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Cardiovascular Computing—Methodologies and Clinical Applications

Springer

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To my father Vassilios and my mother Polyniki

Spyretta Golemati

To my late father Spilios and my mother Kostoula

Konstantina S. Nikita

Preface

Cardiovascular computing is an interdisciplinary field aiming to deploy the principles and advances in computing and engineering to address current clinical challenges and provide new opportunities in cardiovascular science. This rapidly evolving scientific field has produced important new knowledge and has markedly improved our understanding of normal cardiovascular function as well as of pathophysiology, diagnosis and treatment of disorders like coronary artery disease, carotid atherosclerosis, heart rhythm abnormalities.

The book was envisioned as a comprehensive state-of-the-art description of the variety of advanced methodologies and applications of computing in cardiovascular research and clinical practice. The field of cardiovascular computing has encountered tremendous development in the last decades, spanning a wide range of different sub-areas, including among others sophisticated analysis of signals and images, modelling of complex physiological procedures and informatics approaches. This volume provides a collection of representative works of different disciplines covered by cardiovascular computing, reflecting the large diversity in this field. The intention of this project is to disseminate new insights into cardiovascular computing obtained by innovative methods of measuring, analysing and modelling cardiovascular data. For this purpose, the contributions included herein are written by leading scientists actively involved at the interface between cardiovascular science and computing engineering and technology.

The book is structured into six parts. In part I, the basic principles of cardiovascular anatomy and physiology are outlined, and a description is provided of current and emerging technologies for cardiovascular imaging. Parts II and III present methodologies for analysis of cardiovascular signals and images, respectively. Part IV discusses approaches for mathematical and computational modelling of cardiovascular data. Part V describes informatics methods, including artificial intelligence, data mining and big data analytics. Finally, part VI is dedicated to specific examples of cardiovascular computing in clinical practice, like stroke prediction, management of atrial fibrillation and applications in the intensive care unit.

The book is intended for a broad readership of various levels, from advanced undergraduate and postgraduate students to researchers and clinicians interested and/or involved in the science and practice of cardiovascular medicine and its interaction with computing technology.

We wish to thank the authors of all chapters for their commitment, valuable time and efforts towards providing high-quality contributions. We would also like to express our gratitude to Springer team members for their understanding, patience and support for materialising this project.

We hope that the book will serve as a useful reference to the readers and that it will stimulate intellectual excitement.

Athens, Greece

Spyretta Golemati
Konstantina S. Nikita

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