Contents

Brain Structure and Function - A Neuroscience Perspective

Towards a Multiscale, High-Resolution Model of the Human Brain.............. 3
Katrin Amunts, Oliver Bücker, and Markus Axer

From RNA Replicators to Genes to Survival Machines with Brains.............. 15
Gyan Bhanot

Integrating Brain Structure and Dynamics on Supercomputers. ............... 22
S.J. van Albada, S. Kunkel, A. Morrison, and M. Diesmann

Computational Models and Brain-Inspired Computing

A Geometric Model for the Functional Circuits of the Visual Front-End ....... 35
Bart M. ter Haar Romeny

Models of the Visual Cortex for Object Representation:
Learning and Wired Approaches ........................................... 51
Antonio J. Rodríguez-Sánchez and Justus Piater

A Generic Model of Visual Selective Attention.................................. 63
Kleanthis C. Neokleous, Marios N. Avraamides, and Christos N. Schizas

COSFIRE: A Brain-Inspired Approach to Visual Pattern Recognition ........ 76
George Azzopardi and Nicolai Petkov

Toward the Development of Cognitive Robots .................................. 88
Antonio Bandera and Pablo Bustos

Distance Measures for Prototype Based Classification .......................... 100
Michael Biehl, Barbara Hammer, and Thomas Villmann

Bayes Optimality of Human Perception, Action and Learning:
Behavioural and Neural Evidence ........................................... 117
Ulrik R. Beierholm

Merging Attention and Segmentation: Active Foveal Image Representation... 130
Rebeca Marfil, Esther Antúnez, Fabián Arrebola, and Antonio Bandera

Performance Analysis and Parallelization Strategies in Neuron
Simulation Codes ................................................................. 143
Victor Lopez, Marçal Sola, and Jesus Labarta
HPC and Visualization for Human Brain Simulations

Towards Brain-Inspired System Architectures ........................................ 159
Thomas Sterling, Maciej Brodowicz, and Timur Gilmanov

Towards an Explorative Visual Analysis of Cortical Neuronal Network Simulations ........................................ 171
Torsten Wolfgang Kuhlen and Bernd Hentschel

Visualization of Large-Scale Neural Simulations ................................ 184
Juan B. Hernando, Carlos Duelo, and Vicente Martin

Supercomputing Infrastructure for Simulations of the Human Brain .......... 198
Thomas Lippert and Boris Orth

Author Index ................................................................. 213