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Brain Informatics and Health

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Preface

This volume contains papers selected for presentation in the technical and invited special sessions of the 2016 International Conference on Brain Informatics and Health (BIH 2016), which was held at Hilton Omaha, Nebraska, USA, during October 13–16, 2016. The conference was co-organized by the University of Nebraska at Omaha College of Information Science and Technology, the Web Intelligence Consortium (WIC), and IEEE Computational Intelligence Society Task Force on Brain Informatics (IEEE-CIS TF-BI), and jointly held with The IEEE/WIC/ACM International Conference on Web Intelligence 2016 (WI 2016).

Brain research is rapidly advancing with the application of big data technology to neuroscience, as reflected in major international initiatives throughout the world. The paradigm of brain informatics (BI) is becoming mainstream and crosses the disciplines of neuroscience, cognitive science, computer science, signal processing, and neuroimaging technologies as well as data science. BI investigates essential functions of the brain, in a wide range of areas from perception to thinking, and encompassing areas such as multi-perception, attention, memory, language, computation, heuristic search, reasoning, planning, decision-making, problem-solving, learning, discovery, and creativity. The current goal of BI is to develop and demonstrate a systematic approach to achieving an integrated understanding of working principles of the brain from macroscopic to microscopic levels, by means of experimental, computational, and cognitive neuroscience studies, not least utilizing advanced Web intelligence-centric information technologies.

The series of BI Conferences had started with the First WICI International Workshop on Web Intelligence Meets Brain Informatics (WImBI 2006), held in Beijing, China, in 2006. The Second, the Third, and the 4th Conference on Brain Informatics (BI 2009, BI 2010, and BI 2011) were jointly held with the International Conferences on Active Media Technology (AMT 2009, AMT 2010, and AMT 2011), in Beijing, China; Toronto, Canada; and Lanzhou, China, respectively. The 5th Conference on Brain Informatics was held jointly with other international conferences (AMT 2012, WI 2012, IAT 2012, and ISMIS 2012) in Macau, China, in 2012. The 2013 International Conference on Brain and Health Informatics was held in Maebashi-City, Japan, and it was the first conference specifically dedicated to interdisciplinary research in brain and health informatics. The BIH 2014 and 2015 conferences were held in Warsaw, Poland, and London, UK, respectively. Following the success of past conferences in this series, BIH 2016 placed a strong emphasis on emerging trends of big data analysis and management technology for brain research, behavior learning, and real-world applications of brain science in human health and wellbeing, especially highlighting the theme “Connecting Network and Brain with Big Data.”

BIH 2016 aimed to give a common thesis of Informatics for Human Brain, Behavior, and Health. The conference gathered researchers at the cutting edge of BI, bringing together investigators and practitioners from neuroscience, cognitive science, computer science, data science, and neuroimaging technologies with the purpose of exploring the

fundamental roles, interactions, and practical impact of BI. This year, the BIH 2016 conference was especially dedicated to the celebration of the 60th anniversary of artificial intelligence (AI). While neuroscientists are making breakthrough progress in understanding brain function, AI researchers also have been striving to formalize the organization and function of the human brain, aiming at creating computer hardware and software with a capacity for intelligent behavior. The integration of technological advancements with fundamental academic research yielded a plethora of brain-inspired achievements. By leveraging AI, BI has produced new products, services, and frameworks empowered by the World Wide Web. Neuromorphic computer architectures, chips that mimic brain dynamics, show promise in the quest to extract context and meaning from big data through both analytical and heuristic means. There has never been a more exciting moment than now, in neuroscience, cognitive science, computer science, and AI.

BIH 2016 involved an inspiring cadre of world leaders in brain research, including keynote speakers Stephen Smith, Senior Investigator of the Allen Institute for Brain Science, and Ivan Soltesz, James R. Doty Professor of Neurosurgery and Neurosciences, at Stanford School of Medicine; and feature speakers Steven Schiff, Brush Chair Professor of Engineering in the Departments of Neurosurgery, Engineering Science and Mechanics, Physics, and BioE, at Pennsylvania State University; Kristen Harris, Professor of Neuroscience at University of Texas at Austin; Giulio Tononi, Professor of Psychiatry, Distinguished Professor in Consciousness Science, and the David P. White Chair in Sleep Medicine, at University of Wisconsin - Madison; Bob Jacobs, Professor of Psychology, at Colorado College; Partha Mitra, Professor at Cold Spring Harbor Laboratory; and Paola Pergami, Associate Professor in Pediatric Neurology, at George Washington University. BIH 2016 also included a panel discussion among the leaders of brain researchers in the world.

Here we would like to express our gratitude to all members of the Conference Committee for their instrumental and unwavering support. BIH 2016 had a very exciting program with a number of features, ranging from keynote talks to technical sessions, workshops/special sessions, and social programs. This would not have been possible without the generous dedication of the Program Committee members in reviewing the papers submitted to BIH 2016, the BIH 2016 workshop and special session chairs and organizers, and our keynote and feature speakers in giving outstanding talks at the conference. BIH 2016 could not have taken place without the great team effort of the local Organizing Committee and generous support from sponsors.

Special thanks go to the Steering Committee co-chairs, Ning Zhong and Hanchuan Peng, for their help in organizing and promoting BIH 2016. We also thank Juzhen Dong and Yang Yang for their assistance with the CyberChair submission system. We are grateful to Springer's *Lecture Notes in Computer Science* (LNCS/LNAI) team for their support. We thank Springer for their help in coordinating the publication of this special volume in an emerging and interdisciplinary research field.

October 2016

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