ABSTRACT

This study aims to analyze the efficiency of Convolutional Neural Network (CNN) and Recurrent Neural Network (RNN) models in classifying Down syndrome in toddlers based on facial images. The dataset used consists of 5,206 images that have undergone pre-processing stages such as grayscale conversion, normalization, and augmentation. The CNN model was built using convolutional, max pooling, batch normalization, and dropout layers, while the RNN adopted an LSTM architecture. The evaluation results show that the CNN performs stably and efficiently in static image classification, achieving an accuracy of 0.9383, precision of 0.6772, recall of 0.7044, and an F1-score of 0.6898 on the training data; an accuracy of 0.9021, precision of 0.9016, recall of 0.9021, and an F1-score of 0.8936 on the validation data; and an accuracy of 0.8733, precision of 0.8662, recall of 0.8733, and an F1-score of 0.8619 on the testing data. On the other hand, the RNN demonstrated superior performance in terms of recall, particularly in detecting positive cases, with the highest recall of 1.0000 and an F1-score of 0.8786 on the training data; a recall of 0.9832 and an F1-score of 0.9011 on the validation data; and a recall of 0.9928 and an F1-score of 0.9039 on the testing data. Although CNN excels in accuracy and precision, RNN is more recommended for applications demanding high sensitivity, such as medical classification. This research concludes that while CNN is more optimal overall, RNN offers a significant advantage in detecting positive cases in new data.

Keywords: *Down syndrome, CNN, RNN, image classification, machine learning.*