Introduction to Statistical Analysis of Medical Images

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Abstract

(1) Due to the inherent ill-posedness of statistical inverse problems, the reconstructed images of positron emission tomography (PET) without regularization will have noise and edge artifacts. This is the limit of PET, which can not be resolved from the improvement of instrumental designs. In order to have better reconstructed images, it is necessary to borrow the strength from the related information from expertise or other tomography systems, such as X-ray CT scan, MRI, and so forth. The correlated boundary information may offer the useful information in reducing the noise and edge artifacts. However, the boundary information may be incomplete or incorrect since the anatomy boundaries are different from the functional ones. Thus, cross-reference is important to make use the boundary information wisely. In this talk, we will present the cross-reference reconstruction methods for the weighted least square and maximum likelihood estimates. Computational improvements by different algorithms and computer clusters will be also addressed. Empirical studies are performed at the PET system of Veteran General Hospital-Taipei.

(2) Image segmentation is a fundamental and important step for image analysis. Tremendous efforts have been made to develop robust and efficient segmentation techniques in literature. However, segmentation for texture images remains as a challenging and unresolved problem due to its textural feature. While classical approaches may fail to give successful segmentation for texture images, human vision demonstrates its incredible ability in localizing the boundaries among various textures. Encouraged by the human visual performance, a new early vision model has been proposed in one of our previous works attempting to mimic the human visual perception. This talk will present new approaches for texture image segmentation and their applications in ultrasound and MR images that are collected in hospitals.