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Preface

This volume contains papers selected for presentation at the technical and invited special sessions of the 2017 International Conference on Brain Informatics (BI 2017), which was held at the Grand Gongda Jianguo Hotel, Beijing, China, during November 16–18, 2017. The conference was co-organized by Beijing University of Technology, Institute of Automation, Chinese Academy of Sciences, Web Intelligence Consortium (WIC), and IEEE Computational Intelligence Society Task Force on Brain Informatics (IEEE-CIS TF-BI).

Brain informatics (BI) started the exploration as a research field with the vision of investigating the brain from the perspective of informatics. First, brain informatics combines aspects of cognitive science, neuroscience, machine learning, big data analytics, AI, and ICT to study the brain as a general information processing system. Second, new measurements and informatics equipment, tools, and platforms are revolutionizing the way we understand the brain. Third, staring from its proposal as a field, brain informatics has the goal of inspiring future artificial intelligence, especially Web intelligence.

The series of Brain Informatics conferences started with the WICI International Workshop on Web Intelligence Meets Brain Informatics, held in Beijing, China in 2006. The next four conferences of Brain Informatics in 2009, 2010, 2011, and 2012 were held in Beijing, China, Toronto, Canada, Lanzhou, China, and Macau, China, respectively. Since 2013, "health" was added to the conference title with an emphasis on real-world applications of brain research in human health and well-being and BHI 2013, BIH 2014, BIH 2015, and BIH 2016 were held in Maebashi, Japan, Warsaw, Poland, London, UK, and Omaha, USA, respectively. This year, we celebrated the tenth anniversary of Brain Informatics. This grand event in Beijing was co-hosted by the Beijing University of Technology, and the Institute of Automation, Chinese Academy of Sciences.

BI addresses the computational, cognitive, physiological, biological, physical, ecological, and social perspectives of brain informatics, as well as topics related to mental health and well-being. It also welcomes emerging information technologies, including but not limited to Internet/Web of Things (IoT/WoT), cloud computing, big data analytics, and interactive knowledge discovery related to brain research. BI also encourages research exploring how advanced computing technologies are applied to and make a difference in various large-scale brain studies and their applications.

Informatics-enabled studies are transforming brain science. New methodologies enhance human interpretive powers when dealing with big data sets increasingly derived from advanced neuro-imaging technologies, including fMRI, PET, MEG, EEG, and fNIRS, as well as from other sources like eye-tracking and wearable, portable, micro and nano devices. New experimental methods, such as in toto imaging, deep tissue imaging, opto-genetics and dense-electrode recording, are generating massive amounts of brain data at very fine spatial and temporal resolutions. These

technologies allow for the measuring, modeling, managing, and mining of multiple forms of big brain data. Brain informatics techniques for the analysis of the data will help achieve a better understanding of human thought, memory, learning, decision-making, emotion, consciousness, and social behaviors. These methods and related studies will also assist in building brain-inspired intelligence, brain-inspired computing, and human-level wisdom-computing paradigms and technologies, thereby improving the treatment efficacy of mental health and brain disorders.

BI 2017 provided a broad forum for academics, professionals, and industry representatives to exchange their ideas, findings, and strategies in utilizing the powers of the mammalian brain, especially human brains and man-made networks to create a better world. In the 2017 version of the Brain Informatics conference, we argued that brain research is a grand challenge to all countries and various scientific communities. Its potential impact not only will help us to understand who we are, and provide us with a better life, but will also enable a paradigm shift in the new intelligence era. Hence, future brain research needs joint efforts and collaboration from different countries worldwide. It also calls for interdisciplinary studies to investigate the brain from various perspectives.

Therefore, the theme of BI 2017 was "Informatics Perspective of Investigation on the Brain and Mind."

BI 2017 involved an inspiring cadre of world leaders in brain informatics research, including keynote speakers Alan Evans, James McGill Professor at McGill University, Canada, Tom Mitchell, E. Fredkin University Professor at Carnegie Mellon University, USA, and feature speakers Yanchao Bi, Professor at Beijing Normal University, China, Adam R. Ferguson, Associate Professor at University of California, San Francisco, USA, Bin Hu, Professor at Lanzhou University, China, Mike Hawrylycz, Investigator at Allen institute for Brain Science, USA, and Dinggang Shen, Professor at University of North Carolina at Chapel Hill, USA. BI 2017 also included a panel discussion among the leaders of brain informatics research worldwide.

Here we would like to express our gratitude to all members of the Conference Committee for their instrumental and unwavering support. BI 2017 had a very exciting program with a number of features, ranging from keynote talks to technical sessions, workshops/special sessions, and panel discussion. This would not have been possible without the generous dedication of the Program Committee members in reviewing the conference papers and abstracts, the BI 2017 workshop and special session chairs and organizers, and our keynote and feature speakers in giving outstanding talks at the conference. BI 2017 could not have taken place without the great team effort of the local Organizing Committee and generous support from our sponsors. We would especially like to express our sincere appreciation to our kind sponsors, including the Beijing Advanced Innovation Center for Future Internet Technology/BJUT (http://bjfnc.bjut.edu.cn), the Faculty of Information Technology/BJUT (http://xxxb.bjut.edu.cn), the Research Center for Brain-inspired Intelligence, Institute of Automation, Chinese Academy of Sciences (http://bii.ia.ac.cn), the Web Intelligence Consortium (http://wi-consortium.org), the Chinese Society for Cognitive Science (http://www.cogsci.org.cn), the Chinese Association for Artificial Intelligence (http://caai.cn), the International Neural Network Society (https://www.inns.org), the IEEE Computational

Intelligence Society (http://cis.ieee.org), the Allen Institute for Brain Science (https://alleninstitute.org), Springer LNCS/LNAI (http://www.springer.com/gp/computer-science/lncs), PsyTech Electronic Technology Co., Ltd. (http://www.psytech.com.cn), Beijing 7Invensun Technology Co., Ltd. (https://www.7invensun.com), John Wiley & Sons, Inc. (http://www.wiley.com), and Synced Technology Inc. (https://syncedreview.com).

Special thanks go to the Steering Committee co-chairs, Ning Zhong and Hanchuan Peng, for their help in organizing and promoting BI 2017. We also thank Juzhen Dong, Yang Yang, Jiajin Huang, Tielin Zhang, and Liyuan Zhang for their assistance with the CyberChair submission system and local affairs. 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.

September 2017

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