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Hybrid Xception-Vision Transformer Model for Automatic Diagnosis and Classification of White Matter Lesions with Explaiable AI Techniques

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White matter hyperintensities (WMHs) or lesion in brain MRI are key biomarkers for neurological conditions, but detecting small lesions remains challenging. Existing deep learning models often act as "black boxes,"limiting clinical trust due to lack of interpretability. This study proposes a hybrid Xception-Vision Transformer (XViT) integrated with explainable AI (XAI) methods to enhance small WMH detection and provide interpretable predictions. Preliminary experiments using ResNet50, custom 3D-CNN, and CNN+LSTM models, along with Grad-CAM and LIME for explanation, showed that CNN+LSTM achieved the best performance, offering high accuracy.This work demonstrates the potential of combining advanced DL architectures with XAI to improve small WMH detection and clinical trust.

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