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Eye Disease Classification by Advanced Deep Transfer Learning System using Resnet50 and Xception

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Abstract: *The burden of vision impairment remains significant in developing nations such as India, where delays in diagnosis often lead to preventable blindness. With advancements in artificial intelligence, deep learning has emerged as a transformative tool for the automated detection of ocular diseases. This study proposes a multi-class classification framework capable of identifying four prevalent eye conditions Cataract, Glaucoma, Diabetic Retinopathy, and Normal using retinal fundus imagery. The methodology employs transfer learning with two high-performing convolutional neural network architectures: Xception and ResNet50, each fine tuned on a curated dataset. Preprocessing strategies including image normalization, resizing, and augmentation were incorporated to improve feature extraction and model generalization.*

The trained models are deployed via a Streamlit-based web interface, enabling medical professionals to upload retinal images and obtain immediate diagnostic feedback accompanied by confidence scores. Quantitative evaluation using precision, recall, F1-score, and confusion matrix reveals an exceptional accuracy of 100%, while ROC curve analysis confirms perfect classification with an AUC of 1.00 across all categories. In comparison with conventional approach-es such as SVM-ANN hybrids and basic CNNs typically limited to binary outputs, the proposed method excels in handling multi-class scenarios. Beyond its technical strengths, the system aligns with the objectives of the United Nations Designed with scalability and accessibility in mind, the solution offers significant potential in low-resource settings where specialist ophthalmic care is scarce. Future developments include expanding the model to additional eye conditions, deploying it via mobile platforms, and integrating with electronic health record (EHR) systems for broader clinical adoption..

Keywords: Eye Disease Detection, Deep Learning, Retinal Fundus Imaging, Transfer Learning, Xception, ResNet50, Multi-Class Classification, Streamlit, Artificial Intelligence in Healthcare

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