

# Lecture Notes in Computational Vision and Biomechanics

Volume 27

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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):

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João Manuel R.S. Tavares  
R.M. Natal Jorge  
Editors

# VipIMAGE 2017

Proceedings of the VI ECCOMAS  
Thematic Conference on Computational  
Vision and Medical Image Processing  
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 Springer

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# Preface

This book contains invited lectures and full papers presented at VipIMAGE 2017—VI ECCOMAS Thematic Conference on Computational Vision and Medical Image Processing, which will be held in Porto, Portugal, during the period 18–20 October 2017. The event had six invited lectures, and 124 contributed presentations originated from twenty-five countries: Brazil, China, Colombia, Czech Republic, Egypt, France, Hungary, India, Italy, Japan, Lithuania, Netherlands, Nigeria, Pakistan, Peru, Poland, Portugal, Romania, Russian Federation, Spain, Sweden, the Slovak Republic, United Arab Emirates, UK and USA.

Computational methodologies of signal processing and analyses have been commonly used in our society. For instances, full automatic or semi-automatic Computational Vision systems have been increasing used in surveillance tasks, traffic analysis, recognition processes, inspection purposes, human–machine interfaces, 3D vision, deformation analysis and aided medical diagnosis and treatment plans.

One of the notable aspects of the Computational Vision domain is the inter- and multi-disciplinarity. Actually, principles and methodologies of other sciences, such as Informatics, Mathematics, Statistics, Psychology, Mechanics, Medicine and Physics, are regularly comprised into this domain. One of the key motives that contributes for the continually effort done in this field of the human knowledge is the high number of applications that can be easily found in Medicine. For instance, computational algorithms can be applied on medical images for shape reconstruction, motion and deformation analysis, tissue characterization or computer-assisted intervention and therapy.

The main objective of these ECCOMAS Thematic Conferences on Computational Vision and Medical Image Processing, initiated in 2007, is to promote a comprehensive forum for discussion on the recent advances in the related fields in order to identify potential collaboration between researchers of different sciences. Henceforth, VipIMAGE 2017 brought together researchers representing fields related to Biomechanics, Biomedical Engineering, Computational Vision, Computer Graphics, Computer Sciences, Computational Mechanics, Electrical

Engineering, Mathematics, Statistics, Medical Imaging, Medicine, Sports and Rehabilitation.

The expertises covered a broad range of techniques for Signal Processing and Analysis, Image Acquisition, Image Processing and Analysis, Data Registration and Fusion, Image Segmentation, Tracking and Analysis of Motion and Deformation, 3D Vision, Computer Simulation, Physics of Medical Imaging, Machine Learning, Medical Imaging, Computer Aided Diagnosis, Surgery, Therapy and Treatment, Computational Bio- imaging and Visualization, Visual Inspection, Software Development and Applications.

The Conference co-chairs would like to take this opportunity to express gratitude for the support given by the International European Community on Computational Methods in Applied Sciences and the Portuguese Association of Theoretical, Applied and Computational Mechanics, and thank all sponsors, all members of the Scientific Committee, all organizers of thematic sessions, all invited lecturers, all session chairs and all authors for submitting and sharing their knowledge.

João Manuel R.S. Tavares  
Conference Co-chairs  
Renato M. Natal Jorge  
Conference Co-chairs

## Invited Lecturers

During VipIMAGE 2017, invited lectures were presented by six expertises from four countries:

Dinggang Shen	University of North Carolina at Chapel Hill, USA
Gerald Schaefer	Loughborough University, UK
Khan M. Iftekharuddin	Old Dominion University, USA
Leo Joskowicz	The Hebrew University of Jerusalem, Israel
Mário Figueiredo	Universidade de Lisboa, Portugal
Zeyun Yu	University of Wisconsin at Milwaukee, USA

## Thematic Sessions

Under the auspicious of VipIMAGE 2017, 13 thematic sessions were organized:

- Advanced Techniques for Image-based Numerical Simulation in Biomedical Applications

Organizers:

Domenico Borzacchiello	Ecole Centrale de Nantes, France
Luisa Silva	Ecole Centrale de Nantes, France
David Gonzalez	University of Zaragoza, Spain

- Advances in Lung CT Image Processing

Organizers:

Paulo Eduardo Ambrósio	Universidade Estadual de Santa Cruz, Brazil
Marcelo Costa Oliveira	Universidade Federal de Alagoas, Brazil
Susana Marrero Iglesias	Universidade Estadual de Santa Cruz, Brazil

- Application of Image Analysis in Musculoskeletal Radiology

Organizers:

Silvana Dellepiane	Universita' degli Studi di Genova, Italy
Angel Alberich-Bayarri	QUIBIM SL - Quantitative Imaging Biomarkers in Medicine, Spain
Waldir Leite Roque	Universidade Federal da Paraíba, Brazil
Zbislav Tabor	Cracow University of Technology, Poland

- Computational Vision and Image Processing applied to Dental Medicine

Organizers:

André Correia	Catholic University of Portugal, Portugal
J.C. Reis Campos	University of Porto, Portugal
Mário Vaz	University of Porto, Portugal

- Computer Vision in Robotics

Organizers:

António J.R. Neves	Universidade de Aveiro, Portugal
Luís Teixeira	Universidade do Porto, Portugal

- Emotions classification from EEG signals

Organizers:

Paolo Di Giamberardino	Sapienza University of Rome, Italy
Daniela Iacoviello	Sapienza University of Rome, Italy
Giuseppe Placidi	University of L'Aquila, Italy



– Image Analysis and Machine Learning for Skin Ulcers

Organizers:

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Benjamín Castañeda Aphan	Pontificia Universidad Católica del Perú, Perú
July Andrea Galeano Zea	ITM Laboratory of Advanced Materials and Energy, Colombia

– Imaging and Image processing in Ophthalmology

Organizers:

Radim Kolar	Brno University of Technology, Czech Republic
Koen Vermeer	Rotterdam Ophthalmic Institute, The Netherlands
Jolita Bernatavičienė	Vilnius University, Lithuania
Povilas Treigys	Vilnius University, Lithuania

– Imaging and Simulation Techniques for Cardiovascular Diseases

Organizers:

A.J. Narracott	University of Sheffield, UK
J.W. Fenner	University of Sheffield, UK

– Imaging of Flows in Lab-on-Chip Devices: trends and challenges

Organizers:

Susana Catarino	University of Minho, Portugal
Rui Lima	University of Minho, Portugal
Graça Minas	University of Minho, Portugal
Mónica Oliveira	The University of Strathclyde, UK

– Infrared Thermal Imaging in Biomedicine

Organizers:

Ricardo Vardasca	University of Porto, Portugal
Joaquim Gabriel	University of Porto, Portugal

– Meta-learning in Deep Learning: New Trends and Directions

Organizers:

André Carlos Carvalho	Universidade de São Paulo, Brazil
João Paulo Papa	Universidade Estadual de São Paulo, Brazil
Carlos Manuel Soares	Universidade do Porto, Portugal
Claudio Rebelo de Sá	Universiteit Leiden, The Netherlands

– Shape Analysis in Medical Imaging: From Math to Clinics

Organizers:

Paolo Piras

Sapienza Università di Roma, Italy

Paolo Emilio Puddu

Sapienza Università di Roma, Italy

Luciano Teresi

University Roma TRE, Italy

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- Associação Portuguesa de Mecânica Teórica Aplicada e Computacional (APMTAC)

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