Detecting Heart Disease Faster

He, Jiacheng Jason (School: The Energy Coast UTC)

Coronary artery disease (CAD) is the leading cause of death world-wide. Coronary CT angiography (CTA) provides a noninvasive method for diagnosing CAD by creating 3D data of the heart. Detecting plaques and stenoses inside coronary arteries are the keys to the CAD diagnosis. Current computer-aided methods are inefficient due to unnecessary algorithm complexity. This project proposes an approach using heuristics to first identify the coronary ostia, where the left and right coronary arteries (LCA and RCA) connect to the ascending aorta, and then segment the coronary vessels, and finally search along the coronary vessels for plaques and stenoses. The identification of the LCA and RCA ostia was automated with three key steps: ascending aorta detection, LCA ostium detection, and RCA ostium detection. Sixty data sets were randomly divided into 30 training 30 testing sets. The training sets were analyzed for heuristics, used as parameters in the ostia detection. This heuristics-based method proved to be efficient. The LCA and RCA ostia were 100% detected on the correct slice. Within each slice, the algorithm attempted to pinpoint the exact x- and y-axis coordinates of the ostia. For the LCA ostium, accuracy of 99.1% was achieved, due to one low-quality CTA volume. For the RCA ostium, the accuracy is 100%. The LCA and RCA vessels were successfully segmented with minimal user interaction. More importantly, the plaques and stenoses were located within the vessels. Using this algorithm, cardiologists will be able to more efficiently diagnose coronary artery disease, and thus, save lives.

Awards Won:

Third Award of $1,000