Segmentation of atherosclerotic plaques in MR carotid artery images

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Abstract

The composition of atherosclerotic plaques in the carotid artery plays an important key to determine their evolution and, consequently, the risk of reduction/obstruction of the blood flow through the artery. Computational algorithms have been proposed in many studies to segment, i.e. to identify [1], and assess atherosclerotic plaques and their main components in images [2]. The use of such algorithms allows, for example, the evaluation more efficiently of the risk to cerebral events.

The aim of this work was the development of an algorithm to segment atherosclerotic plaques and the related main components in MR images of the carotid artery, which has two main steps: 1) segmentation of the lumen and arterial walls and 2) further segmentation of the atherosclerotic plaques. The first step provides the region containing the atherosclerotic plaques, i.e. the region between the lumen and arterial wall boundaries. In this step, the K-means algorithm is used to obtain the regions comprised by the pixels of low intensity and related to the lumen and the background of the image under analysis. Since the lumen region is approximately circular, indexes of circularity and irregularity are used to find the desired region among the various region candidates. Then, a deformable level-set based model is used to refine the lumen boundary. Once the lumen is segmented, the final segmentation of the artery wall boundary is accomplished using also a deformable model. In the second step, the segmentation of the atherosclerotic plaques is performed by using a fuzzy C-means algorithm. Again, a deformable model is used to refine the boundaries of the segmented plaques.

Besides the description of the developed algorithm, experimental results will be presented and discussed.

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