ABSTRACT

Partial color vision deficiency such as protanomaly and deuteranomaly causes individuals to experience difficulties in distinguishing certain colors, which affects various daily visual activities. This study aims to develop a deep learning–based system capable of automatically detecting partial color vision deficiency types and performing color transformation to make images more perceivable for affected users. The proposed method consists of two main stages: color vision deficiency detection using Convolutional Neural Networks and color transformation using generative models. In the detection stage, three CNN architectures are evaluated, namely SqueezeNet, MobileNetV2, and EfficientNet-B0. Experimental results show that SqueezeNet achieves the best performance with an accuracy of 96%, outperforming the other architectures. This finding indicates that lightweight architectures are more effective in capturing micro color patterns produced by color vision deficiency simulations. In the color transformation stage, U-Net and Autoencoder architectures are implemented using paired datasets generated through daltonization. To enhance visual representation, this study integrates monogram image processing by adding brightness, edge, and contrast information into a multi-channel image format. Evaluation results demonstrate that monogram-based U-Net produces superior color transformation quality, achieving PSNR values above 36, SSIM close to 0.97, and low Delta E2000 scores for both protanomaly and deuteranomaly. Overall, the integration of lightweight CNNs, U-Net, and monogram image processing proves effective, adaptive, and suitable for real-time applications to improve visual accessibility for individuals with partial color vision deficiency.

Keywords: *partial color blindness, color conversion, color detection, deep learning, monogram image.*