ABSTRACT

Tuberculosis (TBC) is an infectious disease that remains one of the leading causes of death worldwide, requiring rapid and accurate diagnosis to reduce transmission and mortality rates. Chest X-ray imaging is widely used as a faster and more cost-effective alternative to laboratory tests, but manual interpretation is highly dependent on radiologists' expertise, which makes it prone to errors. This study aims to develop an automated TB classification system using the VGG-19 architecture optimized through hyperparameter tuning and *Multi-Scale Retinex* (MSR) preprocessing on chest X-ray images. The dataset consists of 2,283 images divided into two classes, Normal (1,583) and Tuberculosis (700), with data augmentation applied using random rotation (20°), 20% zoom, and horizontal flipping. Four key hyperparameters were explored: learning rate (10^{-3} and 10^{-4}), batch size (16 and 32), dropout (0.3 and 0.4), and L2 regularization (10^{-3}). The best configuration was achieved with a learning rate of 10^{-4}, batch size of 16, and dropout of 0.3, yielding a test accuracy of 99.71% for both Retinex and non-Retinex models. Although Retinex did not produce a significant numerical improvement in accuracy, the analysis of accuracy and loss curves indicated that Retinex-based models achieved more stable generalization and reduced overfitting. These findings highlight that combining hyperparameter optimization, regularization, and image enhancement can effectively improve VGG-19 performance in TB classification using chest X-rays.

Keywords :*Tuberculosis*, VGG-19*, Deep Learning, L2 Regularization, Retinex, X-ray.*

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