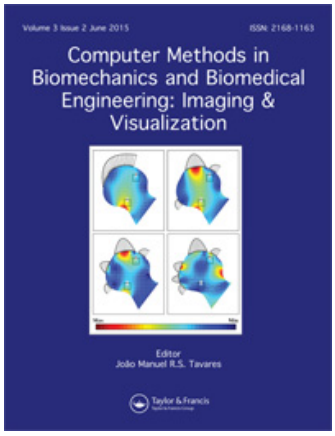

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Computational modeling of objects presented in images: fundamentals, methods and applications

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EDITORIAL

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Images and their analysis play an important role in several fields of human science and applications, and the more science and technology contribute to enhance the capabilities and the possibilities, the more the application fields grow in number and significance. The multi-disciplinary nature of image analysis brings different specific problems, peculiar for each area, which at a first sight can lead to different ways to approach each problem.

Leaving the visual and, in some sense, human-based image analysis and information extraction to the specific problems in which the importance of human experiences and skills are almost the only support to the process, interesting problems can arise when the information must be, or it is wanted to be, extracted from the images in an automatic way. Therefore, different applications, such as the ones that can be found in medicine, including for assisted diagnostic and surgery, material science, surveillance, biometric, robotics, defence, satellite imaging, traffic analysis, architecture and urbanism, history and even in humanities, and different methodologies, such as of optimisation methods, geometry, principal component analysis, stochastic methods, neural networks, fuzzy logic, have been involved. However, in spite of the consequent heterogeneity in the methodological approaches, the relationships between the requirements for each research area are higher than can appear in a first glance.

The cultural background and skills of both researchers and end users from the different fields in which image analysis is of central importance have forced us to look at each problem from a particular point of view. Moreover, methodologies like the ones for image segmentation, 2D and 3D reconstruction, data acquisition, interpolation and registration, scientific data visualisation, remote sensing, modeling and simulation, biometric recognition, medical imaging, motion and deformation analysis, material science, vision in robotics and automation, architecture, just to mention a few, have been developed and used in each different field remaining too often bounded within the field itself.

To contribute in bridging the gap among researchers and end users involved in different applications, in September 2012, the *International Symposium Comp-IMAGE 2012: Computational Modeling of Object Presented in Images: Fundamentals, Methods and Applications* was held in Rome, at the Department of Computer, Control and Management Engineering Antonio Ruberti of Sapienza University of Rome, Italy. The aim was to bring together researchers and end users representing several scientific fields such as Engineering, Medicine, Mathematics, Physics, Statistic and Architecture. The participants presented and shared their knowledge allowing us to define new stakeholders. It was the third edition of the *CompIMAGE* Conferences, after the edition held in Coimbra (Portugal) in 2006 and the edition held in Buffalo (USA) in 2010. In *CompIMAGE 2012*, following the cultural and historical background of the guesting Organizing Committee, a session on artistic, architectural and urban heritages was included to propose an important field of application of vision and image analysis. Four thematic sessions were organised on MRI brain image analysis, material science, architectural heritages and surgical planning.

Some of the papers presented at *CompIMAGE 2012*, selected to represent the research fields addressed in the Conference, are now presented in an extended form and after being reviewed by the Journal editorial board. In particular, Petersen and Stricker from German Research Center for Artificial Intelligence present an approach for image-based rendering of articulated objects to give reliable estimates of the object's shape and shading in new poses. A kinematic 3D model with an extension to billboard rendering was combined with a computationally lightweight axis-aligned morphing technique. The approach faithfully approximates both shape and shading of a hand in an unseen target pose even with large unobservable hand parts in the prototype images used for synthesising. The method does not require any preparation or skin colour segmentation or edge extraction but operates directly.

Avola, Placidi and Petracca from the University of L'Aquila continued a previous work to support the three-dimensional reconstruction, rendering and processing of biomedical images. In particular, they provided final details of the 3D Bio-IPF framework and, at the same time, they completed the description of the Implant plug-in. The system is of interest and could be employed for semi-automatic surgery if integrated with a position indicator system and a numerically positionable drilling machine.

Marinozzi F., Bini, and Zuppante from Sapienza of Rome, Marinozzi A. from Campus Bio-Medico of Rome and Bedini from Istituto Superiore di Sanità of Rome, considered by finite element analysis the altered load

distribution within femoral head in osteoarthritis, implementing a 2D (homogeneous) isotropic and linearly elastic model of the proximal half of the human femur from X-ray images.

Ribeiro, Bate and Goncalves from Polytechnic Institute of Lisbon, O'Neill from New University of Lisbon and Mauricio from Medical Imagin Centre Tomar, were interested in computer tomography automated and semi-automated procedures in the assessment of coronary arterial disease; their study aimed to optimise the protocol acquisition in order to reduce the radiation dose and explain the flow of procedures to quantify CAD.

Varga, Balazs and Nagy from University of Szeged studied discrete tomography (DT) to propose a new method for multivalued DT, to perform the reconstruction of the inner structure of objects consisting of only few different homogeneous materials as an energy minimisation task. The algorithm was validated by comparing its performance with other cutting-edge reconstruction algorithms from the literature.

Boschetto, Pochini, Bottini, Giovagnoli and Giansanti from Rome, were interested in Digital Pathology, an image-based information environment enabled by computer technology that allows for the management of information generated from an e-slide; two main fields are involved, digital cytology and digital histology. In the proposed study the Digital-Cytology was considered; the problem of the increasing of the memory occupancy was faced and studied using the Mathematica software.

The papers selected represent an example of the main problems in image analysis, from methodological and applicative point of view. The guest editors would like to thank the authors for sharing their work with the Journal readers and to the Journal for the possibility to organise this special issue.

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