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Medical image segmentation using rough set and local polynomial regression

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Abstract Rough-set based multimodal histogram thresholding technique is effective for medical image segmentation. However, it is difficult to obtain the significant peaks and valleys of the roughness measure. Moreover, it is sensitive to the noise for medical image. In this paper, we proposed a new medical image segmentation method using rough set theory and local polynomial regression model to address those disadvantages. Firstly, compute histogram of image intensity information and histon of image intensity and spatial information. Secondly, use the local polynomial regression model to smooth the histogram and histon. The smoothed histogram correlates with lower approximation and the smoothed histon correlates with upper approximation. Lastly, rough measure is calculated with the lower and upper approximations. And then, multimodal thresholding method is applied to medical image segmentation. The local polynomial regression model can obtain a smooth rough measure and has two advantages: first, it is easy to find the real peaks and valleys of the smoothed roughness measure to segment medical image; second, the local polynomial regression reduces the effect of noise and can find the thresholds correctly. The proposed approach is compared with the histogram based approach, histon based approach, and rough set with the histogram and histon based approach. Experimental results demonstrate that our approach can find the real peaks and valleys more easily and yields better segmentation results than those of other three methods.

Keywords Medical image segmentation · Rough set · Local polynomial regression · Thresholding segmentation

1 Introduction

Medical image segmentation is a critical step towards the content analysis and image understanding, such as quantification of tissue volumes, study of anatomical structure and computer-integrated surgery [5]. Due to the presence of noise, intrinsic tissue variation, partial volume effects, unclear tissue boundaries and intensity non-uniformity, medical image segmentation remains challenging.

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