Facial Expression Recognition using CNNs

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Abstract

This report represents the development and evaluation of Convolution Neural Network (CNN) for Facial Expression Recognition using the FER-2013 dataset. The study explores data preprocessing, model architecture, training methodology and performance analysis.

1 Introduction

Facial Expression Recognition (FER) plays a crucial role in various application such as healthcare, security, and human-computer interaction. This project aims to develop a CNN based model for FER using the FER-2013 dataset. The key contributions include data augmentation techniques, model optimization strategies, and performance evaluation.

2 Related Works

Several studies have been explored CNN architectures for FER. Our approach builds upon these methods while incorporating data augmentation and hyper-parameter tunning to improve accuracy.

3 Preliminary / Background

The FER-2013 dataset consist of 48x48 pixel images classified into seven emotion categories. CNNs are well-suited for image-based classification tasks due to their ability to learn spatial hierarchies of features.

4 Methodology

4.1 Data Preprocessing

The dataset was cleaned and normalized. Data augmentation techniques such as rotation, flipping and brightness adjustments were applied to address class imbalance.

4.2 Model Architecture

Our CNN model consist of multiple convolution layers with ReLU activation, batch normalization, max-pooling layers, and fully connected layers with dropout regularization.

4.3 Training and Hyperparameter Tuning

The model was trained using categorical cross-entropy loss, Adam optimizer and learning rate scheduler. Hyperparameter were tuned using validation accuracy.

5 Experiment and Results

Experiment was conducted using 70

Dataset Size	Training Accuracy	Test Accuracy
70%	71.57%	70.23%

Table 1: Model Performance Comparison

6 Conclusion

The CNN model successfully classified facial expression with an accuracy of **70.23%** on the test set using 70% of the data. Future improvements include using transformer-based architecture and larger datasets.

7 Appendix

Additional code, figures, and analysis can be found in the accompanying Jupyter Notebook.