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Abstract: The standard fuzzy C-means (FCM) algorithm does not fully utilize the spatial information for image segmentation and is sensitive to noise especially in the presence of intensity inhomogeneity in magnetic resonance imaging (MRI) images. The underlying reason is that a single fuzzy membership function in FCM algorithm cannot properly represent pattern associations to all clusters. In this paper, we present a spatial fuzzy C-means (SpFCM) algorithm for the segmentation of MRI images. The algorithm utilizes spatial information from the neighbourhood of each pixel under consideration and is realized by defining a probability function. A new membership function is introduced using this spatial information to generate local membership values for each pixel. Finally, new clustering centers and weighted joint membership functions are presented based on the local and global membership functions. The resulting SpFCM algorithm solves the problem of sensitivity to noise and intensity inhomogeneity in MRI data and thereby improves the segmentation results. The experimental results on several simulated and real-patient MRI brain images show that the SpFCM algorithm has superior performance on image segmentation when compared to some FCM-based algorithms.  
keywords: {biomedical MRI;fuzzy set theory;image segmentation;medical image processing;pattern clustering;FCM algorithm;MRI image segmentation;SpFCM;clustering centers;fuzzy membership function;global membership functions;intensity inhomogeneity;local membership functions;local membership values;magnetic resonance imaging images;pattern associations;probability function;real-patient MRI brain images;spatial fuzzy c-means algorithm;weighted joint membership functions;Brain;Clustering algorithms;Image segmentation;Linear programming;Magnetic resonance imaging;Noise;Nonhomogeneous media;MRI brain image;fuzzy c-means;image segmentation;spatial FCM},  
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