Computer-aided detection and diagnosis in medical imaging
Nilanjan Dey

Abstract

Advancement in medical imaging modalities results in huge varieties of images engaged in the different management phases, namely prognosis, diagnosis, and treatment. In clinical practice, imaging has reserved a vital role to assist physicians and medical expert in decision-making. However, the counterpart that faces the physician is the complexity to deal with a large amount of data and image contents. Mainly, the interpretation is based on the physician's observations, which is tedious, subject to error, and highly depends on the skills and experience of the clinicians. Accordingly, an emerging demand for automated tools become essential for detecting, quantifying and classifying the disease for accurate diagnosis.

Computer-aided Diagnosis (CADx) is an emergent research area that aims to meet the physicians' demands, to speed up the diagnostic process, to reduce diagnostic errors, and to improve the quantitative evaluation. It is based mainly on medical images that provide direct visualization of the bodies and information ranging from functional activities, anatomical information, to the cellular and molecular expressions. Recently, varieties of Computer-aided Detection (CADe) and diagnosis procedures have been established to assist the automated interpretation of the medical images to attain an accurate and reliable diagnosis. Several CADe and CADx approaches can be categorized according to their uses into i) type I for qualitative analysis and visual detection of the objects under concern in the medical images by enhancing the salient features of the objects or suppressing the background noises, ii) type II for assisting objects' extraction for further quantitative analyses for boundary delineation, tree-structure reconstruction, and fiber tracking, iii) type III for automatically detect and classify the objects using signal processing, medical image analysis and technologies, iv) type VI for estimating the functional and anatomical tissue properties based on mathematical modeling, where such properties are not obviously clear in the medical images, for example, physiology, heat transfer, biomechanics, and so forth.

This talk provides a state-of-the-art sight in medical imaging applied to CAD. It highlights the different imaging modalities, such as magnetic resonance imaging (MRI), Computed Tomography (CT), Positron Emission Tomography (PET), and ultrasound. The talk emphasizes on the CAD ability to improve the diagnostic accuracy and different future directions as an opening that gathers the clinicians and engineers for accurate diagnosis.