Segmentation of 3D microPET images of the rat brain via the HGMM with KDE

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Abstract

Segmentation of positron emission tomography (PET) is typically achieved using the K-Means method or other approaches. In preclinical and clinical applications, the K-Means method needs a prior estimation of parameters such as the number of clusters and appropriate initialized values. This work segments microPET images using a novel hybrid method combining the Gaussian mixture model (HGMM) with kernel density estimation (KDE). Segmentation is crucial to registration of disordered 2-deoxy-2-fluoro-D-glucose (FDG) accumulation locations with functional diagnosis and to estimate standardized uptake values (SUVs) of region of interests (ROIs) in PET images. Therefore, simulation studies are conducted to apply spherical targets to evaluate segmentation accuracy based on Tanimoto's definition of similarity. The proposed method generates a higher degree of similarity than the K-Means method. The PET images of a rat brain are used to compare the segmented shape and area of the cerebral cortex by the K-Means method and the proposed method by volume rendering. The proposed method provides clearer and more detailed structures of an FDG accumulation location in the cerebral cortex than those by the K-Means method.

Keywords: PET, FDG, cerebral cortex, K-means, hybrid Gaussian mixture model, kernel density estimation