

An Integrated Deep Learning Framework for Early Detection of Vision Disorders

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Vision impairment due to retinal diseases like Diabetic Retinopathy (DR), Age-Related Macular Degeneration (AMD), Glaucoma, and Retinal Vein Occlusion (RVO) poses a significant health challenge in Sri Lanka, where these conditions are leading causes of blindness. This research presents a novel multi-disease prediction system leveraging advanced deep learning techniques for early detection of DR, AMD, Glaucoma, and RVO. The study utilized publicly available datasets, including retinal fundus images from repositories such as RFMiD, IDRiD, APTOS validated by medical professionals to ensure diagnostic reliability. These images were preprocessed and augmented to train robust convolutional neural network (CNN) models tailored to each disease. The predictive models were developed and optimized using hybrid architectures, integrating attention mechanisms and feature fusion for enhanced performance. This approach achieved high accuracies 93% for DR, 92% for AMD, 94% for Glaucoma, and 94% for RVO demonstrating robustness and consistency across diverse retinal conditions. To validate real-world applicability, the models underwent further testing in clinical settings using a Sri Lankan dataset, reflecting local disease prevalence and imaging conditions. By combining validated public data with clinical testing, this scalable system supports ophthalmologists in early diagnosis, reducing diagnostic delays and improving patient outcomes. This work offers a reliable, innovative solution to mitigate the burden of blindness in Sri Lanka and beyond.

Keywords— Age Related Macular Degeneration, Diabetic Retinopathy, Glaucoma, Retinal Vein Occlusion