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Segmentation of retinal vessels by means of directional response vector similarity and region growing

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Abstract. This paper presents a novel retinal vessel segmentation method. Opposed to the general approach in similar directional methods, where only the maximal or summed responses of a pixel are used, here, the directional responses of a pixel are considered as a vector. The segmentation method is a unique region growing procedure which combines a hysteresis thresholding scheme with the response vector similarity of adjacent pixels. A vessel score map is constructed as the combination of the statistical measures of the response vectors and its local maxima to provide the seeds for the region growing procedure. A nearest neighbor classifier based on a rotation invariant response vector similarity measure is used to filter the seed points. Many techniques in the literature that capture the Gaussian-like cross-section of vessels suffer from the drawback of giving false high responses to the steep intensity transitions at the boundary of the optic disc and bright lesions. To overcome this issue, we also propose a symmetry constrained multiscale matched filtering technique. The proposed vessel segmentation method has been tested on three publicly available image sets, where its performance proved to be competitive with the state-of-the-art and comparable to the accuracy of a human observer, as well.

Keywords: Retinal image analysis, vessel segmentation, directional filters, multiscale matched filtering, directional response similarity.

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