

*Commenced Publication in 1973*

Founding and Former Series Editors:

Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

## Editorial Board

David Hutchison

*Lancaster University, Lancaster, UK*

Takeo Kanade

*Carnegie Mellon University, Pittsburgh, PA, USA*

Josef Kittler

*University of Surrey, Guildford, UK*

Jon M. Kleinberg

*Cornell University, Ithaca, NY, USA*

Friedemann Mattern

*ETH Zurich, Zürich, Switzerland*

John C. Mitchell

*Stanford University, Stanford, CA, USA*

Moni Naor

*Weizmann Institute of Science, Rehovot, Israel*

C. Pandu Rangan

*Indian Institute of Technology, Madras, India*

Bernhard Steffen

*TU Dortmund University, Dortmund, Germany*

Demetri Terzopoulos

*University of California, Los Angeles, CA, USA*

Doug Tygar

*University of California, Berkeley, CA, USA*

Gerhard Weikum

*Max Planck Institute for Informatics, Saarbrücken, Germany*

More information about this series at <http://www.springer.com/series/7407>

Long Cheng · Qingshan Liu  
Andrey Ronzhin (Eds.)

# Advances in Neural Networks – ISNN 2016

13th International Symposium  
on Neural Networks, ISNN 2016  
St. Petersburg, Russia, July 6–8, 2016  
Proceedings

*Editors*

Long Cheng  
The Chinese Academy of Sciences  
Beijing  
China

Andrey Ronzhin  
SPIIRAS  
St. Petersburg  
Russia

Qingshan Liu  
Huazhong University of Science  
and Technology  
Wuhan, Hubei  
China

ISSN 0302-9743                      ISSN 1611-3349 (electronic)  
Lecture Notes in Computer Science  
ISBN 978-3-319-40662-6              ISBN 978-3-319-40663-3 (eBook)  
DOI 10.1007/978-3-319-40663-3

Library of Congress Control Number: 2016941302

LNCS Sublibrary: SL1 – Theoretical Computer Science and General Issues

© Springer International Publishing Switzerland 2016

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, 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.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made.

Printed on acid-free paper

This Springer imprint is published by Springer Nature  
The registered company is Springer International Publishing AG Switzerland

# Preface

This volume of *Lecture Notes in Computer Science* constitutes the proceedings of the 13th International Symposium on Neural Networks (ISNN 2016) held during July 6–8, 2016, in Saint Petersburg, Russia. Building on the success of the previous events, ISNN has become a well-established series of popular and high-quality conferences on neural networks and their applications. This year the symposium was held for the second time outside China, in Saint Petersburg, a very beautiful city in Russia. As usual, it achieved great success.

ISNN aims at providing a high-level international forum for scientists, engineers, educators, as well as students to gather so as to present and discuss the latest progresses in neural network research and applications in diverse areas. It encouraged open discussion, disagreement, criticism, and debate, and we think this is the right way to push the field forward.

This year, we received 104 submissions from about 291 authors in 40 countries and regions. Based on the rigorous peer-reviews by the Program Committee members and reviewers, 84 high-quality papers were selected for publication in the LNCS proceedings. These papers cover many topics of neural network-related research including intelligent control, neurodynamic analysis, memristive neurodynamics, computer vision, signal processing, machine learning, optimization etc.

Many organizations and volunteers made great contributions toward the success of this symposium. We would like to express our sincere gratitude to the City University of Hong Kong, the St. Petersburg Institute for Informatics and Automation, Russian Academy of Sciences, the IEEE Hong Kong Section (CIS Chapter), the International Neural Network Society, the Asia Pacific Neural Network Society, and the Russian Neural Networks Society for their technical co-sponsorship. We would also like to sincerely thank all the committee members for all their great efforts and time in organizing the symposium. Special thanks go to the Program Committee members and reviewers whose insightful reviews and timely feedback ensured the high quality of the accepted papers and the smooth flow of the symposium. We would also like to thank Springer for their cooperation in publishing the proceedings in the prestigious *Lecture Notes in Computer Science* series. Finally, we would like to thank all the speakers, authors, and participants for their support.

