Comparison of the Keras-LSTM Algorithms for Classifying Autism Spectrum Disorder Using Facial Images

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Abstract

Autism Spectrum Disorder (ASD) is a neurodevelopmental condition that affects early childhood communication abilities, leading to depression and suicidal ideation. The CDC reported that one in forty-four children in the US, totaling five million, were diagnosed with autism in 2018. Conventional methods for diagnosing autism involve questionnaires that several researchers have done. However, machine learning techniques for diagnosing autism using the Keras library (VGG16, VGG19, and MobileNet) have shown superior accuracy. The long-short-term memory (LSTM) algorithm has been widely used in various fields, but the direct LSTM algorithm for autism detection has been limited. This study presents a proposed Keras-LSTM architecture, i.e., VGG16-LSTM, VGG19-LSTM, and MobileNet-LSTM, for transfer learning and conducts a comparative analysis. The proposed architectures are simple and robust and can achieve high accuracy with minimal modifications. The dataset for this research contained 2940 facial images of children aged two to fourteen. The results showed that the VGG19-LSTM model had the highest overall accuracy at 75.85%, outperforming the other two models in non-autistic precision, average precision, and all F1-scores. However, VGG16-LSTM demonstrated superior performance in autistic precision (90.27%) and non-autistic recall (96.26%), while MobileNet-LSTM achieved the highest autistic class recall (96.60%).

Keywords: autism spectrum disorder (ASD), facial image, Keras-LSTM, classification