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EDITORIAL

Special Issue on Computational Methods for Biomedical Image Processing and Analysis

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This special issue of the journal includes eleven articles related with biomedical image processing: two concern brain segmentation from MRI images; two of them use medical imaging to build patient customized 3D finite element models; one applies segmentation algorithms on CT images of the spine; one addresses the simulation of middle cerebral artery Doppler signals; two are related with the study of red blood cells from images; one uses classification procedures on cell tissue images; one addresses Monte Carlo simulations of PET imaging to estimate the activity correction according to patient specific weight; and a last one uses electromyography (EMG) and wavelet functions to study diabetic neuropathy in the lower limb muscles during gait. The main objective of this special issue on "*Computational Methods for Biomedical Image Processing and Analysis*" is to disseminate the recent advances in the related fields trying to identify widespread areas of potential collaboration among researchers of different sciences. The issue comprises 11 contributions from 9 countries that were selected from 15 works previously presented at "*III ECCOMAS Thematic Conference on Computational Vision and Medical Image Processing (VipIMAGE 2011)*", that was held in Algarve, Portugal, in October 12-14, 2011, and particularly extended for this special issue. The articles included address different topics and applications related to Biomedical Image Processing and Analysis, including medical imaging, image segmentation, modeling and simulation, biomedical signal and image processing and analysis, biomechanics, 3D reconstruction, motion tracking and analysis, optimization, software developing, assisted diagnosis and virtual reality.

Computational methods of signal processing and analysis, particularly regarding 2D, 3D and 4D images, have been commonly used in different applications of the human society. For instances, full automated or semi-automated systems based on Image Processing and Analysis algorithms have been increasing used in surveillance, recognition, inspection, human-machine interfaces, 3D vision and motion and deformation analysis. One of the main characteristics of Image Processing and Analysis domain is its inter-multidisciplinary. In fact, methodologies of several sciences, including Informatics, Mathematics, Statistics, Psychology, Mechanics and Physics, can be usually found in this domain. Besides this inter-multidisciplinary, one of the main reasons that contributes for the continually effort done in this domain of the human knowledge is the number of applications that can be easily found in medicine. For example, the use on medical images of statistical, geometrical or physical-based procedures in order to model the imaged structures and achieve different goals, such as image segmentation, image registration, shape reconstruction, simulation, motion and deformation analysis, virtual reality, computer-assisted therapy or tissue characterization.

In this special issue on "*Computational Methods for Biomedical Image Processing and Analysis*" two articles present procedures to segment brain images from MRI: E Binaghi and V Padoia [1] present an automatic MRI 2D brain segmentation procedure based on graph searching

techniques and J-B Fiot *et al.* [2] describe an efficient brain lesion segmentation algorithm using multi-modality tissue-based feature selection and support vector machines. Based on the finite element method, one biomechanical analysis is performed by W Wolanski *et al.* [3] to study the craniosynostosis (a skull malformation) correction and another one by B Gzik-Zroska *et al.* [4] to assist the treatment of chest deformities. M. Schwier *et al.* [5] show an approach that applies object-based image analysis to detect the spine in CT images. Simulation of middle cerebral artery Doppler signals is carried out by IB Gonçalves *et al.* [6] in order to detect the presence of emboli in blood circulation. D Pinho et al. [7] propose an automatic method to segment and track red blood cells flowing through microchannels. To simulate meso-scopic blood flow a mechanical model of a red blood cell is presented by M Nakamura *et al.* [8]. JE Gil *et al.* [9] propose an expert system to do an accurate classification of cell tissue on microscopic images related with studies of bone tissue regeneration from stem cells. In order to estimate the correct radiotracer dose amount that should be used in a specific patient during a positron emission tomography (PET) examination, Monte Carlo simulations of PET imaging were carried out by J Boldys *et al.* [10]. Finally, HA Weiderpass *et al.* [11] attempt to detect EMG alterations related to diabetic neuropathy in the lower limb muscles during gait using wavelets and principal components analysis.

The guest editors would like to express their deep gratitude to the Editor-in-Chiefs and Editorial Board of the International Journal for Numerical Methods in Biomedical Engineering for this opportunity, to all authors for sharing their work and to the manuscript reviewers that had an important role in the selection and improvements of the contributions that are enclosed in this special issue.

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