Interim Project Report

Capstone Project: Emotion Recognition using Facial Images

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1. Introduction

This project, titled 'Emotion Recognition using Facial Images,' aims to develop a machine learning model that can accurately classify human emotions from facial images. The project seeks to leverage deep learning (CNNs) alongside effective data preprocessing techniques to build a robust classification pipeline. Given the recent shift from a cricket performance project, the team has realigned its focus on emotion recognition to explore the challenges and opportunities in computer vision.

2. Business Problem

In many applications—from human-computer interaction to mental health analysis—emotion recognition is crucial for understanding human behavior. Our goal is to develop a robust pipeline that accurately classifies facial emotions and can be integrated into practical applications like mobile apps or web interfaces.

3. Data Acquisition

The dataset was sourced from Kaggle and includes labeled images representing various emotions. Images were downloaded, organized, and reviewed to ensure integrity(FER-2013 Facial Expression Dataset)

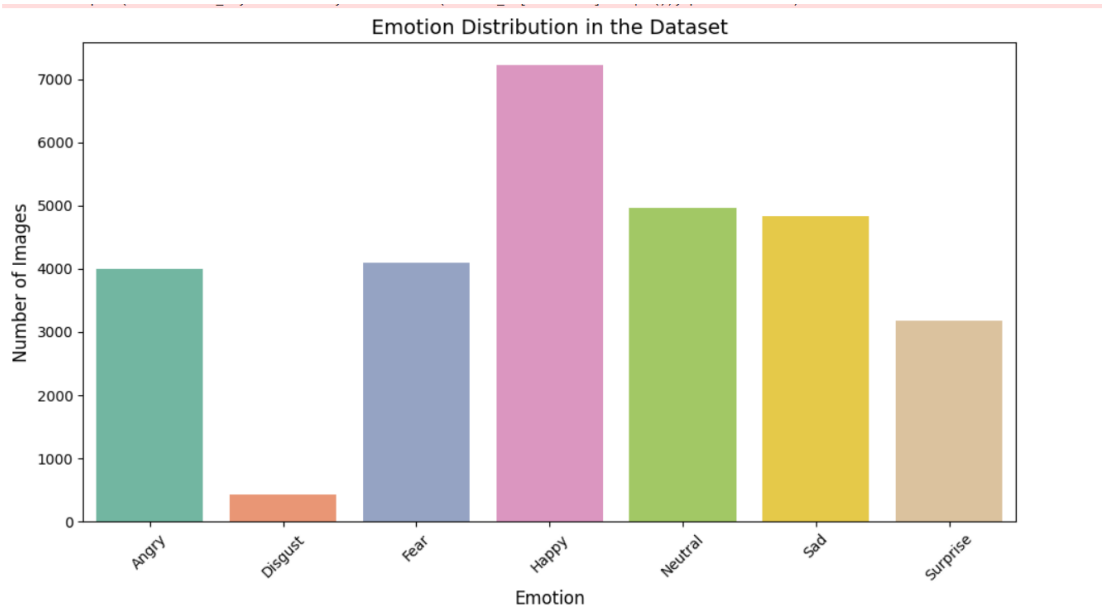
4. Data Cleaning

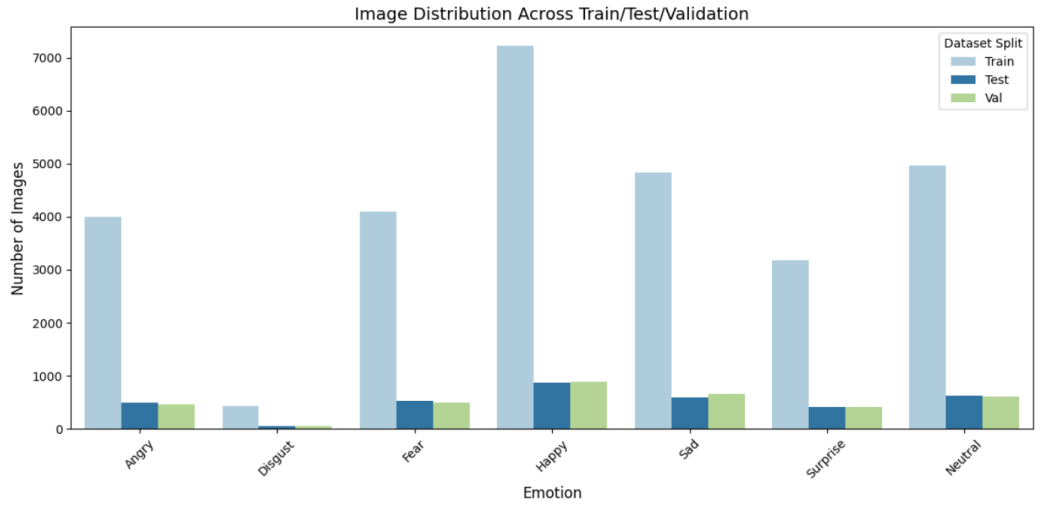
Following best practices from the article, we conducted:
• Handling Missing Values: Confirmed no missing images; discarded unreadable or corrupted files.

• Label Conversion: Ensured consistent labeling formats.
• Image Standardization: Resized all images and normalized pixel values for consistent model input.

5. Exploratory Data Analysis (EDA)

• Displayed random image samples to verify correctness and distribution.
• Used distribution plots to analyze class balance and pixel intensity ranges.
• Discussed dataset imbalance issues that may require augmentation.





6. Modeling