April 2016

Long Cheng  
Qingshan Liu  
Andrey Ronzhin

# Organization

## General Chairs

|                              |   |
|------------------------------|---|
| Tatiana V.<br>Chernigovskaya | St. Petersburg State University, Saint Petersburg, Russia   |
| Jun Wang                     | City University of Hong Kong, Hong Kong, SAR China  |
| Rafael Yusupov               | St. Petersburg Institute for Informatics and Automation,<br>Russian Academy of Sciences, Saint Petersburg, Russia |

## Advisory Chairs

|                     |   |
|---------------------|---|
| Vladimir Cherkassky | University of Minnesota, Minneapolis, USA   |
| Boris Kryzhanovsky  | Russian Academy of Sciences, Moscow, Russia |
| Danil Prokhorov     | Toyota Motor Corporation, Ann Arbor, USA    |

## Steering Chairs

|            |  |
|------------|--|
| Haibo He   | University of Rhode Island, Kingston, USA    |
| Derong Liu | University of Illinois-Chicago, Chicago, USA |

## Organizing Committee Chair

|                |   |
|----------------|---|
| Alexey Potapov | St. Petersburg State University, Saint Petersburg, Russia |
|----------------|---|

## Program Chairs

|                |   |
|----------------|---|
| Long Cheng     | Institute of Automation, Chinese Academy of Sciences,<br>Beijing, China   |
| Qingshan Liu   | Huazhong University of Science and Technology, Wuhan,<br>China  |
| Andrey Ronzhin | St. Petersburg Institute for Informatics and Automation,<br>Russian Academy of Sciences, Saint Petersburg, Russia |

## Special Sessions Chairs

|            |  |
|------------|--|
| Jinde Cao  | Southeast University, Nanjing, China           |
| Min Han    | Dalian University of Technology, Dalian, China |
| Xiaolin Hu | Tsinghua University, Beijing, China            |

## Publicity Chairs

|                |  |
|----------------|--|
| Huaguang Zhang | Northeastern University, Shenyang, China                 |
| Jun Zhang      | Sun Yat-sen University, Guangzhou, China                 |
| Li Zhang       | Chinese University of Hong Kong, Hong Kong,<br>SAR China |

## Publications Chairs

|              |   |
|--------------|---|
| Zhenyuan Guo | Hunan University, Changsha, China                                       |
| Biao Luo     | Institute of Automation, Chinese Academy of Sciences,<br>Beijing, China |
| Sitian Qin   | Harbin Institute of Technology at Weihai, Weihai, China                 |

## Registration Chairs

|                 |  |
|-----------------|--|
| Yiu-Ming Cheung | Hong Kong Baptist University, Hong Kong, SAR China |
| Shenshen Gu     | Shanghai University, Shanghai, China               |
| Daniel W.C. Ho  | City University of Hong Kong, Hong Kong, SAR China |

## Local Arrangements Chairs

|                        |   |
|------------------------|---|
| Alexey Karpov          | St. Petersburg Institute for Informatics and Automation,<br>Russian Academy of Sciences, Saint Petersburg, Russia |
| Natalia P. Nesmeyanova | St. Petersburg State University, Saint Petersburg, Russia   |

## Program Committee

|                  |  |
|------------------|--|
| Jose Aguilar     | Universidad de Los Andes, Venezuela                                |
| Plamen Angelov   | Lancaster University, UK   |
| Daniel Araújo    | Universidade Federal do Rio Grande do Norte, Brazil                |
| Laxmidhar Behera | Indian Institute of Technology Kanpur, India                       |
| Pascal Bouvry    | University of Luxembourg, Luxembourg                               |
| Salim Bouzerdoum | University of Wollongong, Australia                                |
| Chien-Lung Chan  | Yuan Ze University, Taiwan   |
| Jonathan Chan    | King Mongkut's University of Technology Thonburi,<br>Thailand      |
| Andrey Chechulin | St. Petersburg Institute for Informatics and Automation,<br>Russia |
| Ke Chen          | Tampere University of Technology, Finland                          |
| Yuehui Chen      | University of Jinan, China   |
| Zengqiang Chen   | Nankai University, China   |
| Long Cheng       | Chinese Academy of Sciences, China                                 |
| Peng Cheng       | Zhejiang University, China   |
| Zhenbo Cheng     | ZheJiang University of Technology, China                           |

