

AbstractID: 4812 Title: A computerized automated segmentation methodology for the recognition of vessels from in vivo acquired DSA images

Purpose: In vivo dynamic visualization, recognition and quantification of microvascular networks represent a methodological requirement of both therapeutic angiogenesis and tumor anti-angiogenesis basic research and clinical studies. The purpose of our study was to develop an automated computerized tool for the segmentation of in vivo acquired DSA images.

Method and Materials: We applied the scale space structural tensor in order to delineate blood vessels. The concept of structural tensor has been extensively investigated and may allow for analysis of local structures, as well as their strength and orientation in local neighborhood pixels. We optimised the image processing software on the basis of the structural tensor concept, and tested the software on a series of DSA images of collateral vessels in the established in-vivo model of chronic rabbit hindlimb ischemia. Firstly, the image is smoothed by a sigma standard deviation 2D Gaussian. Sigma is a free parameter, which controls the scale of the extracted vessels. Finally, the accuracy of vessel recognition was evaluated by direct comparison with the analysis of an expert vascular radiologist, who was considered a priori as the "gold standard".

Results: The result was a fully automated tool developed in Matlab that can be used to process images as a batch process without any user intervention. Microvessels' recognition sensitivity depended on the value of the sigma parameter. The segmentation performance of the software was tested in the recognition of collateral vessels in digital DSA images of ischemic rabbit hindlimbs. The proposed software was highly successful in delineating vessels of all sizes with an accuracy score varying between 77.24% and 82.12%.

Conclusion: The proposed method is automatic, robust and escapes human subjectivity. It is a promising new tool for analyzing macro- and micro-vessels in DSA images acquired for either experimental or clinical use.