evaluation of UAS Camera Operator Interfaces in a Simulated Task Environment: An Optical Brain Imaging Approach .....	62
<i>Murat Perit Çakır, Abdullah Murat Şenyiğit, Daryal Murat Akay, Hasan Ayaz, and Veysi İşler</i>	
Cerebral Activation Patterns in the Preparation and Movement Periods of Spontaneous and Evoked Movements .....	72
<i>Chunguang Li and Lining Sun</i>	
Neurobiologically-Inspired Soft Switching Control of Autonomous Vehicles .....	82
<i>Erfu Yang, Amir Hussain, and Kevin Gurney</i>	
An Intelligent Multiple-Controller Framework for the Integrated Control of Autonomous Vehicles .....	92
<i>Amir Hussain, Rudwan Abdullah, Erfu Yang, and Kevin Gurney</i>	



Evolution of Small-World Properties in Embodied Networks . . . . .	102
<i>Derek Harter</i>	
Brain Memory Inspired Template Updating Modeling for Robust Moving Object Tracking Using Particle Filter . . . . .	112
<i>Yujuan Qi, Yanjiang Wang, and Tingting Xue</i>	
VLSI Implementation of Barn Owl Superior Colliculus Network for Visual and Auditory Integration . . . . .	120
<i>Juan Huo and Alan Murray</i>	
Membrane Computing Optimization Method Based on Catalytic Factor . . . . .	129
<i>Fuluo Wang, Yourui Huang, Ming Shi, and Shanshan Wu</i>	

## Cognitive Neuroscience

Effect of Body Position on NIRS Based Hemodynamic Measures from Prefrontal Cortex . . . . .	138
<i>Murat Ozgoren, Merve Tetik, Kurtulus Izzetoglu, Adile Oniz, and Banu Onaral</i>	
Using Brain Activity to Predict Task Performance and Operator Efficiency . . . . .	147
<i>Hasan Ayaz, Scott C. Bunce, Patricia Shewokis, Kurtulus Izzetoglu, Ben Willems, and Banu Onaral</i>	
“Arousal” or “Activation” Dysfunction in the Frontal Region of Children with Attention-Deficit/Hyperactivity Disorder: Evidence from an Electroencephalogram Study . . . . .	156
<i>Ligang Wang, Jie Kong, Jing Luo, Wenbin Gao, and Xianju Guo</i>	
A New Italian Sign Language Database . . . . .	164
<i>Marco Fagiani, Emanuele Principi, Stefano Squartini, and Francesco Piazza</i>	
Study of Phase Relationships in ECoG Signals Using Hilbert-Huang Transforms . . . . .	174
<i>Gahangir Hossain, Mark H. Myers, and Robert Kozma</i>	
Treatment Status Predicts Differential Prefrontal Cortical Responses to Alcohol and Natural Reinforcer Cues among Alcohol Dependent Individuals . . . . .	183
<i>Scott C. Bunce, Kurtulus Izzetoglu, Meltem Izzetoglu, Hasan Ayaz, Kambiz Pourrezaei, and Banu Onaral</i>	
A Filtering Method for Pressure Time Series of Oil Pipelines . . . . .	192
<i>Jinhai Liu and Zhibo Yu</i>	

## Models of Consciousness

The Role of Event Boundaries in Language: Perceiving and Describing the Sequence of Simultaneous Events .....	198
<i>Shulan Lu and Lonnie Wakefield</i>	
Hyperchaotification Control for a Class of 3D Four-Wing Chaotic Systems via State Feedback .....	208
<i>Shuang Wu and Guohua Fu</i>	
Semantic-Based Affect and Metaphor Interpretation in Virtual Drama.....	213
<i>Li Zhang</i>	
A Framework for Experience Representation.....	223
<i>Jan Kaczmarek and Dominik Ryżko</i>	
Emotional Balance as a Predictor of Impulse Control in Prisoners and Non-prisoners.....	232
<i>Yunfeng Duan and Feng Jin</i>	
Time Scales of Sensorimotor Contingencies .....	240
<i>Alexander Maye and Andreas K. Engel</i>	
Analysis of Birefringent Characteristics of Photonic Crystal Fibers Filled Magnetic Fluid .....	250
<i>Yuyan Zhang and Donghua Li</i>	

