

A new computer-aided solution for the automatic detection of metal stent struts in follow-up evaluation in OCT images.

Zofia Schneider¹ [0000-0003-4987-5361], Elżbieta Pociask¹ [0000-0001-8938-1089],
Klaudia Proniewska² [0000-0002-0105-1825]

¹ BioMedical Imaging Science Club, Department of Biocybernetics and Biomedical Engineering, AGH University of Science and Technology, Kraków, Poland

² Department of Bioinformatics and Telemedicine, Faculty of Medicine, Jagiellonian University Medical College, Kraków, Poland

schneider@student.agh.edu.pl

Aims: Stent implantation is commonly used to treat coronary artery disease. Therefore, it is very important to evaluate the stent immediately after implantation to optimize stenting results and to assess the stent coverage by neointima, which may contribute to the late lumen loss.

Identification and evaluation of stent struts after implantation is a common procedure in clinical practice, however, manual analysis is laborious and time-consuming. Therefore, automated algorithms for stent segmentation in OCT images have been developed for many years, but they mainly apply to stents without thick tissue coverage.

This study proposes a new computer-aided method for automatic strut detection in OCT images without and with thick strut coverage.

Methods: The algorithm consists of 4 steps: image preprocessing, lumen segmentation based on adaptive thresholding and active contour model, stent struts segmentation and verification of detection results. Struts detection method includes segmentation of strut shadows, determination of their orientation and analysis of pixel intensity distribution in the neighborhood of the detected shadows. The algorithm was validated on 406 cross-sections from the 22 cases. The analyzed dataset contains both pullbacks: at baseline and at 3-12 months follow-up. The obtained images are of various quality and contain artifacts, thrombi, bifurcations, and malapposed struts.

Results: Validation based on manual comparison showed that the median precision of the algorithm is 1.0 (0.89 - 1.0), sensitivity is 0.85 (0.72 - 0.93) and Dice index is 0.89 (0.80 - 0.95).

Conclusion: The proposed method provides accurate detection of stent struts in OCT scans taken immediately after stent implantation and after several months of follow-up, including thick tissue-covered struts.