**Explainable Vision Transformer Approach for Automated Detection of Multiple Retinal Diseases**

**ABSTRACT:**

Timely and precise diagnosis of multiple eye diseases is critical for preventing vision loss and facilitating effective treatment. This study introduces an interpretable, multi-disease detection framework utilizing Vision Transformers (ViTs) for automated analysis of retinal fundus images. Unlike conventional methods targeting single conditions like age-related macular degeneration (AMD), our approach performs multi-class classification across prevalent eye diseases, including diabetic retinopathy, glaucoma, cataract, and AMD. An advanced preprocessing pipeline, incorporating Principal Component Analysis (PCA) for noise reduction, enhances image clarity and consistency across diverse datasets. The ViT model employs self-attention to capture intricate local and global retinal patterns, achieving high diagnostic accuracy with balanced sensitivity and specificity. To enhance clinical trust, we integrate SHapley Additive exPlanations (SHAP) and PCA-guided GradCam visualizations to provide clear, region-specific textual explanations of predictions. A user-friendly interface enables image uploads and delivers intuitive diagnostic outputs, making the system accessible for telemedicine and population-wide screening. Experimental results highlight superior performance and robustness, positioning this framework as a scalable, trustworthy solution for automated retinal disease screening.

**Keywords**: Multi-disease detection, retinal fundus imaging, Vision Transformer (ViT), Principal Component Analysis (PCA), explainable AI (XAI), SHAP, GradCam, computer-aided diagnosis, telemedicine.

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