

Enhancing the Accuracy of Convolutional Neural Network Models for Emotion Detection Based on Facial Expressions Using Data Augmentation and Transfer Learning

Akhmad Reyhan Rustani

Data Science Study Program, Faculty of Science and Technology

University of Technology Yogyakarta

Jl. Ringroad Utara Jombor Sleman Yogyakarta

E-mail: akhmadreyhan123@gmail.com

ABSTRACT

This study explores the application of data augmentation and transfer learning techniques to improve emotion detection from facial expressions using the FER-2013 dataset. The primary objective is to enhance the performance of Convolutional Neural Network (CNN) models in accurately recognizing diverse human emotions. Both techniques were implemented and evaluated using a designated test dataset, resulting in improved model accuracy compared to baseline CNN models without these enhancements, despite the challenge of imbalanced class distribution. The dataset comprises 32,841 facial expression images categorized into seven emotion classes: angry, happy, neutral, sad, disgust, fear, and surprise, achieving a final accuracy of 68%. The results demonstrate the CNN's capacity to capture complex visual patterns in facial features, with transfer learning and data augmentation playing a crucial role in emotion classification. The model achieved satisfactory performance with a prediction time of 8.6 seconds and a test loss of 1.12. However, data imbalance across emotion classes posed significant challenges during training and evaluation. Future research is recommended to incorporate additional facial features, such as eyebrow shape, mouth structure, and eye configuration, leverage multi-modal approaches, apply class weighting strategies, and integrate hybrid models by utilizing CNN as a feature extractor and alternative classifiers for final decision-making. These approaches are expected to significantly advance the effectiveness of facial expression-based emotion detection systems.

Keywords: Convolutional Neural Network (CNN), data augmentation, transfer learning, emotion, accuracy.