ABSTRACT

Glaucoma is the second leading cause of permanent blindness worldwide after cataracts, with a high prevalence especially among the elderly population. This progressive disease often develops silently without symptoms in its early stages, making early detection crucial to prevent irreversible optic nerve damage. This study aims to develop an early glaucoma detection system based on deep learning using Convolutional Neural Network (CNN) models to classify retinal fundus images into two categories: normal and glaucoma. Four CNN architectures were evaluated, including ResNet50, EfficientNetB0, MobileNetV2, and VGG16, through systematic hyperparameter tuning experiments to determine the optimal training configurations. The system was tested using the public SMDG19 dataset consisting of 12,449 fundus images and additional images captured with a pantoscopic ophthalmoscope camera connected to a smartphone. The results showed that the VGG16 model achieved the highest accuracy of 86.7%, exceeding the predetermined minimum success threshold of 80%. The system is capable of processing images in real time with an average processing time of under 3 seconds and was developed using open-source platforms. These findings demonstrate that deep learning approaches can be effectively utilized as a supporting solution for digital and efficient glaucoma screening, particularly in areas with limited access to healthcare technology.

Keywords: *glaucoma, deep learning, fundus image, Convolutional Neural Network, early detection.*