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# Advances in Neural Networks – ISNN 2012

9th International Symposium on Neural Networks  
Shenyang, China, July 11-14, 2012  
Proceedings, Part I

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# Preface

This book and its sister volume constitute the proceedings of the 9th International Symposium on Neural Networks (ISNN 2012). ISNN 2012 was held in the beautiful city Shenyang in northeastern China during July 11–14, 2012, following other successful conferences in the ISNN series. ISNN has emerged as a leading conference on neural networks in the region with increasing global recognition and impact. ISNN 2012 received numerous submissions from authors in six continents (Asia, Europe, North America, South America, Africa, and Oceania), 24 countries and regions (Mainland China, Hong Kong, Macao, Taiwan, South Korea, Japan, Singapore, India, Iran, Poland, Germany, Finland, Italy, Spain, Norway, Spain, Russia, UK, USA, Canada, Brazil, Australia, and Tunisia). Based on rigorous reviews, 147 high-quality papers were selected by the Program Committee for presentation at ISNN 2012 and publication in the proceedings. In addition to the numerous contributed papers, three distinguished scholars (Kunihiko Fukushima, Erkki Oja, and Alessandro Sperduti) were invited to give plenary speeches at ISNN 2012. The papers are organized in many topical sections under coherent categories (mathematical modeling, neurodynamics, cognitive neuroscience, learning algorithms, optimization, pattern recognition, vision, image processing, information processing, neurocontrol and novel applications) spanning all major facets of neural network research and applications. ISNN 2012 provided an international forum for the participants to disseminate new research findings and discuss the state of the art of new developments. It also created a pleasant opportunity for the participants to interact and exchange information on emerging areas and future challenges of neural network research.

Many people made significant efforts to ensure the success of this event. The ISNN 2012 organizers are grateful to sponsors for their sponsorship; grateful to the National Natural Science Foundation of China for the financial support; and grateful to the Asian Pacific Neural Network Assembly, European Neural Network Society, IEEE Computational Intelligence Society, and IEEE Harbin Section for the technical co-sponsorship. The organizers would like to thank the members of the Program Committee for reviewing the papers. The organizers would particularly like to thank the publisher Springer for their agreement and cooperation in publishing the proceedings as two volumes of *Lecture Notes in Computer Science*. Last but not least, the organizers would like to thank all the authors for contributing their papers to ISNN 2012. Their enthusiastic contribution and participation are an essential part of the symposium, which made the event a success.

July 2012

Jun Wang  
Gary G. Yen  
Marios M. Polycarpou

# ISNN 2012 Organization

ISNN 2012 was organized and sponsored by the Northeastern University and Institute of Automation of the Chinese Academy of Sciences. It was co-sponsored by the Chinese University of Hong Kong and University of Illinois at Chicago. It was technically cosponsored by the Asia Pacific Neural Network Assembly, and European Neural Network Society, IEEE Computational Intelligence Society, IEEE Harbin Section, and International Neural Network Society. It was financially supported by the National Natural Science Foundation of China.

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