Preface

The perception–action cycle has been described by the eminent neuroscientist JM Fuster as the circular flow of information that takes place between the organism and its environment in the course of a sensory-guided sequence of behaviour towards a goal. Each action in the sequence causes certain changes in the environment that are analysed bottom-up through the perceptual hierarchy and leads to the processing of further action, top-down through the executive hierarchy, towards motor effectors. These cause new changes that are analysed and lead to new action, and so on.

This book provides a snapshot and a resumé of the current state-of-the-art of the ongoing research avenues concerning the perception–action cycle. The central aim of the volume is to be an informational resource and a methodology for anyone interested in constructing and developing models, algorithms and hardware implementations of autonomous machines empowered with cognitive capabilities.

The book is divided into three thematic areas: (1) computational neuroscience models, (2) cognitive architectures and (3) hardware implementations. In the first thematic area, leading computational neuroscientists present brain-inspired models of perception, attention, cognitive control, decision making, conflict resolution and monitoring, knowledge representation and reasoning, learning and memory, planning and action, and consciousness grounded on experimental data. In the second thematic area, architectures, algorithms and systems with cognitive capabilities and minimal guidance from the brain are discussed. These architectures, algorithms and systems are inspired from the areas of cognitive science, computer vision, robotics, information theory, machine learning, computer agents and artificial intelligence. In the third thematic area, the analysis, design and implementation of hardware systems with robust cognitive abilities from the areas of mechatronics, sensing technology, sensor fusion, smart sensor networks, control rules, controllability, stability, model/knowledge representation and reasoning are discussed.

This engaging volume will be invaluable to computational neuroscientists, cognitive scientists, robotists, electrical engineers, physicists, mathematicians and others interested in developing cognitive models, algorithms and systems of the perception–action cycle. Graduate level students and trainees in all of these fields will find this book a significant source of information.

Finally, there are many people whom we would like to thank for making this book possible. This includes all the contributing authors who did a great job. We would like to thank Ann H. Avouris, our Springer senior editor, and members of the production team, for their consistent help and support. We dedicate this work to our families.

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