Chapter 6
Automated Diagnosis of Eye Problems Using Deep Learning Techniques on Retinal Fundus Images

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ABSTRACT

Automated diagnosis of eye diseases using deep learning techniques on retinal fundus images has become an active area of research in recent years. The suggested method divides retinal images into various disease categories by extracting relevant data using convolutional neural network (CNN) architecture. The dataset used in this study consists of retinal images taken from patients with various eye conditions, such as age-related macular degeneration, glaucoma, and diabetic retinopathy. The aim of this study is to investigate the potential of deep learning algorithms in detecting and classifying various retinal diseases from fundus images. The suggested approach may make early eye disease diagnosis and treatment easier, reducing the risk of vision loss and enhancing patient quality of life. The DenseNet-201 model is tested and achieved an accuracy rate of 80.06%, and the findings are extremely encouraging.

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1. INTRODUCTION

The general workflow of automated diagnosis of eye diseases using deep learning techniques on retinal fundus images involves several steps. Firstly, retinal fundus images are preprocessed to remove noise, enhance contrast, and standardize their size. Then, CNN-based algorithms are trained on large datasets of labelled retinal fundus images to learn the patterns and features of different eye diseases. During the training process, the CNN algorithm learns to classify retinal fundus images into different disease categories. The trained model is then validated on a separate set of images to evaluate its performance. Metrics such as sensitivity, specificity, and area under the receiver operating characteristic curve (AUC-ROC) are used to measure the accuracy of the model. The model can be used to automatically diagnose eye problems once it has been trained and validated. Retinal fundus images are input to the trained model, and the output of the algorithm most likely provides the diagnosis of the disease. In some circumstances, the algorithm can also provide a likelihood score for each type of sickness, indicating how confident the diagnosis is. Diabetic eye disease (DED) is a group of eye problems that can affect diabetic people. Over time, diabetes can harm the eyes, resulting in blurry vision or even total blindness. Therefore, it is crucial to identify DED signs early in order to stop the condition from progressing and receive prompt treatment. (Mule et al., 2019), (WebQiao et al., 2020) (Li et al., 2020).

2. RELATED WORK

The KNN model reported by (Singh et al., 2022). achieved an accuracy of 99%, which is not the best result. (Sesikala et al., 2022) CNN .'s model and (Akbar et al., 2022) almix's of DarkNet and DenseNet both showed increased accuracy. The highest levels of accuracy have been delivered by KNN, DarkNet, and DenseNet. Nevertheless, (Suganyadevi et al., 2022) CNN's model could not be considered the most accurate since it only managed an average accuracy of 85%. For the other models, the accuracy ranges were 89.29% to 98%.

3. PROPOSED ARCHITECTURE

The effectiveness and precision of ophthalmic diagnosis could be greatly increased by automating the diagnosis of eye illnesses using deep learning methods on retinal fundus images. The following is a suggested structure for such a system: Data gathering: Gathering a sizable dataset of retinal fundus photographs is the initial

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