Lecture Notes in Computational Vision and Biomechanics

Volume 21

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This book is the twenty-first volume to be published under the Book Series "Lecture Notes in Computational Vision and Biomechanics (LNCV&B)".
The research related to the analysis of living structures (Biomechanics) has been a source of recent research in several distinct areas of science, for example, Mathematics, Mechanical Engineering, Physics, Informatics, Medicine and Sport. However, for its successful achievement, numerous research topics should be considered, such as image processing and analysis, geometric and numerical modelling, biomechanics, experimental analysis, mechanobiology and enhanced visualization, and their application to real cases must be developed and more investigation is needed. Additionally, enhanced hardware solutions and less invasive devices are demanded.

On the other hand, Image Analysis (Computational Vision) is used for the extraction of high-level information from static images or dynamic image sequences. Examples of applications involving image analysis can be the study of motion of structures from image sequences, shape reconstruction from images and medical diagnosis. As a multidisciplinary area, Computational Vision considers techniques and methods from other disciplines, such as Artificial Intelligence, Signal Processing, Mathematics, Physics and Informatics. Despite the many research projects in this area, more robust and efficient methods of Computational Imaging are still demanded in many application domains in Medicine, and their validation in real scenarios is matter of urgency.

These two important and predominant branches of Science are increasingly considered to be strongly connected and related. Hence, the main goal of the LNCV&B book series consists of the provision of a comprehensive forum for discussion on the current state of the art in these fields by emphasizing their connection. The book series covers (but is not limited to):

- Applications of Computational Vision and Biomechanics
- Biometrics and Biomedical Pattern Analysis
- Cellular Imaging and Cellular Mechanics
- Clinical Biomechanics
- Computational Bioimaging and Visualization
- Computational Biology in Biomedical Imaging
- Development of Biomechanical Devices
- Device and Technique Development for Biomedical Imaging
- Experimental Biomechanics
- Gait & Posture Mechanics
- Grid and High Performance Computing for Computational Vision and Biomechanics
- Image Processing and Analysis
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- Multi-Modal Image Systems
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- Neuromuscular Biomechanics
- Numerical Methods for Living Tissues
- Numerical Simulation
- Software Development on Computational Vision and Biomechanics
- Sport Biomechanics
- Virtual Reality in Biomechanics
- Vision Systems

In order to match the scope of the LNCV&B book series, each book must include contents relating to or combining both Image Analysis and Biomechanics. Proposals for new books are welcome and should be submitted to the editors of the book series.

The Editors would like to take this opportunity to thank once again to all members of the Advisory Board for their support and help in the scientific managing tasks of this book series, and also to Nathalie Jacobs and Anneke Pot to offer their assistance.

More information about this series at http://www.springer.com/series/8910

João Manuel R.S. Tavares
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Editors

Computational and Experimental Biomedical Sciences: Methods and Applications

ICCEBS 2013–International Conference on Computational and Experimental Biomedical Sciences

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Preface

The main aim of the *International Conference on Computational and Experimental Biomedical Sciences (ICCEBS)* is to solidify knowledge in the fields of bioengineering and biomedical engineering. The use of more robust, affordable and efficient techniques and technologies with application in biomedical sciences is presently a subject of huge interest and demand, and this conference is intended to be a privileged discussion forum to define their key stakeholders. The aim of *ICCEBS* is to bring together researchers from around the world representing several scientific fields related to biomedical sciences, including engineering, medicine, biomechanics, bioengineering, biomaterials, experimental mechanics, computer sciences, computational mathematics, hardware developers and manufactures, electronic and instrumentation and materials science.

This book contains the full papers presented at *ICCEBS 2013–1st International Conference on Computational and Experimental Biomedical Sciences*, which was organized in Azores, in October 2013. *ICCEBS 2013* brought together researchers representing several fields, such as biomaterials, biomechanics, engineering, medicine, mathematics, medical imaging, orthopaedics, rehabilitation and statistic. The included works present and discuss new trends in those fields, using several methods and techniques, including active shape models, constitutive models, isogeometric elements, genetic algorithms, level sets, material models, neural networks, optimization and the finite element method, in order to address more efficiently different and timely applications involving biofluids, computer simulation, computational biomechanics, image-based diagnosis, image processing and analysis, image segmentation, image registration, scaffolds, simulation and surgical planning.

The editors would like to take this opportunity to thank the members of the *ICCEBS 2013* Program Committee, and to all the authors for sharing their works, experiences and knowledge, making possible its dissemination through this book.

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