

## Neuromorphic and Brain-Based Robots

Neuromorphic and brain-based robotics have enormous potential for furthering our understanding of the brain. By embodying models of the brain on robotic platforms, researchers can investigate the roots of biological intelligence and work towards the development of truly intelligent machines.

This book provides a broad introduction to this groundbreaking area for researchers from a wide range of fields, from engineering to neuroscience. Case studies explore how robots are being used in current research, including a whisker system that allows a robot to sense its environment and neurally inspired navigation systems that show impressive mapping results. Looking to the future, several chapters consider the development of cognitive, or even conscious, robots that display the adaptability and intelligence of biological organisms. Finally, the ethical implications of intelligent robots are explored, from morality and Asimov's three laws to the question of whether robots have rights.

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# Neuromorphic and Brain-Based Robots

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## Preface

The genesis for this book came about from a series of conversations, over a period of several years, between Jeff Krichmar and Hiro Wagatsuma. Initially, these conversations began when Krichmar was at The Neurosciences Institute in San Diego and Wagatsuma was at the Riken Brain Science Institute near Tokyo. They included discussions at each other's institutes, several conversations and workshops at conferences, and an inspiring trip to a Robotics Exhibition at the National Museum of Nature and Science in Tokyo. In these conversations, we realized that we shared a passion for understanding the inner workings of the brain through computational neuroscience and embodied models. Moreover, we realized that: (1) there was a small, but growing, community of like-minded individuals around the world, and (2) there was a need to publicize this line of research to attract more scientists to this young field. Therefore, we contacted many of the top researchers around the world in Neuromorphic and Brain-Based Robotics. The requirements were that the researchers should be interested in some aspect of the brain sciences, and were using robotic devices as an experimental tool to further our understanding of the brain. We have been thrilled at the positive response. We know we have not included everyone in this field and apologize for any omissions. However, we feel that the contributed chapters in this book are representative of the most important areas in this line of research, and that they represent the state-of-the-art in the field at this time. We sincerely hope this book will inspire and attract a new generation of neuromorphic and brain-based roboticists.

JLK – To Tom Vogl, my mentor and advisor.

HW – To Natsue Sekiguchi, my lifelong supporter and advisor.

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