Techniques for Pre-processing CT Angiography (CTA) Images for the Diagnosis of Cardiac Disease

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Abstract:
Artificial Intelligence (AI) is a rapidly developing discipline that concentrates on teaching computers to comprehend and scrutinize images, particularly in the medical field, with a specific emphasis on diagnosing Cardiovascular Diseases. Coronary Computed Tomography Angiography (CCTA) is a widely accepted non-invasive diagnostic examination used to evaluate cardiac disease (CD). CCTA images are coronary artery anatomy, whereas functional stress testing assesses for inducible cardiac ischemia. Nevertheless, CCTA images frequently encounter diverse forms of noise and artifacts that can deteriorate their quality and hinder precise diagnosis. Preprocessing CT Angiography images is a vital undertaking in medical diagnosis utilizing computer vision. This study commences by employing image enhancement preprocessing methods to diminish noise, blurring, and image weakening. The initial stages involve utilizing edge detection algorithms and smoothing/filtering functions to enhance pixel clarity and edge definition in CCTA images using Python programming language and the PyCharm Integrated Development Environment (IDE) are implemented in this work.

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Contents

Data preparation is an essential prerequisite for performing comprehensive internal and external validation. Computer vision is a field focused on enabling machines to intelligently interpret Coronary Computed Tomography Angiography (CCTA) images. When accounting for all the necessary preparations, the CCTA scan typically lasts approximately 15 minutes when the heart rate remains slow and consistent [1]. However, if the baseline heart rate is fast and a beta-blocker is administered to slow it down, the scan may take longer. In addition to evaluating the severity of stenosis, CCTA provides a non-invasive method to comprehensively quantify atherosclerosis in the entire heart. With advancements in CT technology, it is now possible to semi-automatically measure coronary atherosclerotic plaque with high level accuracy, comparable to intravascular ultrasound [2]-[5].

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