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Abstract: P775

Computationally efficient image-based IVUS pullbacks gating

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Introduction: IVUS sequences can show arteriosclerotic plaques from coronary vessels. Image-based gating algorithms have been proposed to overcome the limitations of ECG-gating of IVUS sequences. Approaches are based on the estimation of the motion between couples of temporal adjacent frames. These methods are computationally expensive not dealing with irregular heart rates (HR). We propose a computationally efficient and robust algorithm to detect optimal frames representing the longitudinal vessel cut and to explore the extension of plaque and vessel stenosis.

Methodology: Applying computer vision algorithms we compute a dissimilarity matrix between different image frames. Then, we obtain a matrix with quantities inversely proportional to the probability that a heart cycle with a specific length begins at a specific position in the pullback IVUS sequence. The minima in this matrix represent the optimal IVUS frames to be gated in order to create a smooth longitudinal view of the vessel.

Results: We applied it on 40 sequences from 19 patients. Fig. 1 shows an ECG-gated sequence (left image) and the image-based gating (central image). The optimal sampling position relative to the HR of ECG-gating is not constant and can vary from patient to patient and heart rates. Fig. 1 (right) shows the interval sampling distribution (in frames) for the ECG-gating (top) and the proposed algorithm (bottom). Thus, our algorithm samples frames adapting better to slight variations of the heart cycle and vessel deformation. We propose a smoothness objective measurement showing the better alignment of our approach.

Conclusions: We developed an efficient and robust algorithm for image-based gating. It works on non-regular HR and adapts locally to variations induced by patients and movement artifacts.