PROCEEDINGS

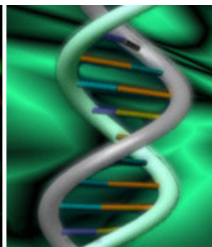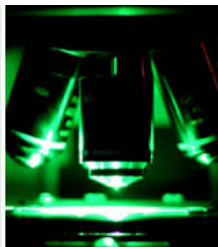## Sixth International Conference on Hybrid Intelligent Systems
and
Fourth Conference on Neuro-Computing and Evolving Intelligence (HIS-NCEI 2006)

Edited by

Ajith Abraham, Yonsei University, Seoul, Korea
Nik Kasabov, KEDRI, AUT, New Zealand
Mario Köppen, Kyushu Institute of Technology, Japan
Andreas König, University of Kaiserslautern, Germany
Qun Song, KEDRI, AUT, New Zealand

Organized by

The Knowledge Engineering and Discovery Research Institute (KEDRI)
Auckland, New Zealand

Los Alamitos, California
Washington • Brussels • Tokyo

Welcome from the HIS-NCEI'06 Chairs
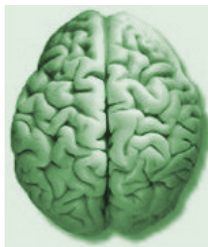
We are very pleased to welcome our colleagues to the Sixth International Conference on Hybrid Intelligent Systems and Fourth Conference on Neuro-Computing and Evolving Intelligence (HIS-NCEI 2006), 13 - 15 December 2006 in Auckland, New Zealand. The previous editions of HIS and NCEI series of conferences attracted a wide range of interests with the development of the next generation of intelligent systems and its various practical applications.

Hybridization of intelligent systems is a promising research field of computational intelligence focusing on synergistic combinations of multiple approaches to develop the next generation of intelligent systems. A fundamental stimulus to the investigations of Hybrid Intelligent Systems (HIS) is the awareness that combined approaches will be necessary to be able to solve hard problems in artificial intelligence. Neural computing, machine learning, fuzzy logic, evolutionary algorithms, agent-based methods, quantum computing, among others, have been established and shown their strength and drawbacks. Applications span across all disciplines of Science, Business, Engineering, Medicine, Health, Environment, Social Sciences. Neuro-Computing (NC) is an area of computer science and engineering concerned with the development, implementation, realization and application of computational models that mimic the brain in its main functions of adaptive learning, predictive generalization, and knowledge discovery. Using NC and hybrid system to build intelligent systems that evolve their structure, their functionality and their knowledge representation over time through interaction with the environment, called evolving intelligence (EI) is a major focus of the conference.

The three days event will include tutorials, invited talks, oral presentations, poster presentations and various demonstrations of neuro-computing and hybrid systems for : bioinformatics and biomedical applications, biometric and security, brain study and cognitive engineering, agriculture, environment, decision support, business and finance, speech-, image- and multimodal information processing, process control, arts and design. HIS-NCEI'06 is focused on the following main topics:

- Novel neurocomputing methods
- Novel methods of soft computing for adaptive modeling and knowledge discovery
- Methods of evolving intelligence (EI)
- Novel methods for Hybrid intelligent systems (HIS)
- Hybrid NN-, fuzzy-, evolutionary- algorithms
- Cellular automata
- Artificial Life systems
- Evolving molecular processes and their modeling
- Evolving processes in the brain and their modeling
- Evolving language and cognition
- Molecular computing
- Quantum information processing
- Quantum inspired computational intelligence
- HIS for neuro-informatics
- HIS for Bioinformatics
- Adaptive speech, image and multimodal processing
- Adaptive decision support systems
- Dynamic time-series modeling
- Adaptive control

- Adaptive intelligent systems on the WWW
- Applications in: Medicine, Health, Information Technologies, Horticulture, Agriculture, Bio-security, Business and finance, Process and robot control, Arts and Design.
- Adaptive integrated/embedded systems for EI
- Agent based systems for EI

The HIS-NCEI'06 program committee represented 23 countries on 5 continents and received over 150 full paper submissions. All papers were refereed by at least three independent referees and, in some uncertain cases the number of referees was up to five. Based on the referee's reports, the Program Committee selected about 70 papers. The high quality accepted papers clearly represents the international importance of the theme of the conference. We would like to thank the HIS-NCEI'06 international program committee and the additional reviewers for providing the reviews in time. The plenary talks are much focused and are presented by outstanding experts from the area. We believe all participants will enjoy and benefit from them. Tutorials focused on latest research topics will be delivered by leading researchers in the field and each will be a half-day long. It is certain that these tutorials will be very useful to students, practitioners and other researchers, as well. Our special thanks also go to all the plenary and tutorial speakers for providing the very interesting and informed talks to catalyze subsequent discussions.

Our special thanks to Ms. Lisa OConner, Proceedings Production Editor, Conference Publishing Services (CPS), IEEE Computer Society Press for all the support and help related to the production of this important scientific work. Finally, we would like to express our sincere gratitude to all the authors and local organizing committees that have contributed towards the success of this conference. We look forward to seeing you in Auckland, New Zealand, during HIS-NCEI'06.

