Communications
in Computer and Information Science 107

Zhihua Cai Hengjian Tong Zhuo Kang
Yong Liu (Eds.)

Computational Intelligence and Intelligent Systems

5th International Symposium, ISICA 2010
Wuhan, China, October 22-24, 2010
Proceedings

Springer

Volume Editors

Zhihua Cai
China University of Geosciences, School of Computer Science, Wuhan, China
E-mail: zhcai@cug.edu.cn

Hengjian Tong
China University of Geosiences, School of Computer Science, Wuhan, China
E-mail: thj07113558@yahoo.com.cn

Zhuo Kang
Wuhan University, Computation Center, Wuhan, China
E-mail: kang_whu@yahoo.com

Yong Liu
The University of Aizu, School of Computer Science and Engineering, Japan
E-mail: yliu@u-aizu.ac.jp

Library of Congress Control Number: 2010936077

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

ISSN 1865-0929
ISBN-10 3-642-16387-4 Springer Berlin Heidelberg New York
ISBN-13 978-3-642-16387-6 Springer Berlin Heidelberg New York

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India
Printed on acid-free paper SPIN: 06/3180 5 4 3 2 1 0

Preface

CCIS 107 is the second volume of the proceedings of the Fifth International Symposium on Intelligence Computation and Applications (ISICA 2010) held in Wuhan, China, October 22–24, 2010. Thirty-one papers among 267 submissions were selected and included in *CCIS* 107.

This volume features the most up-to-date research in evolutionary design, evolutionary optimization, hybrid evolutionary algorithms, intelligent systems, particle swarm optimization, and predictive modeling.

CCIS 107 is dedicated to the memory of Lishan Kang. ISICA conferences were one of the first series of international conferences on computational intelligence that combined elements of learning, adaptation, evolution and fuzzy logic to create programs as alternative solutions to artificial intelligence. The idea for ISICA came about after Lishan Kang organized an international symposium on evolutionary computation at Wuhan University in 2000. After he was invited to be the Director of the School of Computer Science, China University of Geosciences, he wondered whether he could establish such discussion forums on computational intelligence at China University of Geosciences. With support from his university, the School of Computer Science organized the first ISICA in 2005, in which some of the leading figures from the scientific computing world were invited, including H.-P. Schwefel, Germany, M. Schoenauer, France, D.J. Evans, UK, T. Higuchi, Japan, Z. Michalewicz, Australia, and X. Yao, UK.

The Second ISICA was jointly held in 2007 with the 7th International Conference on Evolvable Systems: From Biology to Hardware (ICES 2007). Since then, ISICA has become an annual event. Sadly, the founder of ISICA, Lishan Kang, passed away last year. However, his spirit will live with us, and inspire us to hold ISICA continually and successfully. Kang firmly believed that evolutionary computation is the foundation of computational intelligence, and computational intelligence is the future of computational science. We truly hope that ISICA will establish a bridge for young researchers to reach this beautiful future one day.

Solutions have been evolving in computational intelligence. So has Kang's research. Kang started his research on the Schwarz algorithm in 1957 under the guidance of Russian computational scientist I.P. Mysovskich. Although the Schwarz algorithm was proposed as early as 1869, it had not attracted enough attention at that time. As a young researcher, Kang became fascinated with the Schwarz algorithm, and submitted his first paper on the multi-domain Schwarz alternating method in 1959. However, his paper was rejected with the only comment being that it was of no practical use. Twenty years later, with the development of parallel computers, researchers' attention was brought back to Kang's results on the Schwarz algorithm. It was like a rebirth of Kang's research. Led by Kang, a group at Wuhan University developed the first distributed computing

system called WuPP-80 in China in 1982. Kang had solved a number of difficult mathematical physics problems using the multi-domain Schwarz alternating method on WuPP-80. Because of Kang's great achievement on asynchronous parallel computing and his theoretical research on the convergence of the Schwarz algorithm with the size of overlapping domains, he was honored with the fourth-class prize of the National Natural Science Award of China in 1993, which was the highest prize awarded to computer science in that year.

After domain decomposition methods reached a level of maturity in the late 1980s, Kang shifted his attention to the new research field of evolutionary computation. There are always great challenges in a new field. But that also means great chances for research. In those years, Kang's students' were excited about evolutionary computation. Meanwhile, there were no foreign research journals and books on evolutionary computation at the Wuhan University Library. Kang sent a student to get a few references from the Beijing Library. In such hard conditions, Kang and his student, Yong Liu, wrote the first research book on evolutionary computation in China, *Non-Numerical Algorithms: (II) Genetic Algorithms* published by China Science Press in 1995.

Being a generation greatly influenced by Chairman Mao, Kang had answered Mao's calling of "Yang Wei Zhong Yong" (to make the foreign things serve China). He had given hundreds of public talks on both the Schwarz alternating method and evolutionary computations at many universities in China starting in the 1980s. Late in his life, Kang still insisted on giving lectures at summer teacher workshops in Guiyang for a number of years till he was diagnosed with stomach cancer. Nowadays thousands of students and researchers in China are following in is footsteps.