|                                  |   |
|----------------------------------|---|
| Vladimir Cherkassky              | University of Minnesota, USA  |
| Zheru Chi                        | Hong Kong Polytechnic University, Hong Kong,<br>SAR China                 |
| Fengyu Cong                      | Dalian University of Technology, China                                    |
| José Alfredo Ferreira<br>Costa   | Universidade Federal do Rio Grande do Norte, Brazil                       |
| Ruxandra Liana Costea            | Polytechnic University of Bucharest, Romania                              |
| Francisco De A.T. De<br>Carvalho | Federal University of Pernambuco, Brazil                                  |
| Mingcong Deng                    | Tokyo University of Agriculture and Technology, Japan                     |
| Habib Dhahri                     | University of Sfax, Tunisia   |
| Qiulei Dong                      | Chinese Academy of Sciences, China  |
| Andries Engelbrecht              | University of Pretoria, South Africa                                      |
| Jianchao Fan                     | National Marine Environmental Monitoring Center, China                    |
| Mauro Forti                      | Universita di Siena, Italy  |
| Wai-Keung Fung                   | Robert Gordon University, UK  |
| Wenyin Gong                      | China University of Geosciences, China                                    |
| Shenshen Gu                      | Shanghai University, China  |
| Chengan Guo                      | Dalian University of Technology, China                                    |
| Ping Guo                         | Beijing Normal University, China  |
| Zhishan Guo                      | University of North Carolina at Chapel Hill, USA                          |
| Honggui Han                      | Beijing University of Technology, China                                   |
| Ran He                           | National Laboratory of Pattern Recognition, China                         |
| Xing He                          | Chongqing University, China   |
| Iliya Hodashinsky                | TUSUR University, Russia  |
| Tzung-Pei Hong                   | National Univesity of Kaohsiung, Taiwan                                   |
| Zhongsheng Hou                   | Beijing Jiaotong University, China  |
| Bill Howell                      | Natural Resources Canada, Canada  |
| Jinglu Hu                        | Waseda University, Japan  |
| Danchi Jiang                     | University of Tasmania, Australia   |
| Haijun Jiang                     | Xinjiang University, China  |
| Min Jiang                        | Xiamen University, China  |
| Yaochu Jin                       | University of Surrey, UK  |
| Kostas Karatzas                  | Aristotle University, Greece  |
| Alexey Karpov                    | St. Petersburg Institute for Informatics and Automation,<br>Russia        |
| Sungshin Kim                     | Pusan National University, Korea  |
| Irina Kipyatkova                 | St. Petersburg Institute for Informatics and Automation,<br>Russia        |
| Evgeniy Kostyuchenko             | Tomsk State University of Control Systems<br>and Radioelectronics, Russia |
| Georgios<br>Kouroupetroglou      | National and Kapodistrian University of Athens, Greece                    |
| Chiman Kwan                      | Signal Processing, Inc., USA  |
| Chengdong Li                     | Shandong Jianzhu University, China  |
| Chuandong Li                     | Chongqing University, China   |

|                     |  |
|---------------------|--|
| Gang Li             | Deakin University, Australia                                       |
| Hongyi Li           | Bohai University, China  |
| Jianmin Li          | Tsinghua University, China   |
| Miqing Li           | Brunel University, UK  |
| Shuai Li            | Hong Kong Polytechnic University, Hong Kong,<br>SAR China          |
| Tieshan Li          | Dalian Maritime University, China                                  |
| Yangmin Li          | University of Macau, Macau, SAR China                              |
| Yongjie Li          | University of Electronic Science and Technology of China,<br>China |
| Jie Lian            | Dalian University of Technology, China                             |
| Hualou Liang        | Drexel University, USA   |
| Alan Wee-Chung Liew | Griffith University, Australia                                     |
| Chih-Min Lin        | Yuan Ze University, Taiwan   |
| Huaping Liu         | Tsinghua University, China   |
| Ju Liu              | Shandong University, China   |
| Lianqing Liu        | Chinese Academy of Sciences, China                                 |
| Qingshan Liu        | Huazhong University of Science and Technology, China               |
| Xingwen Liu         | Southwest University for Nationalities of China, China             |
| Wenlian Lu          | Fudan University, China  |
| Jinwen Ma           | Peking University, China   |
| Deyuan Meng         | Beihang University, China  |
| Felix Pasila        | Petra Christian University, Indonesia                              |
| Zhouhua Peng        | Dalian Maritime University, China                                  |
| Irina Perfilieva    | University of Ostrava, Czech                                       |
| Leonid Perlovsky    | US Air Force Research Laboratory, USA                              |
| Vladimir Red'Ko     | Russian Academy of Sciences, Russia                                |
| Andrey Ronzhin      | St. Petersburg Institute for Informatics and Automation,<br>Russia |
| Manuel Roveri       | Politecnico di Milano, Italy                                       |
| Juha Rönning        | University of Oulu, Finland  |
| Alireza Sadeghian   | Ryerson University, Canada   |
| Igor Saenko         | St. Petersburg Institute for Information and Automation,<br>Russia |
| Md. Shahjahan       | Khulna University of Engineering and Technology,<br>Bangladesh     |
| Bo Shen             | Donghua University, China  |
| Qiankun Song        | Chongqing Jiaotong University, China                               |
| Stefano Squartini   | Università Politecnica delle Marche, Italy                         |
| Lev Stankevich      | St. Peterburg Polytechnic University, Russia                       |
| Jian Sun            | Beijing Institute of Technology, China                             |
| Ning Sun            | Nankai University, China   |
| Zhanquan Sun        | Shandong Computer Science Center, China                            |
| Manchun Tan         | Jinan University, China  |
| Qing Tao            | Chinese Academy of Sciences, China                                 |
| Christos Tjortjis   | International Hellenic University, Greece                          |

