


Lecture Notes in Computational Vision and Biomechanics

Volume 999

Series Editors

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Research related to the analysis of living structures (Biomechanics) has been carried out extensively in several distinct areas of science, such as, for example, mathematics, mechanical, physics, informatics, medicine and sports. 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 on 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) aims to extract a high level of information from static images or dynamical image sequences. An example of applications involving Image Analysis can be found in the study of the 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, like from Artificial Intelligence, Signal Processing, mathematics, physics and informatics. Despite the work that has been done in this area, more robust and efficient methods of Computational Imaging are still demanded in many application domains, such as in medicine, and their validation in real scenarios needs to be examined urgently.

Recently, these two branches of science have been increasingly seen as being strongly connected and related, but no book series or journal has contemplated this increasingly strong association. Hence, the main goal of this book series in Computational Vision and Biomechanics (LNCV&B) consists in 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 on Computational Vision and Biomechanics
- Image Processing and Analysis
- Image processing and visualization in Biofluids
- Image Understanding
- Material Models
- Mechanobiology
- Medical Image Analysis
- Molecular Mechanics
- Multi-modal Image Systems
- Multiscale Biosensors in Biomedical Imaging
- Multiscale Devices and BioMEMS for Biomedical Imaging
- Musculoskeletal Biomechanics
- Multiscale Analysis in Biomechanics
- Neuromuscular Biomechanics
- Numerical Methods for Living Tissues
- Numerical Simulation
- Software Development on Computational Vision and Biomechanics
- Sport Biomechanics
- Virtual Reality in Biomechanics
- Vision Systems
- Image-based Geometric Modeling and Mesh Generation
- Digital Geometry Algorithms for Computational Vision and Visualization

In order to match the scope of the Book Series, each book has to include contents relating, or combining both Image Analysis and mechanics. Indexed in SCOPUS, Google Scholar and SpringerLink.


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


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Paulo Rui Fernandes
Editors

New Developments on Computational Methods and Imaging in Biomechanics and Biomedical Engineering

 Springer

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Preface

The 15th International Symposium on Computer Methods in Biomechanics and Biomedical Engineering and the 3rd Conference on Imaging and Visualization (CMBBE2018), were run together at Instituto Superior Técnico (IST), Technical University of Lisbon, Portugal, from March 20 to 26, 2018.

We believe that CMBBE2018 had a strong impact on the development of computational biomechanics and biomedical imaging and visualization; particularly, by identifying emerging areas of research and promoting the collaboration and networking between participants. Actually, CMBBE2018 included 176 oral presentations and 37 poster presentations. In addition, 16 renowned researchers delivered very interesting plenary keynotes, addressing current challenges in computational biomechanics and biomedical imaging. This book includes the extended versions of selected works presented in CMBBE2018.

Briefly, the included 10 chapters address important topics in Biomechanics and Biomedical Imaging, including Control Theory, Finite Element Method, Fluid Dynamics, Geometrical Modeling, Image Segmentation, Image Analysis, Monte Carlo Simulation, Multibody Modeling, and Numerical Methods. Different applications are addressed and described throughout the book, comprising Computational Simulation, Flow Analysis, Medical Diagnosis and Rehabilitation, Numerical Analysis, and Stress and Strain Analysis.

Therefore, this book is of high interest for Researchers, Students, End Users, and Manufacturers from several multidisciplinary fields, as the ones related with Bioengineering, Biology, Biomechanics, Computational Mechanics, Computer Graphics, Computer Sciences, Mathematics, Mechanobiology, Medical Imaging, Medicine, Physics, Physiological Cybernetics, and Telemetry.

The editors would like to take this opportunity to thank the authors of the 10 selected contributions for sharing their works, experiences, and knowledge, making possible their dissemination through this book.

Porto, Portugal
Lisbon, Portugal

João Manuel R. S. Tavares
Paulo Rui Fernandes
Co-editors and Co-chairs of CMBBE2018

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He graduated in Mechanical Engineering at the Universidade do Porto, Portugal in 1992. He also earned his M.Sc. degree and Ph.D. degree in Electrical and Computer Engineering from the Universidade do Porto in 1995 and 2001, and attained his Habilitation in Mechanical Engineering in 2015. He is a senior researcher at the Instituto de Ciência e Inovação em Engenharia Mecânica e Engenharia Industrial (INEGI) and Associate Professor with Habilitation at the Department of Mechanical Engineering (DEMec) of the Faculdade de Engenharia da Universidade do Porto (FEUP).

João Tavares is co-editor of more than 45 books, co-author of more than 35 book chapters, 650 articles in international and national journals and conferences, and 3 international and 3 national patents. He has been a committee member of several international and national journals and conferences, is co-founder and co-editor of the book series “Lecture Notes in Computational Vision and Biomechanics” published by Springer, founder and Editor-in-Chief of the journal “Computer Methods in Biomechanics and Biomedical Engineering: Imaging & Visualization” published by Taylor & Francis, and co-founder and co-chair of the international conference series: CompIMAGE, ECCOMAS VipIMAGE, ICCEBS, and BioDental. Additionally, he

has been (co-)supervisor of several M.Sc. and Ph.D. theses and supervisor of several postdoc projects, and has participated in many scientific projects both as researcher and as scientific coordinator.

His main research areas include computational vision, medical imaging, computational mechanics, scientific visualization, human–computer interaction, and new product development (more information can be found at www.fe.up.pt/~tavares)



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He is Associate Professor with “Agregação” (Habilitation) at Mechanical Eng. Department of Instituto Superior Técnico (IST), University of Lisbon, where he received his Ph.D. degree in 1998 and the “Agregação” in 2012. After the Ph.D., he was a postdoctoral fellow at the Musculoskeletal Research Laboratory of Pennsylvania State University from July to December 1998. He was awarded with the IBM scientific prize 1997 (IBM—Portugal) with the work “Simulation of the Bone Remodelling Process”. His main research field is Biomechanics, particularly Bone Tissue Mechanics and Orthopaedic Implants Design. Paulo Fernandes teaches Computational Mechanics and Tissue Biomechanics in the Biomedical Engineering Program where he was the coordinator of the Biomechanics and Biomedical Devices profile from 2013 to 2018. His research work has been an important contribution for the development of Biomechanics in IST leading a research group with a strong impact in the formation of human resources. He has also led several research projects funded by the Portuguese Foundation for Science and Technology. He is author/co-author of numerous publications in international and national journal, book chapters, and communications in international conferences. He maintains international collaborations with research groups from Europe, Brazil, and the USA. He was a member of the council of the European Society of Biomechanics since July 2012–July 2016 and President of the Portuguese Society of Biomechanics from February 2013 to February 2017.