Preface

This book is the result of a series of international workshops organized by the EmerNet project on Emergent Neural Computational Architectures based on Neuroscience sponsored by the Engineering and Physical Sciences Research Council (EPSRC). The overall aim of the book is to present a broad spectrum of current research into biologically inspired computational systems and hence encourage the emergence of new computational approaches based on neuroscience. It is generally understood that the present approaches to computing do not have the performance, flexibility, and reliability of biological information processing systems. Although there is a massive body of knowledge regarding how processing occurs in the brain and central nervous system this has had little impact on mainstream computing so far.

The process of developing biologically inspired computerized systems involves the examination of the functionality and architecture of the brain with an emphasis on the information processing activities. Biologically inspired computerized systems address neural computation from the position of both neuroscience and computing by using experimental evidence to create general neuroscience-inspired systems.

The book focuses on the main research areas of modular organization and robustness, timing and synchronization, and learning and memory storage. The issues considered as part of these include: How can the modularity in the brain be used to produce large scale computational architectures? How does the human memory manage to continue to operate despite failure of its components? How does the brain synchronize its processing? How does the brain compute with relatively slow computing elements but still achieve rapid and real-time performance? How can we build computational models of these processes and architectures? How can we design incremental learning algorithms and dynamic memory architectures? How can the natural information processing systems be exploited for artificial computational methods?

We hope that this book stimulates and encourages new research in this area. We would like to thank all contributors to this book and the few hundred participants of the various workshops. Especially we would like to express our thanks to Mark Elshaw, network assistant in the EmerNet network who put in tremendous effort during the process of publishing this book.

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