|                |  |
|----------------|--|
| Feng Wan       | University of Macau, Macau, SAR China                              |
| Dan Wang       | Dalian Maritime University, China                                  |
| Ding Wang      | Chinese Academy of Sciences, China                                 |
| Dong Wang      | Dalian University of Technology, China                             |
| Hanlei Wang    | Beijing Institute of Control Engineering, China                    |
| Jun Wang       | City University of Hong Kong, Hong Kong, SAR China                 |
| Yong Wang      | Central South University, China                                    |
| Yunpeng Wang   | Beijing Institute of Control Engineering, China                    |
| Guanghui Wen   | Southeast University, China  |
| Huai-Ning Wu   | Beijing University of Aeronautics and Astronautics, China          |
| Tao Xiang      | Chongqing University, China  |
| Lin Xiao       | Jishou University, China   |
| Rui Xu         | Hohai University, China  |
| Chenguang Yang | University of Plymouth, UK   |
| Qinmin Yang    | Zhejiang University, China   |
| Yingjie Yang   | De Montfort University, UK   |
| Mao Ye         | University of Electronic Science and Technology of China,<br>China |
| Jianqiang Yi   | Chinese Academy of Science, China                                  |
| Wen Yu         | Cinvestav, Mexico  |
| Yang Yu        | Nanjing University, China  |
| Ales Zamuda    | University of Maribor, Slovenia                                    |
| Yi Zeng        | Chinese Academy of Sciences, China                                 |
| Jie Zhang      | Newcastle University, UK   |
| Jinhui Zhang   | Beijing University of Chemical Technology, China                   |
| Mengjie Zhang  | Victoria University of Wellington, New Zealand                     |
| Xuebo Zhang    | Nankai University, China   |
| Dongya Zhao    | China University of Petroleum, China                               |
| Jun Zhao       | Dalian University of Technology, China                             |
| Liang Zhao     | University of São Paulo, Brazil                                    |

# Contents

## Signal and Image Processing

|   |    |
|---|----|
| Large Scale Image Steganalysis Based on MapReduce. . . . .  | 3  |
| <i>Zhanquan Sun, Huifen Huang, and Feng Li</i>  |    |
| Edge Detection Using Convolutional Neural Network . . . . .   | 12 |
| <i>Ruohui Wang</i>  |    |
| Spectral-spatial Classification of Hyperspectral Image Based on Locality<br>Preserving Discriminant Analysis . . . . .                      | 21 |
| <i>Min Han, Chengkun Zhang, and Jun Wang</i>  |    |
| Individual Independent Component Analysis on EEG: Event-Related<br>Responses Vs. Difference Wave of Deviant and Standard Responses. . . . . | 30 |
| <i>Tiantian Yang, Fengyu Cong, Zheng Chang, Youyi Liu,<br/>Tapani Ristainiemi, and Hong Li</i>  |    |
| Parallel Classification of Large Aerospace Images by the Multi-alternative<br>Discrete Accumulation Method . . . . .                        | 40 |
| <i>Vladimir I. Vorobiev, Elena L. Evnevich, and Dmitriy K. Levonevskiy</i>  |    |
| Instantaneous Wavelet Correlation of Spectral Integrals Related to Records<br>from Different EEG Channels. . . . .                          | 49 |
| <i>Sergey V. Bozhokin and Irina B. Suslova</i>  |    |
| The Theory of Information Images: Modeling of Communicative<br>Interactions of Individuals . . . . .  | 56 |
| <i>Alexandr Y. Petukhov and Sofia A. Polevaya</i>   |    |
| A Two-Stage Channel Selection Model for Classifying EEG Activities<br>of Young Adults with Internet Addiction . . . . .                     | 66 |
| <i>Wenjie Li, Ling Zou, Tiantong Zhou, Changming Wang,<br/>and Jiongru Zhou</i>   |    |
| Text-independent Speaker Recognition Using Radial Basis Function<br>Network. . . . .  | 74 |
| <i>Anton Yakovenko and Galina Malychina</i>   |    |
| Usage of DNN in Speaker Recognition: Advantages and Problems . . . . .  | 82 |
| <i>Oleg Kudashev, Sergey Novoselov, Timur Pekhovsky,<br/>Konstantin Simonchik, and Galina Lavrentyeva</i>                                   |    |

