

Preface

The chapters included in this book are extended versions of the most relevant works presented at the *Brain-inspired Cognitive Systems Conference* held in July 2010 in Madrid, during mild estival days. BICS 2010 was a multitrack conference organised around four strongly related symposia:

- The *Sixth International Symposium on Neural Computation* (NC 2010)
- The *Fifth International Symposium on Biologically Inspired Systems* (BIS 2010)
- The *Fourth International Symposium on Cognitive Neuroscience* (CNS 2010)
- The *Third International Symposium on Models of Consciousness* (MoC 2010)

BICS 2010 was the fourth of a series of BICS events taking place biennially. The three previous BICS conferences were BICS 2008 (Sao Luis, Brazil), BICS 2006 (Lesbos, Greece) and BICS 2004 (Stirling, UK).

The Brain Inspired Cognitive Systems Conference in Madrid brought together a group of leading scientists and engineers who use analytic and synthetic methods both to understand the astonishing cognitive processing properties of biological systems, and specifically those of the living brain, and to exploit such knowledge to advance engineering methods for building artificial systems with higher levels of cognitive competence.

The four BICS 2010 Conference Symposia were closely connected events around different aspects of the relation between brain science and the engineering of cognitive systems. The scientific program tried to encourage cross-fertilization across the many symposia topics. This emphasized the role of BICS as a major meeting point for researchers and practitioners in the areas of biological and artificial cognitive systems, encouraging debates across disciplines so as to enrich researchers with complementary perspectives from the diverse scientific fields:

NC 2010 presented realistic neural network models and applications. In particular, the symposium focussed on pattern onset learning, structural analyses on Spike-Timing-Dependent Plasticity (STDP) and computational implementations of the Continuum Neural Field Theory.

BIS 2010 was mainly devoted to neuromorphic systems and neurophysiologically inspired models. The symposium explored biologically inspired architectures for simulation of object perception, decision making, attention, language or emotions in autonomous agents.

CNS 2010 covered both computational models of the brain and brain-inspired algorithms and artifacts. This symposium presented a wide-ranging set of empirical and theoretical papers on key topics in the field of cognitive neuroscience such as, perception, attention, memory or cognitive impairment.

MoC 2010 shed light on both philosophical and neurological basis of consciousness. Machine Consciousness focusses on both aspects by investigating how to build self-aware machines. The symposium focused on Machine Consciousness and presented papers such as a metric of visual qualia in ar-

tificial cognitive architectures, and design and implementation principles for self-conscious robots or machine free will.

BICS 2010 gathered cognitive systems engineers and brain scientists in sessions where cross-domain ideas were fostered in the hope of getting new emerging insights on the nature, operation and extractable capabilities of brains. This multiple perspective approach is necessary in complex cognitive systems engineering because the progressively more accurate data about brains is producing a growing need of both a quantitative and theoretical understanding and an associated capacity to manipulate this data and translate it into engineering applications rooted in sound theories.

The conference hosted both researchers that aim to build brain inspired systems with higher cognitive competences, and as well as life scientists who use and develop mathematical and engineering approaches for a better understanding of complex biological systems like the brain. All them trying to meet at the point of rigorous theorising necessary both to understand biology and support engineering.

The four symposia and this resulting book—a collection of selected and extended papers—is an attempt to provide a broader perspective on these issues which are at the core of XXI century science: the discovery of the organisational principles governing the neural dynamics that mediate in cognition and the potential application of these principles into technical systems.

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From Brains to Systems

Brain-Inspired Cognitive Systems 2010

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