
Preface

The past decade has seen a fast growing interest to develop an effective communication interface connecting the human brain to a computer, the “brain-computer interface” (BCI). BCI research follows three major goals: (1) it aims to provide a new communication channel for patients with severe neuromuscular disabilities bypassing the normal output pathways, (2) it provides a powerful working tool in computational neuroscience to contribute to a better understanding of the brain, and finally (3)—often overseen—it provides a generic novel independent communication channel for man-machine interaction, a direction that is at only the very beginning of scientific and practical exploration. During a workshop at the annual Neural Information Processing Systems (NIPS) conference, held in Whistler, Canada, in December 2004, a snapshot of the state of the art in BCI research was recorded. A variety of people helped in this, especially all the workshop speakers and attendees who contributed to lively discussions. After the workshop, we decided that it would be worthwhile to invest some time to have an overview about current BCI research printed.

We invited all the speakers as well as other researchers to submit papers, which were integrated into the present collection. Since BCI research has previously not been covered in an entire book, this call has been widely followed. Thus, the present collection gathers contributions and expertise from many important research groups in this field, whom we wholeheartedly thank for all the work they have put into our joint effort. Note, of course, that since this book is the outcome of a workshop, it cannot cover all groups and it may—clearly unintentionally—contain some bias.

However, we are confident that this book covers a broad range of present BCI research: In the first part we are able to present overviews about many important noninvasive (that is, without implanting electrodes) BCI groups in the world. We have been also able to win contributions from a few of the most important invasive BCI groups giving an overview of the current state of the invasive BCI research. These contributions are presented in the second part. The book is completed by three further parts, namely an overview of state-of-the-art techniques from machine learning and signal processing to process brain signals, an overview about existing software packages in BCI research, and some ideas about applications of BCI research for the real world.

It is our hope that this outweighs the shortcomings of the book, most notably the fact that a collection of chapters can never be as homogeneous as a book conceived by a single author. We have tried to compensate for this by writing an introductory chapter (see chapter 1) and prefaces for all five parts of the book. In addition, the contributions were carefully refereed.

**Guido Dornhege, José del R. Millán, Thilo Hinterberger, Dennis J. McFarland, and
Klaus-Robert Müller**

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