

# Visual classification of complicated plaques based on multidimensional image fusion

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**Introduction** High-grade internal carotid artery stenoses are a leading source of ischemic stroke and the plaque constitution is known to be an important risk factor. While CT gives a reliable detection of calcifications, the analysis of histological slices is the goldstandard for the analysis of other plaque constituents. Multicontrast(MC) MRI can be used to distinguish major components of plaque but an automatic analysis based on MR contrasts is still subject of current research. The aim of the present work is to provide software assistants for the analysis and comparison of histological images, CT images and MC MRI ex-vivo and in-vivo and provide a framework for the evaluation of imaging sequences and algorithms for ex-vivo as well as in-vivo image data.

**Methods** Study data stems from patients who underwent carotid endarterectomy. Image data include pre-interventional MC MR, post-interventional highresolution MC MR,  $\mu$ CT and histological slices. The software supports manual classification of histological images as well as combined analysis of ex-vivo or in-vivo images. Different contrasts are fused via RGB channels or arithmetic combinations to achieve meaningful data representations. Vessel segmentation and registration are applied to determine the plaque region and correct for patient motion in in-vivo images.

**Results** The software has been applied successfully by the clinical experts. Visual exploration of fused MC MR images resulted in a quicker apprehension of the plaque constitution than conventional side-by-side comparison. Corresponding regions to the histological slices could be determined in the MR volumes. Tests of the in-vivo analysis indicate that the methods developed with ex-vivo image data can be transferred.

**Conclusions** In an ongoing study, datasets have been processed successfully with prototypical software for multi-modal inspection of carotid plaque specimens. Initial results indicate the potential for improved delineation of specific plaque components. Future work will focus on the development and evaluation of automatic analysis methods for MC MR images.