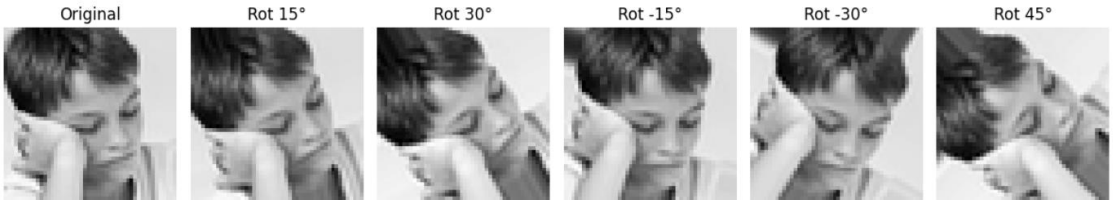
Model Selection:

• Baseline Models: Initially implemented classical machine learning models (KNN, Random Forest) to establish benchmarks.

• Deep Learning Models: Designed and implemented a Convolutional Neural Network (CNN) with Conv2D, MaxPooling, and Dense layers.

Handling Class Imbalance:

• Discussed implementing data augmentation techniques (e.g., horizontal flipping, rotation) to balance classes.



Training & Validation:

• Split the dataset into training and test sets (80/20 split).

• Applied appropriate loss functions and performance metrics (accuracy, precision, recall).

7. Interpretation

Preliminary Findings:

• CNN models showed higher accuracy compared to classical models.

• Certain emotion classes remain challenging due to subtle facial differences.

• Data augmentation is planned to improve model generalization.

Potential Solutions:

• Continue exploring advanced data augmentation techniques using Roboflow.

• Implement a frontend (Streamlit or Flask) for user interaction and real-time emotion predictions.

8. Future Work

• Hyperparameter tuning of the CNN to improve performance.

• Develop user-friendly interfaces for deploying the model.

• Integrate with GitHub for version control and documentation.

• Extend the project to include live webcam feeds for real-time emotion detection.

9. Challenges

- Time constraints due to topic switch.
- Data imbalance(Disgust emotion with fewer pictures) impacts classification accuracy.
- Integration of frontend and backend components.

10. Conclusion

The project has transitioned successfully from an earlier topic to facial emotion recognition using CNNs. Preliminary results are promising, with CNN models showing better performance than classical models. Future work will focus on model deployment, frontend integration, and ongoing performance improvements.