

A new automatic border detection method for lumen and media-adventitia boundaries in IVUS images

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1. Introduction

Intravascular Ultrasound (IVUS) is a catheter-based medical imaging technique. IVUS not only provides a quantitative assessment of the vessels' wall but also introduces information about the nature of atherosclerotic lesions as well as the plaque shape and size. Several algorithms for lumen and media-Adventitia contours detection have been reported in the past decade. Recent approaches are mostly based on the active contours together with minimizing an energy or cost function which guides a snake towards the vessel borders. The active contours used in the previous approaches are mostly based on a kind of parametric deformable model.

The non-parametric models (also referred to as geometric deformable models) are used for boundary detection. These models are based on the curve evolution theory and the level set method.

2 Method

In this work, we have focused on the development and validation of an automated method based on non-parametric deformable models for accurate IVUS image segmentation. The non-parametric models (also referred to as geometric deformable models) are used for boundary detection. These models are based on the curve evolution theory and the level set method. It provides an elegant solution to address the above mentioned primary limitation of the parametric deformable models.

In this work, we have focused on the development and validation of an automated method based on non-parametric deformable models for accurate IVUS image segmentation.

While IVUS images are noisy and the actual boundaries of regions of interest are difficult to be identified in many cases, it is essential to perform a denoising method before any edge detection algorithm.

3 Results

The proposed method is evaluated using 50 IVUS frames from 10 different patients. The level set based method was applied to each frame to detect intima layer by defining a circle of radius 1.5 times larger than radius of the catheter located at the centre of the image and can be located easily due to its clearly different contrast with the surrounding region.

4 Conclusions

The proposed algorithm detects the Intima and Medial-adventitial borders. The inner and outer arterial wall boundaries generated by our segmentation algorithm are close to those manually identified by an IVUS expert.