Abstract

On Medical Image Processing, Analysis, Retrieval and Security Management

Medical imaging is undoubtedly one of the most impacting technologies in modern society. In the last few decades, various domains of medical imaging paradigm have advanced remarkably. Despite all these advancements, there still exist several inherent problems that need to be solved. Finding effective solutions to these problems require significant advancements in various fields of medical image processing, analysis and management paradigm. The main objective of this thesis is to study and improve certain aspects of the medical image computing domain. Emphasis is given on developing various pre/post-processing enhancement schemes for diverse modalities of medical images. Specifically, the high computational cost of popular non-local means filtering scheme for magnetic resonance image is reduced without compromising the denoising performance. The advantages of non-local means and pulse coupled neural networks are combined to achieve this goal. To effectively integrate complementary information from multimodal medical images, medical image fusion schemes are proposed based on multiscale geometric analysis of non-subsampled contourlet transform and pulse coupled neural network. Importance has also been given to effective management and distribution issues of medical images. In this regard, novel classification and retrieval systems are proposed for diverse modalities of medical images based on various multiscale geometric analysis tools. Attempts have been made to represent the content of medical images through compact and robust feature vectors. This results in classification and retrieval systems which work efficiently even in the presence of common medical imaging artifacts. Various critical and ethical issues regarding medical images and related information like security, authenticity, integrity, confidentiality and non-repudiation are handled by novel medical image watermarking techniques. The proposed schemes exhibit high payload and imperceptibility characteristics. Extensive experiments and comparisons with state-of-the-art schemes are carried out to qualitatively as well as quantitatively evaluate the performance effectiveness of the proposed solutions. The above mentioned novel developments are suitable for inclusion as services in a comprehensive integrated medical imaging system.