## Neural Computation

A Lateral Inhibitory Spiking Neural Network for Sparse Representation in Visual Cortex .....	259
<i>Jiqian Liu and Yunde Jia</i>	
Global Stability of a Class of High-Order Recurrent Neural Networks with Multiple Delays .....	268
<i>Zhanshan Wang, Yongbin Zhao, and Shuxian Lun</i>	
Hybrid Neural Network Based on ART2—BP Information Fusion Control in Circulating Fluidized Bed Boiler (CFBB).....	278
<i>Peifeng Niu, Yunfei Ma, Pengfei Li, Yang Zhang, Guoqiang Li, and Xiangye Zhang</i>	
An Improved Single Neuron Adaptive PID Controller Based on Levenberg-Marquardt Algorithm .....	288
<i>Ting-Ting Hu, Yu-Feng Zhuang, and Jin Yu</i>	

Variable Step Length Best Combination AEC Algorithm in IPC . . . . .	296
<i>Long Wu, Li-kun Xing, Meng-ran Zhou, and Shuai Chen</i>	
Stochastic Resonance in Excitable Neuronal System with Phase-Noise . . . . .	304
<i>Xiaoming Liang and Liang Zhao</i>	
Emotion Recognition Based on Physiological Signals . . . . .	311
<i>Naiyu Wu, Huiping Jiang, and Guosheng Yang</i>	
A Comparative Study of Two Reference Estimation Methods in EEG Recording . . . . .	321
<i>Sanqing Hu, Yu Cao, Shihui Chen, Jianhai Zhang, Wanzeng Kong, Kun Yang, Xun Li, and Yanbin Zhang</i>	
Single LFP Sorting for High-Resolution Brain-Chip Interfacing . . . . .	329
<i>Mufti Mahmud, Davide Travalin, Amir Hussain, Stefano Girardi, Marta Maschietto, Florian Felderer, and Stefano Vassanelli</i>	
Variable Momentum Factor Odd Symmetry Error Function Blind Equalization Algorithm . . . . .	338
<i>Li-kun Xing, Xin Li, and Ying-ge Han</i>	
A Flexible Implementation Method of Distributed ANN . . . . .	345
<i>Yuzhen Pi, Quande Yuan, and Xiangping Meng</i>	
Prediction of Thermal Comfort Index Using Type-2 Fuzzy Neural Network . . . . .	351
<i>Chengdong Li, Jianqiang Yi, Ming Wang, and Guiqing Zhang</i>	
The Possibility of Using Simple Neuron Models to Design Brain-Like Computers . . . . .	361
<i>Hong Hu and Zhongzhi Shi</i>	
A Parametric Survey for Facial Expression Database . . . . .	373
<i>Siyao Fu, Guosheng Yang, Xinkai Kuai, and Rui Zheng</i>	
Analysis of Pesticide Application Practices Using an Intelligent Agriculture Decision Support System (ADSS) . . . . .	382
<i>Ahsan Abdullah, Amir Hussain, and Ahmed Barnawi</i>	
Survey of the Facial Expression Recognition Research . . . . .	392
<i>Ting Wu, Siyao Fu, and Guosheng Yang</i>	

The Intelligent Identification and Elimination of Non-precipitation Echoes in the Environment of Low-Latitude Plateaus . . . . .	403
<i>Jian Wang, Na Zhao, Peng Li, Yong Yu, Fei Dai, Zhongwen Xie, and Jianglong Qin</i>	
Road Sign Detection and Recognition from Video Stream Using HSV, Contourlet Transform and Local Energy Based Shape Histogram . . . . .	411
<i>Usman Zakir, Eran A. Edirishinghe, and Amir Hussain</i>	
<b>Author Index . . . . .</b>	<b>421</b>