With the popularity of "Yang Wei Zhong Yong" in the computational field in China, we would also like to call attention to "Gu Wei Jin Yong" (to make the past serve the present) among researchers. Nengchao Wang, for example, has demonstrated in a keynote speech at ICES 2007 how evolution of Yin and Yang could be used in designing modern computer architectures and algorithms. Hard as it is to believe, even many foreign experts became interested in Wang's speech, given in Chinese. Kang solved the 100-year-old convergence problem existing in the Schwarz algorithm, while Wang uncovered a thousand-year-old mathematical mystery, rediscovering how the ancient mathematician Hui Liu calculated the ratio of a circle's area to the square of its radius π to 3.1416 more than a thousand years ago. The methodology used in calculating π actually shares a similar idea with computational intelligence concerning the evolution of solutions.

Finally, on behalf of the Organizing Committee, we would like to warmly thank the sponsor, China University of Geosciences for helping us in sundry ways to achieve our goals for the conference. We wish to express our appreciation to Springer for publishing the proceedings of ISICA 2010. We also wish to acknowledge the dedication and commitment of the *LNCS* and *CCIS* editorial staff. We would like to thank the authors for submitting their work, as well as the Program Committee members and reviewers for their enthusiasm, time and

expertise. The invaluable help of active members from the Organizing Committee, including Hengjian Tong, Chengyu Hu, Wei Qiang, Hongwei Zhang and Hao Zhang, in setting up and maintaining the online submission systems, assigning the papers to the reviewers, and preparing the camera-ready version of the proceedings, is highly appreciated. We would like to thank them personally for their help making ISICA 2010 a success.

October 2010

Zhihua Cai
Yong Liu
Zhenhua Li

Organization

ISICA 2010 was organized by the School of Computer Science, China University of Geosciences, sponsored by China University of Geosciences, and supported by Springer.

General Chair

Huiming Tang	China University of Geosciences, China

Program Chairs

Zhihua Cai	China University of Geosciences, China
Yong Liu	University of Aizu, Japan
Zhijian Wu	Wuhan University, China

Publication Chairs

Hengjian Tong	China University of Geosciences, China
Chengyu Hu	China University of Geosciences, China

Local Arrangement Chair

Hui Li	China University of Geosciences, China

Program Committee

Tughrul Arslan	The University of Edinburgh, UK
Javad Sohafi Bonab	Islamic Azad University, Iran
Tan Kay Chen	National University of Singapore, Singapore
Carlos A. Coello	LANIA, Mexico
Guangming Dai	China University of Geosciences, China
Kalyanmoy Deb	Indian Institute of Technology, India
Yaochu Jin	Honda Research Institute Europe, Germany
Pavel Kromer	Technical University of Ostrava, Czech Republic
Yuanxiang Li	Wuhan University, China
Zhenhua Li	China University of Geosciences, China
Steffen Limmer	Friedrich Alexander University Erlangen Nürnberg, Germany

Shiow-Jyu Lin	National Taiwan Normal University, Taiwan
Charles X. Ling	The University of Western Ontario, Canada
Bob McKay	Seoul National University, Korea
Ryszard Tadeusiewicz	AGH University of Science and Technology, Krakow, Poland
Hamid R. Tizhoosh	The University of Waterloo, Canada
Dong-Min Woo	Myongji University, Korea
Zhijian Wu	Wuhan University, China
Shengxiang Yang	University of Leicester, UK
Xin Yao	University of Birmingham, UK
Gary G. Yen	Oklahoma State University, USA
Sanyou Zeng	China University of Geosciences, China
Huajie Zhang	University of New Brunswick, Canada
Qingfu Zhang	University of Essex, UK
Xiufen Zou	Wuhan University, China

Local Co-chair

Zhenhua Li	China University of Geosciences, China
Guangming Dai	China University of Geosciences, China
Sifa Zhang	China University of Geosciences, China
Yi Zeng	China University of Geosciences, China

Local Committee

Shuanghai Hu	China University of Geosciences, China
Wei Qiang	China University of Geosciences, China
Siqing Xue	China University of Geosciences, China
Siwei Jiang	China University of Geosciences, China
Ming Yang	China University of Geosciences, China

Secretaries

Hongwei Zhang	China University of Geosciences, China
Hao Zhang	China University of Geosciences, China
Jing Zai	China University of Geosciences, China

Sponsoring Institutions

China University of Geosciences, Wuhan, China

Table of Contents

Section I: Evolutionary Design

Section II: Evolutionary Optimization

Section III: Hybrid Algorithms

Section IV: Intelligent Systems

Section V: Particle Swarm Optimization

Section VI: Predictive Modeling