|  |     |
|--|-----|
| Boosted Inductive Matrix Completion for Image Tagging. . . . .   | 92  |
| <i>Yuqing Hou</i>  |     |
| Neurological Classifier Committee Based on Artificial Neural Networks<br>and Support Vector Machine for Single-Trial EEG Signal Decoding . . . . . | 100 |
| <i>Konstantin Sonkin, Lev Stankevich, Yulia Khomenko,<br/>Zhanna Nagornova, Natalia Shemyakina, Alexandra Koval,<br/>and Dmitry Perets</i>         |     |
| Calculation of Analogs for the Largest Lyapunov Exponents for Acoustic<br>Data by Means of Artificial Neural Networks . . . . .                    | 108 |
| <i>German A. Chernykh, Yuri A. Kuperin, Ludmila A. Dmitrieva,<br/>and Angelina A. Navleva</i>  |     |
| Robust Acoustic Emotion Recognition Based on Cascaded Normalization<br>and Extreme Learning Machines . . . . .                                     | 115 |
| <i>Heysem Kaya, Alexey A. Karpov, and Albert Ali Salah</i>   |     |
| <b>Dynamical Behaviors of Recurrent Neural Networks</b>  |     |
| Matrix-Valued Hopfield Neural Networks . . . . .   | 127 |
| <i>Călin-Adrian Popa</i>   |     |
| Synchronization of Coupled Neural Networks with Nodes of Different<br>Dimensions . . . . .   | 135 |
| <i>Manchun Tan and Desheng Xu</i>  |     |
| Asymptotic Behaviors for Non-autonomous Difference Neural Networks<br>with Impulses and Delays . . . . .   | 143 |
| <i>Shujun Long and Bing Li</i>   |     |
| Optimal Real-Time Price in Smart Grid via Recurrent Neural Network . . . . .   | 152 |
| <i>Haisha Niu, Zhanshan Wang, Zhenwei Liu, and Yingwei Zhang</i>   |     |
| Exponential Stability of Anti-periodic Solution of Cohen-Grossberg Neural<br>Networks with Mixed Delays . . . . .                                  | 160 |
| <i>Sitian Qin, Yongyi Tan, and Fuqiang Wang</i>  |     |
| Stability of Complex-Valued Cohen-Grossberg Neural Networks<br>with Time-Varying Delays . . . . .  | 168 |
| <i>Zhenjiang Zhao and Qiankun Song</i>   |     |
| Space-Time Structures of Recurrent Neural Networks with<br>Controlled Synapses . . . . .   | 177 |
| <i>Vasilii Osipov</i>  |     |
| A Practical Simulator of Associative Intellectual Machine . . . . .  | 185 |
| <i>Sergey Baranov</i>  |     |

