Editorial

Intelligent Signal and Image Processing in eHealth

Highly technological intelligent solutions based on the appropriate and careful interpretation of medical data, acquired by diagnostic investigations are more and more assuming a key importance in the improvement of health care quality and management.

The considerable advances in diagnostic technologies and enhancement of the different modalities have made possible to obtain high-resolution images and signals which are able to provide highly precise information regarding body structure and function, which allow clinicians making more accurate and efficient diagnoses, often in a non-invasive way. As a result, in the last decades, the development of computerised methods for diagnostic data processing and management has attracted a lot of interest and effort within medical imaging and diagnostic radiology, becoming in some cases a practical clinical approach. The basic concept of these methods is to provide a *second opinion* or a *second reader* that can aid clinicians in improving the accuracy and consistency of the diagnostic, prognostic and follow-up processes. Actually, the clinical interpretation of diagnostic data and their findings largely depends on the reader's subjective point of view, knowledge and experience. The presence of noise or the vast amount of data, generated by some devices, can make the detection of potential diseases a burdensome task and may cause oversight errors. Hence, computer-aided methods, able to make this interpretation reproducible and consistent, are fundamental for reducing subjectivity while increasing accuracy.

Moreover, the amount and complexity of data and information to be analyzed and managed strongly demand for the development of computerised decision aiding systems able to cope with the increasing bulk of clinical data by providing an integrated approach to analysis, foster adherence to guidelines, prevent omissions and disseminate up-to-date specialist knowledge.

In this respect, the aim of this Special Issue is to gather new research and application trends in eHealth including intelligent signal and image processing, advanced systems for medical ontologies, medical knowledge discovery, representation and management, efficient clinical decision support systems, multilevel modeling of pathologies, therapy simulation and virtualization of the human physiology; all methods that are becoming an essential component in supporting clinicians' decision making during their clinical routine workflow.

The issues related to the development of specialized platforms and tools to speed up the process of biomedical data analysis are faced by Skounakis *et al.* in the first paper. The authors present *Doctor Eye*, a novel, open access interactive platform which is devoted to 3D medical image analysis, simulation and visualization. Currently focused on oncological application, the platform allows clinicians managing a large number of 3D tomographic datasets by providing them methods for efficiently annotating multiple regions of interest, and quickly and accurately delineating tumors by manual and semi-automatic segmentation techniques, combined with integrated correction tool.

The potential of acoustic emission is investigated by Shark *et al*. for osteoarthritis diagnosis. There is a fundamental weakness that characterized all common imaging techniques usually employed in aiding such a diagnosis, and it comes from the assessment of a dynamic anatomical structure, such as knee joints, in a static mode. A pilot study has been carried out by the authors to assess the effectiveness of acoustic emission in osteoarthritis diagnosis. A four-phase model of the *sit-stand-sit* movement and a two-feature descriptor of acoustic emission signals have been used to discover the differences in acoustic emission between healthy and osteoarthritis knee joints in the same age group. To enable the rapid visualization of the acoustic feature profile of a knee an image based visual display has been created based on a combination of multiple 2D colour histograms.

The localization of epicardial fat has recently become an urgent problem in cardiology for it has been proved its correlation with cardiovascular diseases, cardiovascular risk factors, metabolic syndrome and its possible role in secreting hormones, cytokines and chemokine that cause atherogenesis. In their paper, Coppini *et al.* present a method for the analysis of epicardial fat in single-frame 3D images, obtained by the standard acquisition protocol used for coronary calcium scoring. A two step segmentation algorithm, based on a course-to-fine approach, is used for identifying the volume of interest, while significant parameters are computed for the evaluation of epicardial fat volume and regional distribution. The method has been developed

1874-4311/10 2010 Bentham Open

paying much attention to the minimization of user intervention, thus fostering the reproducibility and quantitatively effectiveness of the analysis.

In the last paper, Candelieri and Conforti discuss a hyper-solution framework for the development of decisional models based on Support Vector Machines (SVM). The framework has been specifically defined and applied to the prediction of acute events (i.e., destabilization or decompensation events) in chronic heart failure patients. Actually, this is a hot issue in the management of chronic patients and currently there are no sharp and objective prediction criteria. Computational reasoning methods appear, then, as a viable solution and, in particular, SVM which are powerful learning paradigms able to provide accurate and reliable decisional functions. The framework presented by the authors is devoted to solve the crucial issue in SVM learning task of parameters tuning (i.e., regularization, kernel type and its internal parameters). Through meta-heuristics, based on Tabu search and Genetic algorithms, the best hyper-classifier for the problem at hand is identified.

Ovidio Salvetti
(***Guest Editor***)
Italian National Research Council (CNR)
Institute of Information Science and Technologies
"Alessandro Faedo" (ISTI)
Italy
E-mail: Ovidio.Salvetti@isti.cnr.it

Sara Colantonio
(***Co-Guest Editor***)
Italian National Research Council (CNR)
Institute of Information Science and Technologies
"Alessandro Faedo" (ISTI)
Italy
E-mail: sara.colantonio@isti.cnr.it