Automatic liver segmentation on computed tomography using random walkers for treatment planning

ABSTRACT

Segmentation of the liver from Computed Tomography (CT) volumes plays an important role during the choice of treatment strategies for liver diseases. Despite lots of attention, liver segmentation remains a challenging task due to the lack of visible edges on most boundaries of the liver coupled with high variability of both intensity patterns and anatomical appearances with all these difficulties becoming more prominent in pathological livers. To achieve a more accurate segmentation, a random walker based framework is proposed that can segment contrast-enhanced livers CT images with great accuracy and speed. Based on the location of the right lung lobe, the liver dome is automatically detected thus eliminating the needfor manual initialization. The computational requirements are further minimized utilizing rib-caged area segmentation, the liver is then extracted by utilizing random walker method. The proposed method was able to achieve one of the highest accuracies reported in the literature against a mixed healthy and pathological liver dataset compared to other segmentation methods with an overlap error of 4.47% and dice similarity coefficient of 0.94 while it showed exceptional accuracy on segmenting the pathological livers with an overlap error of 5.95% and dice similarity coefficient of 0.91.