Title: Machine Learning Diagnosis of Peripheral Arterial Disease from CT-Angiography (CTA) Images

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Introduction: Peripheral Arterial Disease (PAD) is a common circulatory problem characterized by narrowed arteries that reduce blood flow to the lower extremities. In 2019 the global burden of disease study attributed over 74,000 deaths to PAD with over 113,000,000 individuals living with the condition globally. Despite its prevalence, accurate and timely diagnosis remains a challenge, often leading to severe complications such as muscular weakness, amputation etc.

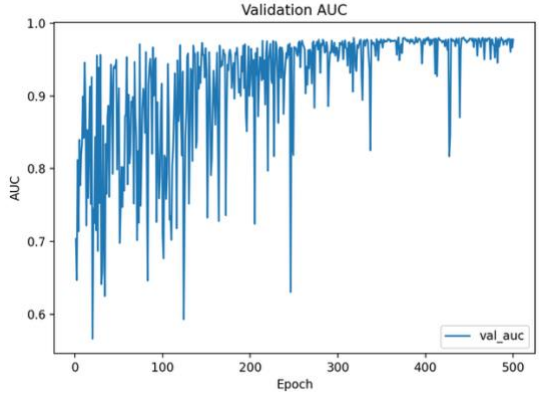
Study Objectives: This research investigates the use of machine learning specifically Convolutional Neural Networks (CNNs), to enhance PAD diagnosis from CT-Angiography (CTA) images.

Methods: The study aims to determine the effectiveness of neural networks in detecting PAD, optimize model performance, and deploy a testing application for clinical use. We have generated PAD ML model by utilizing pretrained ResNet-50 architecture on PyTorch Framework with dataset splits of 80% training and 20% validation, a AdamW optimizer for 500 epochs.

Results: Overall, the model shows stable validation performance with high accuracy, F1-score, and AUC. Metrics remain consistent in later epochs, and the selected checkpoint reflects strong generalization behavior. A validation accuracy of ~93–94%, precision of ~0.93–0.95, recall of ~0.91–0.94, F1-score of ~0.93, and an AUC of ~0.97–0.98 was observed from training (Figure 1).

Discussion: By improving diagnostic accuracy, this project has the potential to facilitate early detection and treatment of PAD, reducing the risk of severe outcomes. The integration of machine learning models into clinical workflows represents a significant step toward more accessible and efficient PAD diagnostics, ultimately improving patient care and outcomes.

Figure 1: Validation Area Under the Curve (AUC) for detecting PAD.



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