A cooperative framework for automated segmentation of tumors in brain MRI images

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Abstract
Brain tumor segmentation from 2D Magnetic Resonance Images (MRI) is an important task for several applications in the field of medical analysis. Commonly, this task is performed manually by medical professionals, but it is not always obvious due to similarities between tumors and normal tissue and variations in tumor appearance. Therefore, the automation of medical image segmentation remains a real challenge that has attracted the attention of several researchers in recent years. Instead of choosing between region and contour approaches, in this article, we propose a region-edge cooperative method for brain tumor segmentation from MRI images. The region approach used is support vector machines (SVMs), one of the popular and highly motivated classification methods, the method distinguishes between normal and abnormal pixels based on some features: intensity and texture. To control and guide the segmentation region, we take advantage of the Ron Kimmel geodesic Active Contour Model (ACM) which produces a good delimitation of the boundaries of the object. The two methods have been cooperated sequentially in order to obtain a flexible and effective system for brain tumor segmentation. Experimental studies are performed on synthetic and real 2D MRI images of various modalities from the radiology unit of the university hospital center in Bab El Oued Algeria. The used MRI images represent various tumor shapes, locations, sizes, and intensities. The proposed cooperative framework outperformed SVM-based segmentation and ACM-based segmentation when executed independently.

List of Abbreviations
MRI   Magnetic Resonance Image
WM   White Matter
GM   Gray Matter
CSF   CerebroSpinal Fluid
SVM   Support Vector Machine
ACM   Active Contour Model

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