

Detection of the carotid artery lumen and bifurcation contours in ultrasound B-mode images

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Abstract

A new algorithm is proposed for the correct identification of the lumen and bifurcation contours of the carotid artery in ultrasound B-mode images. The algorithm uses hypoechogenic characteristics to guide the lumen identification and echogenic characteristics to detect the artery bifurcation. The input image is preprocessed for speckle removal by an anisotropic diffusion filter and morphologic operators for image enhancement. Two initial contours are then automatically defined in the preprocessed image, one for the lumen identification and a second one to segment the bifurcation boundaries, which are used to initialize two Chan-vedese level set models [1], [2], [3].

A set of B-mode images of the common carotid artery (CCA) was acquired using a GE Healthcare Vivid-e ultrasound scanner. All the images under evaluation included a part of the CCA and the bifurcation that separates the CCA into the internal carotid artery and external carotid artery. In order to achieve the highest contrast and lowest speckle noise level, the parameters of the scanner were defined differently for each image.

We successfully apply our computational method based on cervical ultrasonography in the detection of the carotid artery lumen and bifurcation contours in all test ultrasound B-mode images. The main advantage of our method relies on the automatic identification of the carotid lumen, overcoming the limitations of the traditional methods. The 3D models of the carotid artery that can be built based on the contours detected by our method will be extremely important for better diagnosis, treatment plans and addressing practical clinical problems in carotid vascular diseases. This task has been currently addressed.

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