

Preface

This book was conceived with the idea to provide an overview of basic methods in *Computational Bioacoustics* and to highlight some important recent developments. Specifically, we illustrate the applicability of a wide range of audio parameterization and pattern recognition methods on tasks aiming at the automated acoustic recognition of species and sound events. Highlighting the technological aspects, we discuss the specifics of various computational bioacoustic tasks that are essential to achieving scalability of biodiversity assessment and monitoring studies. In addition, we provide implementation details and examples on the application of state-of-the-art signal processing and machine learning methods, which facilitate coping with key challenges such as robust operation in real-world conditions. In this regard, along with the traditional audio analysis and sound events recognition methods, we describe some image processing techniques applied on the audio spectrogram seen as an image and current advances in the area of multi-label multi-instance machine learning. Finally, we analyse the technological innovation brought by some recent application-oriented projects, among which ARBIMON, SABIOD, ENTOMATIC, and REMOSIS that made significant contributions to the automation of biodiversity monitoring studies, pest population control in agriculture, and monitoring the spatial distribution of mosquito populations that pose a major threat to human health. These projects are considered the present-day success stories that illustrate well the perspectives opened due to the advances in computational bioacoustics.

Another, and even stronger, stimulus that motivated the emergence of this book was the need for popularizing computational bioacoustic methods and applications among young researchers and engineers, and especially those who already followed an introductory course on speech, audio, or image processing technology. We will be glad if this book would hopefully attract, inspire, or encourage talented researchers to join the growing computational bioacoustic community and pursue a career that will contribute to the efforts to protect and preserve biodiversity. The author is hopeful that the improved awareness of governmental institutions and policymakers about the importance of automated biodiversity monitoring and the opportunities that technological support offers to wildlife protection, environment monitoring, and pest populations automated control applications will stimulate the growth of job openings for technicians, engineers, and data scientists who specialize in the area of computational bioacoustics.

We hope that the interested reader who will go through all book chapters will reap the benefits of an improved understanding of the role, use, and applications

of computational bioacoustics, as well as its importance in the global efforts for slowing down the loss of biodiversity. Broadening our knowledge about tasks, methods, and the inherent limitations of technology would allow appropriate practical use of tools and services, as well as the correct interpretation of result obtained through these. The correct comprehension of the potential for automation will establish the ground for future advances in information retrieval from soundscape recordings, a prerequisite for improved technological support to wildlife monitoring and conservation actions.

This volume is not intended to serve as an academic textbook. However, it could be used as a supplementary reference in undergraduate or graduate courses that embrace topics on bioacoustics, ecoacoustics, or general topics associated with audio and image processing applications. Master and PhD students will learn various facets of audio parameterization and acquaint with some well-conceived applications of contemporary pattern recognition methods. Engineers and developers of applications will advance their understanding of methods behind some less-known technological workarounds and trade-offs in computational bioacoustics.

The manuscript preparation coincided with traumatic period in the author's personal life, and the completion of this book has become a challenge. The author would like to express gratitude and acknowledge the understanding and empathetic support by the book series editor, Dr Amy Neustein, and the publisher (Dr Alex Greene and his team), who made possible the emergence of this book.

Finally, the author would like to express sincere thanks for the interest to this topic and hopes that notwithstanding all the imperfections of the text, the reader will enjoy going through the book. All readers who notice errors or inaccuracies in the presentation of tasks, methods, and applications, and communicate these to the author¹ will receive a postcard of Varna in recognition of their contribution. The energetic critics of this work will also receive a small gift of appreciation from the author. Furthermore, given an explicit consent, their names will appear on the home page of this book² and in section Acknowledgements of its subsequent revised and extended editions.

Todor D. Ganchev

¹ Email address for providing feedback and error reporting to the author: tganchev@ieee.org

² Home page for the *Computational Bioacoustics* book, <http://tu-varna.bg/aspl/CBbook/>