|   |     |
|---|-----|
| Hopfield Network with Interneuronal Connections Based on Memristor Bridges . . . . .  | 196 |
| <i>Mikhail S. Tarkov</i>  |     |
| Two-Dimensional Fast Orthogonal Neural Networks . . . . .   | 204 |
| <i>A. Yu. Dorogov</i>   |     |
| Existence of Periodic Solutions to Non-autonomous Delay Cohen-Grossberg Neural Networks with Impulses on Time Scales . . . . .  | 211 |
| <i>Zhouhong Li</i>  |     |
| <b>Intelligent Control</b>  |     |
| Improved Direct Finite-control-set Model Predictive Control Strategy with Delay Compensation and Simplified Computational Approach for Active Front-end Rectifiers. . . . . | 223 |
| <i>Xing Liu, Dan Wang, and Zhouhua Peng</i>   |     |
| Distributed Tracking Control of Uncertain Multiple Manipulators Under Switching Topologies Using Neural Networks . . . . .  | 233 |
| <i>Long Cheng, Ming Cheng, Hongnian Yu, Lu Deng, and Zeng-Guang Hou</i>   |     |
| A Novel Emergency Braking Method with Payload Swing Suppression for Overhead Crane Systems . . . . .  | 242 |
| <i>He Chen, Yongchun Fang, and Ning Sun</i>   |     |
| Neural Network Approximation Based Multi-dimensional Active Control of Regenerative Chatter in Micro-milling . . . . .  | 250 |
| <i>Xiaoli Liu, Chun-Yi Su, and Zhijun Li</i>  |     |
| A Distributed Delay Consensus of Multi-Agent Systems with Nonlinear Dynamics in Directed Networks . . . . .   | 260 |
| <i>Li Qiu, Liuxiao Guo, Jia Liu, and Yongqing Yang</i>  |     |
| Discrete-Time Two-Player Zero-Sum Games for Nonlinear Systems Using Iterative Adaptive Dynamic Programming. . . . .   | 269 |
| <i>Qinglai Wei and Derong Liu</i>   |     |
| Neural Network Technique in Boundary Value Problems for Ordinary Differential Equations . . . . .   | 277 |
| <i>Elena M. Budkina, Evgenii B. Kuznetsov, Tatiana V. Lazovskaya, Sergey S. Leonov, Dmitriy A. Tarkhov, and Alexander N. Vasilyev</i>                                       |     |
| Transmission Synchronization Control of Multiple Non-identical Coupled Chaotic Systems . . . . .  | 284 |
| <i>Xiangyong Chen, Jinde Cao, Jianlong Qiu, and Chengdong Yang</i>  |     |

|   |     |
|---|-----|
| Pneumatic Manipulator with Neural Network Control . . . . .   | 292 |
| <i>Anton Aliseychik, Igor Orlov, Vladimir Pavlovsky,<br/>Alexey Podoprosvetov, Marina Shishova, and Vladimir Smolin</i>   |     |
| Dynamic Noise Reduction in the System Measuring Efficiency of Light<br>Emitting Diodes . . . . .                          | 302 |
| <i>Galina Malykhina and Yuri Grodetskiy</i>   |     |
| Neural Network Technique in Some Inverse Problems of<br>Mathematical Physics . . . . .                                    | 310 |
| <i>Vladimir I. Gorbachenko, Tatiana V. Lazovskaya, Dmitriy A. Tarkhov,<br/>Alexander N. Vasilyev, and Maxim V. Zhukov</i> |     |
| The Model of the Robot’s Hierarchical Behavioral Control System . . . . .   | 317 |
| <i>A.V. Bakhshiev and F.V. Gundelakh</i>  |     |
| Object Trajectory Association Rules for Tracking Trailer Boat<br>in Low-frame-rate Videos. . . . .                        | 328 |
| <i>Jing Zhao, Shaoning Pang, Bruce Hartill,<br/>and Abdolhossein Sarrafzadeh</i>  |     |
| Learning Time-optimal Anti-swing Trajectories for Overhead<br>Crane Systems . . . . .                                     | 338 |
| <i>Xuebo Zhang, Ruijie Xue, Yimin Yang, Long Cheng, and Yongchun Fang</i>   |     |
| Attitude Estimation for UAV with Low-Cost IMU/ADS Based on<br>Adaptive-Gain Complementary Filter. . . . .                 | 346 |
| <i>Lingling Wang, Li Fu, Xiaoguang Hu, and Guofeng Zhang</i>  |     |
| Hot-Redundancy CPCI Measurement and Control System Based on<br>Probabilistic Neural Networks. . . . .                     | 356 |
| <i>Dan Li, Xiaoguang Hu, Guofeng Zhang, and Haibin Duan</i>   |     |
| Individually Adapted Neural Network for Pilot’s Final Approach<br>Actions Modeling . . . . .                              | 365 |
| <i>Veniamin Evdokimenkov, Roman Kim, Mikhail Krasilshchikov,<br/>and German Sebrjakov</i>                                 |     |
| <b>Clustering, Classification, Modeling, and Forecasting</b>  |     |
| On Neurochemical Aspects of Agent-Based Memory Model. . . . .   | 375 |
| <i>Alexandr A. Ezhov, Andrei G. Khromov, and Svetlana S. Terentyeva</i>   |     |
| Intelligent Route Choice Model for Passengers’ Movement<br>in Subway Stations . . . . .                                   | 385 |
| <i>Eric Wai Ming Lee and Michelle Ching Wa Li</i>   |     |