General Chairs

Nik Kasabov, KEDRI, AUT, New Zealand
Mario Köppen, Kyushu Institute of Technology, Japan

Technical Program Chairs

Andreas König, University of Kaiserslautern, Germany
Ajith Abraham, Yonsei University, Korea
Qun Song, KEDRI, AUT, New Zealand

HIS-NCEI'06 Conference Chairs

General Chairs
Nik Kasabov, KEDRI, AUT, New Zealand
Mario Köppen, Kyushu Institute of Technology, Japan

Technical Program Chairs
Andreas König, University of Kaiserslautern, Germany
Ajith Abraham, Yonsei University, Korea
Qun Song, KEDRI, AUT, New Zealand

Local Organizing Chair
Joyce D'Mello, KEDRI, AUT, New Zealand

Technical Assistance Chair
Peter Hwang, KEDRI, AUT, New Zealand

HIS-NCEI'06 Program Committee

Abonyi Janos, Hungary
Adeli Hojjat, USA
Angelov Plamen, UK
Apolloni Bruno, Italy
Arbib Michael, USA
Asano Akira, Japan
Attikiouzel Yianni, Australia
Bajic Vlad, Singapore
Bang Sung Yang, Korea
Benuskova Lubica, NZ
Berenji Hamid, USA
Boyanov Kiril, Bulgaria
Browne Wiliam, UK
Cassim Monte, Japan
Castillo Oscar, Mexico
Chiu David, Canada
Cho Sung-Bae, Korea
Coelho Leandro, Brazil
Coghill George, NZ
Corne David, UK
de Baets Bernard, Belgium
de Carvalho Andre, Brazil
de Macedo Mourelle Luiza, Brazil
Deb Suash, India
Defoin-Platel Michael, NZ
Deng Da, NZ
Diederich Joachim, Australia
Dimitrov Dimiter, USA
do Carmo Nicoletti Maria, Brazil
Duro Richard, Spain
Fedrizzi Mario, Italy
Fogel Gary, USA
Franke Katrin, Germany
Freeman Walter, USA
Furuhashi Takeshi, Japan

Ganzha Maria, Poland
Gedeon Tom, Australia
Gelbukh Alexander, Mexico
Giles Lee, USA
Gomide Fernando, Brazil
Grabot Bernard, France
Grosan Crina, Romania
Grzymala-Busse Jerzy, USA
Gulyaev Sergei, NZ
Halgamuge Saman, Australia
Havukkala Ilkka, NZ
Hawemdeh Suliman, USA
Hendtlass Tim, Australia
Herrera Francisco, Spain
Hoffmann Frank, Germany
Howell Bill, Canada
Igel Christian, Germany
Ionita Silviu, Romania
Ishibuchi Hisao, Japan
Ishida Yoshiteru, Japan
Jakubczyc Janina, Poland
Jan van der Zwaag Berend, Netherlands
Jin Yaochu, Germany
Kacprzyk Janusz, Poland
Karny Miroslav, Czech Republic
Kerre Etienne, Belgium
Klawonn Frank, Germany
Koczy Laszlo, Hungary
Korotkikh Galina, Australia
Korotkikh Victor, Australia
Langdon William, UK
Laws Mark, NZ
Lozano Sebastian, Spain
Ludermir Teresa Bernarda, Brazil
MacDonell Stephen, NZ
Magdalena Luis, Spain
Marcus Gary, USA
Mukkamala Srinivas, USA
Nakamatsu Kazumi, Japan

Nakao Zensho, Japan
Nedjah Nadia, Brazil
Nikravesh Masoud, USA
Nishikawa Ikuko, Japan
Nobuhara Hajime, Japan
Pal Nikhil, India
Palade Vasile, UK
Pang Shaoning, NZ
Paprzycki Marcin, Poland
Pedrycz Witold, Canada
Pereira Francisco, Portugal
Precup Radu-Emil, Romania
Raidl Guenther, Austria
Rajapakse Jagath, Singapore
Rodrigo Allen, NZ
Roy Rajkumar, UK
Ruiz-del-Solar Javier, Chile
Saad Ashraf, USA
Sato-Ilic Mika, Japan
Seiffert Udo, Germany
Semeraro Giovanni, Italy
Soria-Frisch Aureli, Spain
Tan Clarence, Singapore
Uchino Eiji, Japan
Veenhuis Christian, Germany
Villa Alessandro, France
Vrahatis Michael N., Greece
Watts Mike, NZ
Weber Richard, Chile
Wermter Stefan, UK
Wright Jim, NZ
Yager Ronald R. , USA
Yamakawa Takeshi, Japan
Yoshida Kaori, Japan
Zhang Yan-Qing, USA
Zimmer Uwe, Australia

Additional Reviewers

Tatiana Valentine Guy, Czech Republic
Pasquale Lops, Italy
Marco Degemmis, Italy
Corrado Mencar, Italy