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Eye Disease Classification Using Deep Learning Algorithms

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Abstract: *Diabetic eye conditions, including diabetic retinopathy, cataracts, glaucoma, and other retinal conditions, remain the leading causes of preventable blindness worldwide. Detection and classification to a stage are essential to early intervention, yet manual classification is labor-intensive, resource-wasteful, and human-error-prone. This paper describes an implementation of a deep learning automatic multi-class classifier from Convolutional Neural Network (CNN) with Vgg19 and ResNet101 architectures. The model is tested and trained over a Kaggle dataset of four classes: normal, cataract, glaucoma, and retina disease images. Data processing steps like image resizing (256x256 pixels), contrast stretch, and normalization are applied over the data to achieve consistent input quality. 75% of the data is used to train the model and 25% for testing to guarantee that the model undergoes a solid test. Performance measures are precision, recall, accuracy, and F1-score to measure the model's performance. Out of the architectures experimented with, ResNet101 performs the best since its residual learning mechanism avoids vanishing gradients and deepens feature extraction. It addresses significant challenges such as model interpretability, image variability, and data imbalance required for clinical deployment. The system to be designed assists medical professionals by simplifying the diagnosis process, reducing manual intervention, and improving diagnostic consistency. The research contributes to the evolution of diagnostic systems based on AI by delivering a scalable, secure, and precise diabetic eye disease classifier. A couple of potential directions for the future include increasing additional data in the dataset, applying attention mechanisms, and deploying the model on edge devices for point-of-care real-time diagnosis*

Keywords: Diabetic retinopathy, Deep learning, Convolutional Neural Networks (CNN), Vgg19, ResNet101, Medical image classification

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