A Gaussian Kernel-based Clustering Algorithm with Automatic Hyper-parameters Computation . . . . . 393  
*Francisco de A.T. de Carvalho, Marcelo R.P. Ferreira, and Eduardo C. Simões*

Network Intrusion Detection with Bat Algorithm for Synchronization of Feature Selection and Support Vector Machines . . . . . 401  
*Chunying Cheng, Lanying Bao, and Chunhua Bao*

Motion Detection in Asymmetric Neural Networks . . . . . 409  
*Naohiro Ishii, Toshinori Deguchi, Masashi Kawaguchi, and Hiroshi Sasaki*

Language Models with RNNs for Rescoring Hypotheses of Russian ASR . . . 418  
*Irina Kipyatkova and Alexey Karpov*

User-Level Twitter Sentiment Analysis with a Hybrid Approach . . . . . 426  
*Meng Joo Er, Fan Liu, Ning Wang, Yong Zhang, and Mahardhika Pratama*

The Development of a Nonlinear Curve Fitter Using RBF Neural Networks with Hybrid Neurons . . . . . 434  
*Michael M. Li*

Networks of Coupled Oscillators for Cluster Analysis: Overview and Application Prospects . . . . . 444  
*Andrei Novikov and Elena Benderskaya*

Day-Ahead Electricity Price Forecasting Using WT, MI and LSSVM Optimized by Modified ABC Algorithm . . . . . 454  
*H. Shayeghi, A. Ghasemi, and M. Moradzadeh*

Categorization in Intentional Theory of Concepts . . . . . 465  
*Dmitry Zaitsev and Natalia Zaitseva*

A Novel Incremental Class Learning Technique for Multi-class Classification . . . . . 474  
*Meng Joo Er, Vijaya Krishna Yalavarthi, Ning Wang, and Rajasekar Venkatesan*

Basis Functions Comparative Analysis in Consecutive Data Smoothing Algorithms . . . . . 482  
*F.D. Tarasenko and D.A. Tarkhov*

FIR as Classifier in the Presence of Imbalanced Data . . . . . 490  
*Solmaz Bagherpour, Angela Nebot, and Francisco Mugica*

|   |     |
|---|-----|
| Neural Network System for Monitoring State of a High-Speed<br>Fiber-Optical Linear Path . . . . .   | 497 |
| <i>I.A. Saitov, O.O. Basov, A.I. Motienko, S.I. Saitov, M.M. Bizin,<br/>and V. Yu. Budkov</i>   |     |
| Pattern Classification with the Probabilistic Neural Networks Based<br>on Orthogonal Series Kernel. . . . .                               | 505 |
| <i>Andrey V. Savchenko</i>  |     |
| Neural Network Methods for Construction of Sociodynamic<br>Models Hierarchy . . . . .   | 513 |
| <i>Ekaterina A. Blagoveshchenskaya, Aleksandra I. Dashkina,<br/>Tatiana V. Lazovskaya, Viktoria V. Ryabukhina, and Dmitriy A. Tarkhov</i> |     |
| Application of Hybrid Neural Networks for Monitoring and Forecasting<br>Computer Networks States . . . . .                                | 521 |
| <i>Igor Saenko, Fadey Skorik, and Igor Kotenko</i>  |     |
| Multiclass Ensemble of One-against-all SVM Classifiers . . . . .  | 531 |
| <i>Catarina Silva and Bernardete Ribeiro</i>  |     |
| Long Exposure Point Spread Function Modeling with Gaussian Processes . . .  | 540 |
| <i>Ping Guo, Jian Yu, and Qian Yin</i>  |     |
| Neural Network Technique for Processes Modeling in Porous Catalyst<br>and Chemical Reactor . . . . .                                      | 547 |
| <i>Tatiana A. Shemyakina, Dmitriy A. Tarkhov, and Alexander N. Vasilyev</i>   |     |
| Fine-Grained Real Estate Estimation Based on Mixture Models . . . . .   | 555 |
| <i>Peng Ji, Xin Xin, and Ping Guo</i>   |     |
| Intellectual Analysis System of Big Industrial Data for Quality<br>Management of Polymer Films . . . . .                                  | 565 |
| <i>Tamara Chistyakova, Mikhail Teterin, Alexander Razygraev,<br/>and Christian Kohlert</i>  |     |
| Some Ideas of Informational Deep Neural Networks Structural<br>Organization. . . . .  | 573 |
| <i>Vladimir Smolin</i>  |     |
| Meshfree Computational Algorithms Based on Normalized Radial<br>Basis Functions. . . . .  | 583 |
| <i>Alexander N. Vasilyev, Ilya S. Kolbin, and Dmitry L. Reviznikov</i>  |     |

