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VisionAbixo:

A Deep Learning Approach to Apply Multi-Image Processing Techniques for Classification of Age-Related Macular Degeneration in Ophthalmology

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Abstract

Age-Related Macular Degeneration, a multi-factorial retinal pathology is the world's third most common retinal pathology that affects the central vision of human eye where scientists believe that there will be an exponential increase of diagnosed patients in the future. Although existing AMD classification systems have satisfiable accuracy, the reliability of the classification remains at a questionable level due to the utilization of less generalized, one or few medical centres centric datasets, artifacts generated by data augmentation and single modality architecture mostly based on either OCT or CFP or similar retinal scans. However, reliability of the predictions generated by the model is crucial as the patients and medical professionals can rely on the generated result. This research project focuses on increasing the reliability of the predictions generated along with generalizability of the system by applying dual-modality architecture based on a well-generalized cross-patient dataset.

A novel CNN based multi-modal architecture aligned with supervised learning has been proposed as the technical approach of this research. Multiple labelled datasets as well as a constructed novel Sri Lankan dataset coined as "MLRetinal Dataset", have been combined for each OCT and CFP modality, where various data preprocessing techniques including image-resizing, flipping, relabelling along with data augmentation such as resampling have been applied to generalize and enhance the diversity of the dataset. to combine features from both image modalities, the system process early feature fusion strategy to feed the model with interrelated features. The classification model is then trained and tested enhancing the reliability of the DL-based diagnostic process of the model.

Despite the challenges the author endured during the collection of manually separated local dataset, she was able to achieve a sufficient accuracy of 0.77 with .76 of precision, 0.73 of recall, and 0.74 of f1-score. While the result verifies the model has sufficient performance, further analysis required to be conducted to apply advance pre-processing techniques and model fine-tuning. Application of XAI, longitudinal scans are some of the key future enhancements suggested.

Subject Descriptors:

Computing Methodologies → Machine Learning → Machine Learning Approaches -> Neural Networks

Applied Computing → Life and Medical Sciences → Health Informatics

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