

Morphological Segmentation of the Spleen From Abdominal CT Images

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Abstract— Organ segmentation is an important step in various medical image applications. Accurate spleen segmentation in abdominal CT images is one of the most important steps for computer aided spleen pathology diagnosis. In this paper, we have proposed a new semi-automatic algorithm for spleen area extraction in abdominal CT images. The algorithm contains several stages. A spleen segmentation method is based on watershed approach. The first, we seek to determine the region of interest by applying the morphological filters such as the geodesic reconstruction to extract the spleen. Secondly, a pre-processing method is employed. In this step, we propose a method for improving the image gradient by applying the spatial filters followed by the morphological filters. Thereafter we proceed to the spleen segmentation by the watershed transform controlled by markers. The new segmentation technique has been evaluated on different CT images, by comparing the semi-automatically detected spleen contour to the spleen boundaries manually traced by an expert. The experimental results are described in the last part in this work. The automated method provides a sensitivity of 95% with specificity of 99% and performs better than other related methods.

Index Terms— CT images, spleen segmentation, anisotropic diffusion filter, morphological filters, the watershed

I. INTRODUCTION

images every day. With increasing emphasis on medical image segmentation, many techniques have been proposed for this purpose.

Paola Campadelli et al 2008 used fast marching Technique' for spleen segmentation [1]. Alireza Behrad, Hassan Masoumi 2010 propose a new automatic algorithm for spleen segmentation via MRI image [2]. Either of them has advantages and disadvantages in terms of applicability, suitability, performance, and computational cost. In this work, we are interested to the watershed approach for the spleen segmentation. The Watershed segmentation technique has been widely used in medical image segmentation.

Advantages of the watershed transform include the fact that it is a fast, simple and intuitive method. More significantly, it is able to produce a complete division of the image in separated regions even if the contrast is poor [3]. The objective of our work is the spleen segmentation. To address above problems, we present a semi-automatic spleen segmentation algorithm in abdominal CT images using the mathematical morphology in particular the watershed approach. Despite its advantages, the watershed segmentation technique has some drawback which includes over-segmentation. A common method is the use of region markers. In this paper, morphological reconstruction is applied to remove salient parts which hinder proper segmentation. In addition, we proposed an algorithm used for improving the image gradient in order to solve over-segmentation problem. In these tasks, we employed the anisotropic diffusion filter used to smooth the original images. After that, we used the morphological filter for improving the image gradient