**Evolutionary Computation**

An Experimental Assessment of Hybrid Genetic-Simulated Annealing Algorithm . . . . . 595  
*Cong Jin and Jinan Liu*

When Neural Network Computation Meets Evolutionary Computation: A Survey . . . . . 603  
*Zonggan Chen, Zhihui Zhan, Wen Shi, Weineng Chen, and Jun Zhang*

New Adaptive Feature Vector Construction Procedure for Speaker Emotion Recognition Based on Wavelet Transform and Genetic Algorithm. . . . . 613  
*Alexander M. Soroka, Pavel E. Kovalets, and Igor E. Kheidorov*

Integration of Bayesian Classifier and Perceptron for Problem Identification on Dynamics Signature Using a Genetic Algorithm for the Identification Threshold Selection. . . . . 620  
*Evgeny Kostyuchenko, Mihail Gurakov, Egor Krivonosov, Maxim Tomyshev, Roman Mescheryakov, and Ilya Hodashinskiy*

**Cognition Computation and Spiking Neural Networks**

Tracking Based on Unit-Linking Pulse Coupled Neural Network Image Icon and Particle Filter. . . . . 631  
*Hang Liu and Xiaodong Gu*

Quaternion Spike Neural Networks . . . . . 640  
*Luis Lechuga-Gutiérrez and Eduardo Bayro-Corrochano*

Vector-Matrix Models of Pulse Neuron for Digital Signal Processing . . . . . 647  
*Vladimir Bondarev*

About  $\Sigma II$ -neuron Models of Aggregating Type . . . . . 657  
*Zaur Shibzukhov and Denis Cherednikov*

Conversion from Rate Code to Temporal Code – Crucial Role of Inhibition . . . 665  
*Mikhail V. Kiselev*

Analysis of Oscillations in the Brain During Sensory Stimulation: Cross-Frequency Relations . . . . . 673  
*Elena Astasheva, Maksim Astashev, and Valentina Kitchigina*

Memristor-Based Neuromorphic System with Content Addressable Memory Structure . . . . . 681  
*Yidong Zhu, Xiao Wang, Tingwen Huang, and Zhigang Zeng*

Detailed Structure of the Cortical Magnetic Response to Words . . . . . 691  
*V.L. Vvedensky and A. Yu. Nikolayeva*

|   |     |
|---|-----|
| Pre-coding & Testing Technique for Interfacing Neural Networks<br>Associative Memory . . . . .            | 698 |
| <i>Fayçal Saffih, Wan Abdullah, and Zainol Ibrahim</i>  |     |
| The Peculiarities of Perceptual Set in Sensorimotor Illusions . . . . .                                   | 706 |
| <i>Valeria Karpinskaia, Vsevolod Lyakhovetskii, Viktor Allakhverdov,<br/>and Yuri Shilov</i>              |     |
| Generalized Truth Values: From Logic to the Applications in Cognitive<br>Sciences. . . . .                | 712 |
| <i>Oleg Grigoriev</i>   |     |
| Modeling of Cognitive Evolution: Agent-Based Investigations in<br>Cognitive Science . . . . .             | 720 |
| <i>Vladimir G. Red'ko</i>   |     |
| Usage of Language Particularities for Semantic Map Construction: Affixes<br>in Russian Language . . . . . | 731 |
| <i>Anita Balandina, Artyom Chernyshov, Valentin Klimov,<br/>and Anastasiya Kostkina</i>                   |     |
| <b>Author Index</b> . . . . .   | 739 |