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**DIABETIC RETINOPATHY DETECTION: CUSTOM CNN ARCHITECTURE
WITH REGULARIZATION AND DATA AUGMENTATION FOR IMPROVED
GENERALIZATION AND EFFICIENCY**

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Abstract

Diabetic Retinopathy (DR) is still among the leading causes of blindness in the working age population worldwide. Manual screening is inconvenient and not feasible. Current research proposes deployment of a light CNN, which was trained with the ODIR dataset (5,018 fundus images: 2,574 Normal and 2,444 Abnormal/DR), on a 70:15:15 train-validation-test split. Dynamic class weights implemented within Binary Focal Loss handled imbalance-induced bias. Compared to a DenseNet121 baseline of 83% accuracy implemented with Test Time Augmentation, the proposed model achieved 98% accuracy and 0.98 (Normal) and 0.97 (Abnormal) F1-scores. Robustness was achieved with LAB color preprocessing and CLAHE enhancement, real-time data augmentation, and stratified sampling. The model's efficiency enables Edge-AI deployment in low-resource environments. Future work will incorporate Explainable AI and multi-source validation to enhance interpretability and clinical reliability.

Keywords: *Diabetic Retinopathy (DR), Deep Learning, Light Convolutional Neural Network (CNN), ODIR Dataset, LAB Color Space*