Purpose:
In vivo dynamic visualization, recognition and quantification of vascular networks represent a very interesting methodological requirement of peripheral angioplasty. Optical coherence tomography (OCT) is a catheter-based imaging method that employs near-infrared light to produce high-resolution intravascular images. The purpose of the present study is the inner-outer lumen contours extraction as well as strut detection, so as to evaluate the re–endothelialization degree in stented arteries derived from OCT images.

Methods:
Inner and outer lumen contours represent the regions of interest on OCT cross-sectional images, from which data clinicians can determine degree of restenosis. In order to recognize and segment these contours a specifically designed algorithm was implemented. The algorithm was based on unsupervised segmentation, utilizing the Markov Random Field model (MRF) and Continuous Wavelet Transform (CWT) analysis. In order to segment struts the scale-space responses derived from wavelet local maxima of Laplacian-of-Gaussian (LOG) across consecutive scales have been employed into a Probabilistic Neural Networks (PNN) based classification scheme.

Results:
A full OCT (270 frames) study was utilized in the study, deriving a case study of 61 consecutive frames including struts. All input scale-space responses were divided in two main categories: Class I (284 cases) corresponding to struts and Class II (3236 cases) to various responses from other structures existing within the image. 15 features were automatically calculated from each scale-space response signals on both classes. The employed PNN classifier exhibited high discrimination accuracy between strut and other responses achieving an area under curve (AUC) value of 0.96.

Conclusions:
We have developed a promising new tool for inner, outer lumen contours as well as strut position detection in OCT data. Its main characteristics are robustness, fast and automatic execution that could be easily adapted to a user friendly interface.