M.Phil. in Computer Science

A Model for Semi- automatic Image Segmentation of Brain Tumours

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Abstract

It is difficult to segment the brain tumours automatically as they have a wide range of appearance and effects on surrounding structures. In this thesis a semi- automatic level-set based deformable model is proposed. Edge-based geometric deformable models depend on the edge information alone, and are not concerned of regional information. Therefore, the results produced may not be accurate enough because of noise and weak edges. As reported by many authors, the methods incorporating regional information are less susceptible to noise and thus can produce more meaningful results, because the region information has an overall effect, i.e., it is global. Thus, we have used a deformable model with the region information in addition to edge information. In our new deformable model, the gradient information as well as the regional statistical information are used to define the speed function that controls the deforming model. The deforming contour will be refined using the velocity forces, which are estimated according to the identified tumour voxels' statistical measures, and the healthy tissues' information. This will be repeated until the deforming model optimally covers the tumour area. An advantage of this method of segmentation is that it would segment the objects even when the edges are weak and/or are broken. Moreover, the deforming contours expand or shrink as necessary so as not to pass the weak edges. Our method has a number of distinguishing characteristics than the methods reported have. Our method uses the information gathered from the currently identified tumour area as well as from the healthy area to determine the velocity forces. This will be performed repeatedly until the contour optimally covers the tumour area. Experiments are carried out on real datasets from various brain tumours images. The results are promising as confirmed by the specialists in the field of cancer treatment.