ABSTRACT

Diabetic Retinopathy (DR) is a severe complication of diabetes mellitus that can lead to permanent blindness if not detected early. Manual diagnosis through fundus images requires significant time and expertise, prompting the development of deep learning approaches, particularly Convolutional Neural Networks (CNNs) such as VGG-19, to improve detection efficiency and accuracy. However, model performance highly depends on hyperparameter selection and data augmentation techniques to address class imbalance in the APTOS 2019 dataset. This dataset classifies DR severity into five levels: No DR, Mild DR, Moderate DR, Severe DR, and Proliferative DR. This study analyzes the impact of hyperparameter variations (learning rate, batch size, dropout) on the performance of the VGG-19 model and compares results between the original dataset and the dataset augmented using Contrast Limited Adaptive Histogram Equalization (CLAHE). CLAHE is typically used as a contrast enhancement method in medical image processing. However, in this study, CLAHE is applied as a data augmentation technique to improve the quality of fundus images before model training. Experimental results show that the optimal hyperparameter combination for the original dataset is a learning rate of 10^{-4}, batch size of 16, and dropout of 0.4, achieving an accuracy of 80.2%, while for the CLAHE-augmented dataset, the best combination is a learning rate of 10^{-3}, batch size of 64, and dropout of 0.3, achieving an accuracy of 80.9%. Data augmentation using CLAHE improved model accuracy by 0.7%. This study demonstrates that hyperparameter variations and data augmentation techniques significantly impact the performance of the VGG-19 model in DR classification. These findings provide a reference for developing automated deep learning-based diagnostic systems for Diabetic Retinopathy.

Keywords : *Diabetic Retinopathy*, VGG-19, *hyperparameter*, CLAHE, *deep learning*.