

# Preface

Brain Computer Interface (BCI) is a challenging application of signal processing and neuroscience. A BCI system uses mental activity, voluntarily produced by the patient, to control a computer or an embedded system via electroencephalogram (EEG) signals which allow communication or interaction with the surrounding environment. Like any communication or control system, a BCI has input (e.g., electrophysiological activity from the user), output (i.e., device commands), components that translate input into output, and a protocol that determines the onset, offset, and timing of operation. The success of a BCI system depends as much on the system it self as on the user's ability to produce distinctive EEG activity. BCI systems can be divided into two groups according to the placement of the electrodes used to detect and measure neurons firing in the brain. These groups are: invasive systems, electrodes are inserted directly into the cortex are used for single cell or multi unit recording, and electrocorticography (EcoG), electrodes are placed on the surface of the cortex (or dura); noninvasive systems, they are placed on the scalp and use electroencephalography (EEG) or magnetoencephalography (MEG) to detect neuron activity.

The book is divided into three parts. Part I of the book from Chaps. 1–4 covers overviews of Brain Computer Interface. Part II of the book from Chaps. 5–9 describes new theoretical developments of BCI systems. Part III of the book from Chaps. 10–14 covers views on real applications of BCI systems.

It is hoped that the book will be a very good compendium for almost all readers—from students of undergraduate to postgraduate levels and also for researchers, professionals, etc.—who wish to enrich their knowledge on BCI systems' principles and applications with a single book in the best manner. As the editors, we hope that the chapters in this book will stimulate further research in BCI systems and utilize them in real-world applications. We hope that this book, covering so many different

aspects, will be of value to all readers. We would like to thank also the reviewers for their diligence in reviewing the chapters. Special thanks go to our publisher, Springer, especially for the tireless work of the series editor of *Intelligent Systems Reference Library*, Dr. Thomas Ditzinger.

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