

Automatic Detection and Measurement of the IMT in Longitudinal Sections of Ultrasound Images of the CCA

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Purpose

This paper details the development of a fully automatic Computer Aided Detection (CAD) tool that is applied to the segmentation and measurement of the Intima Media Thickness (IMT) in 2D ultrasound images of the Common Carotid Artery (CCA). The IMT is an early indicator of arterial degeneration and its accurate identification is a reliable measure used in the evaluation and tracking the progression of atherosclerotic vascular diseases.

Methods and Materials

The proposed segmentation technique implements a spatially continuous vascular model using statistical solutions for the identification of the two IMT interfaces without any user intervention.

The proposed IMT segmentation algorithm was tested on 33 images acquired by clinicians from RCSI Beaumont Hospital, Dublin, from a cohort of women with and without a history of pregnancy induced hypertension using a Philips IU22 ultrasound scanner.

Results

To evaluate the accuracy of the proposed tool, each image used in this study was manually segmented by clinical experts and performance metrics such as the point-to-curve errors between the segmentations returned by the proposed method and the ground-truth data were calculated. The results are as follows: the average point-to-curve error for the lumen-intima interface is 0.075 mm, the standard deviation is 0.056 and the root-mean-square is 0.095. For the media-adventitia interface the average error is 0.075 mm, the standard deviation is 0.058, while the root-mean-square is 0.097.

Conclusions

The experimental results indicate that the developed CAD technique is robust in accurately estimating the IMT even in images with low resolution, poor contrast and high levels of noise.