Multimodal Deep Neuro-Ophthalmic Framework for Hierarchical Classification and Lesion-Level Segmentation of Fundus Pathologies Using Hybrid CNN–U-Net Architectures

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Abstract

The diseases of eye fundus as diabetic retinopathy and age-related macular degeneration and glaucoma are highly dangerous of causing visual impairment and blindness unless they can be diagnosed in good time. Conventional manual diagnosis is manual and it is highly based on the expertise of the ophthalmologists which has a tendency of causing treatment delays. The study introduces an AI-based classification and segmentation system of eye fundus diseases to classify and segment them efficiently. The training of deep learning models is based on a massive dataset of fundus images, annotated with expert-generated segmentation masks. It employs the use of Convolutional Neural Networks (CNNs), such as le Net in classification, and U-Net in segmentation of the disturbed areas to give accurate results. The data is divided into training, validation and testing very meticulously to have a great evaluation of a model. The experimental evidence has shown high accuracy of the proposed system in both disease classification and segmentation which offer credible information about the presence of diseases and the severity. The approach is an excellent diagnostic instrument, which assists ophthalmologists to distinguish and confirm eye fundus diseases as early as possible.

Keywords

Eye Fundus, Diabetic Retinopathy, Glaucoma, Macular Degeneration, Vision Impairment, Medical Imaging, Disease Diagnosis.