Advances in Cognitive Neurodynamics
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Preface

Fifty years ago, enthused by successes in creating digital computers and the DNA model of heredity, scientists were confident that solutions to the problems of understanding biological intelligence and creating machine intelligence were within their grasp. Progress at first seemed rapid. Giant ‘brains’ that filled air-conditioned rooms were shrunk into briefcases. The speed of computation doubled every two years.

What these advances revealed is not the solutions but the difficulties of the problems. We are like the geographers who ‘discovered’ America, not as a collection of islands but as continents seen only at shores and demanding exploration. We are astounded less by the magnitude of our discoveries about how brains cogitate than by the enormity of the tasks we have undertaken, to explain and replicate the higher functions of brains.

Five decades of brain research have led to the emergence of a new field, which spans the entire range of brain cognition from quantum fields to social interactions, and which is combined by the conceptions of nonlinear neurodynamics operating simultaneously at and across all levels. A new breed of scientists has emerged, schooled in multiple academic disciplines, comfortable in working with data from different levels, and conversant with the mathematical tools that are essential to cross boundaries.

Cognition in its essence is dynamic and multilayered, and pursuit of new clues inevitably leads from one layer to the next, both reductive and holistic. Something more is needed to track these clues than the collaboration of experts. It is the self-education of scientists in each field to journeyman competence in adjacent fields. Thus, a new scientific branch focused on these topics, cognitive neurodynamics has been emerged and intrigued scientists and engineers working in various fields.

An international journal “Cognitive Neurodynamics” edited by us was published early this year by Springer, which may be the first one totally dedicated to this important new branch and provide a forum for scientists and engineers, including neuroscientists, neuropsychologists, cognitive scientists, physicists, mathematicians, IT engineers, and many other experts to publish their results and exchanges their ideas and views.

Although there were special sessions with the title of “Neurodynamics” in many conferences, however, there were very few international meetings focusing all its themes on cognitive neurodynamics, maybe except for a series of Tamagawa
Dynamic Brain Forums organized by the Japanese “Gang of Five” on nonlinear
dynamics in the past decade. We are very glad now that the 1st International Con-
ference on Cognitive Neurodynamics was held in Shanghai, China Nov. 17–21,
which is sponsored and organized by East China University of Science & Tech-
nology, Shanghai Society for Biophysics, the journal “Cognitive Neurodynamics”,
and cosponsored by The National Natural Science Foundation of China (NSFC),
Shanghai Association for Science & Technology, Beijing University of Aeronau-
tics and Astronautics, Beijing University of Technology, Brain Science Center of
Tamagawa University, Brain Science Research Center of KAIST, CAS-MPG Part-
ner Institute for Computational Biology (PICB), Chinese Society for Neuroscience
(CSN), Chinese Society of Theoretical and Applied Mechanics (CSTAM), IEEE
Singapore Computational Intelligence Chapter, International Neural Network Soci-
ety (INNS), Japanese Neural Network Society (JNNS), Nanjing University Aeronau-
tics and Astronautics, Research Center for Brain Science of Fudan University,
RIKEN Brain Science Institute (BSI), Shanghai Jiaotong University, Shanghai So-
ciety for Nonlinear Science (SSNS), Shanghai University, Tongji University, Xi’an
Jiaotong University, Zhejiang University. We are also very glad that the conference
has warmly welcomed by the scientists and engineers working in this field. We have
10 plenary talks given by the leading scientists in this field and 14 mini-symposia
organized by some of them and other outstanding experts. In addition, we have other
8 special sessions and one poster session. The topics of the contributions almost
cover all the fields of cognitive neurodynamics, from micro-, meso- to macroscopic
cognitive neurodynamics, their applications and some related topics. Within our
knowledge, this conference is the biggest one wholly dedicated to this topic up to
now. It’s also our great pleasure to notice the high quality of the contributions, which
come from about 30 countries and areas all over the world. We hope the readers will
also enjoy and be inspired by the papers in this book.

We hope this is only the first step to create a forum for the scientists and engineers
working in the field to show their latest progress, to exchange their ideas and views,
and discuss the perspective of this fast growing interdisciplinary area. We hope this
book is only the 1st volume of a book series on cognitive neurodynamics.

We would like to express our sincere gratitude to all the sponsors and the con-
tributors, this book could not be published without their supports.

Rubin Wang
Fanji Gu
Enhua Shen
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Zhang, Yi  University of Electronic Science and Technology of China  P. R. China
Mini-Symposium Organizers

MS – 1. Models of Mental Disorders
Hans Liljenström, Swedish University of Agricultural Sciences, Sweden
James Wright, Auckland University, New Zealand

MS – 2. Cognitive Machines
John Taylor, King’s College, UK

MS – 3. Visual cortex: Information processing and dynamics
Tiande Shou, Fudan University, P.R China
Anna W Roe, Vanderbilt University, USA

Guang Li, Zhejiang University, P.R China
Robert Kozma, The University of Memphis, USA

MS – 5. Advanced Signal Processing Techniques for Brain Data Analysis
Jianting Cao, Sitama Institute of Technology, Japan
Danilo Mandic, Department of Electrical and Electronic Engineering, Imperial College, UK
MS – 6. Neuroinformatics
Shiro Usui, Brain Science Institute (BSI) Japan

MS – 7. Dynamics in learning and memory
Yoko Yamaguchi, Brain Science Institute (BSI) Japan
Minoru Tsukada, Tamagawa University Japan

MS – 8. Cognitive Computational Modeling of Human Language Processing
Heui-Seok Lim, Hanshin University Korea

MS – 9. Translational Cognitive Neuroimaging
Gary Egan, University of Melbourne Australia

MS – 10. Brain Networks: From Anatomy to Dynamics
Tianzi Jiang, Institute of Automation, Chinese Academy of Sciences P.R. China

MS – 12. Dynamics of Firing Patterns and Synchronization in Neuronal Systems
Qishao Lu, Beijing University of Aeronautics and Astronautics P.R. China
**MS – 13. Central nervous system synchronization**
Paul E. Rapp, Drexel University, College of Medicine USA

**MS – 14. Cognitive Neurodynamics of Attention: Bottom-Up and Top-Down**
Soo-young Lee, Korea Advanced Institute of Science and Technology Korea
Minho Lee, Kyungpook National University Korea

**MS – 15. Structure Formation through Interaction**
Andreas Dress, CAS-MPG Partner Institute for Computational Biology (PICB) Germany
Shanghai Institutes for Biological Sciences (SIBS) China
Chinese Academy of Sciences (CAS),

**Proceeding Chair**
Shen, Enhua East China University of Science and Technology P.R.China

**Finance Chair**
Shi, Yongde Shanghai Society for Biophysics P.R.China

**Secretary**
Qian, Zhiqin East China University of Science and Technology P.R.China
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Olds, James L.
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Sandner, Guy
Sato, Shunsuke
Schoener, Gregor
Shao, Zhiqing
Shen, Enhua
Shi, Hongbo
Shou, Tiande
Siegel, Ralph Mitchell
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Szeto, Kwok Yip
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Tang, Akaysha
Tang, Xiaowei
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Teich, Malvin Carl
Trappenberg, Thomas
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Tsukada, Minoru
Usui, Shiro
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van Ooyen, Arjen
van Pelt, Jaap
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Wang, Deliang
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Wermter, Stefan
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