Abstract

Coronary artery disease (CAD) remains the leading cause of cardiovascular mortality worldwide, with coronary atherosclerosis as its primary pathological mechanism. Manual interpretation of coronary angiography is limited by inter-observer variability, motion artifacts, and vessel overlap, necessitating automated diagnostic support systems. This study aimed to develop and evaluate a YOLOv8-based deep learning application for automated detection and segmentation of coronary atherosclerotic regions from angiography images. An open-access annotated coronary angiography dataset was used for model training and validation. Five YOLOv8 architectures (YOLOv8n, s, m, l, and x) were trained using a batch size of 4, learning rate of 0.01, and 500 epochs, then evaluated using precision, recall, mAP@50, and confusion matrix analysis. All five variants successfully identified stenotic vessel regions with good general agreement with ground truth annotations. Larger architectures demonstrated more stable mAP50 training curves and more consistent segmentation contours compared to smaller models, though requiring longer training times ranging from 6 to 26 hours. The best-performing model was integrated into a Streamlit-based web application, enabling clinicians to upload angiography images and receive real-time automated segmentation outputs. These findings demonstrate that YOLOv8-based models can effectively perform coronary atherosclerosis segmentation from angiography images and serve as accessible clinical decision support tools in interventional cardiology.

Keywords: Angiography imaging, Atherosclerosis, CAD, Deep learning, YOLOv8