Universität Basel

Publication

Guided review by frequent itemset mining - additional evidence for plaque detection

PURPOSE: A guided review process to support manual coronary plaque detection in computed tomography coronary angiography (CTCA) data sets is proposed. The method learns the spatial plaque distribution patterns by using the frequent itemset mining algorithm and uses this knowledge to predict potentially missed plaques during detection. MATERIALS AND METHODS: Plaque distribution patterns from 252 manually labeled patients who underwent CTCA were included. For various cross-validations a labeling with missing plaques was created from the initial manual ground truth labeling. Frequent itemset mining was used to learn the spatial plaque distribution patterns in form of association rules from a training set. These rules were then applied on a testing set to search for segments in the coronary tree showing evidence of containing unlabeled plaques. The segments with potentially missed plaques were finally reviewed for the existence of plaques. The proposed guided review was compared to a weighted random approach that considered only the probability of occurrence for a plaque in a specific segment and not its spatial correlation to other plaques. RESULTS: Guided review by frequent itemset mining performed significantly better ($p < 0.001$) than the reference weighted random approach in predicting coronary segments with initially missed plaques. Up to 47% of the initially removed plaques were refound by only reviewing 4.4% of all possible segments. CONCLUSIONS: The spatial distribution patterns of atherosclerosis in coronary arteries can be used to predict potentially missed plaques by a guided review with frequent itemset mining. It shows potential to reduce the intra- and inter-observer variability.