Facial Emotion Recognizer Project Report

1. Introduction

This project, Facial Emotion Recognizer, involves developing a real-time emotion detection system using TensorFlow and OpenCV. The objective is to classify facial emotions, captured via a webcam, into seven categories: Angry, Disgusted, Fearful, Happy, Neutral, Sad, and Surprised. The project utilizes deep learning through Convolutional Neural Networks (CNN) for accurate emotion detection.

2. Technology Stack

Libraries and tools used:

- TensorFlow

- OpenCV

- Keras (for building the CNN model)

3. Dataset and Preprocessing

The dataset consists of grayscale images resized to 48x48 pixels. To augment the data, the ImageDataGenerator class is used to rescale pixel values and improve model performance.

4. Model Architecture

The Convolutional Neural Network (CNN) architecture for emotion recognition includes:

- Convolutional layers (Conv2D) to capture spatial features from images.

- MaxPooling layers to down-sample feature maps, reducing spatial dimensions.

- Dropout layers to prevent overfitting.

- Dense layers for final classification of emotions into 7 categories.

5. Learning Rate Scheduler

An exponential decay schedule is used for learning rate adjustment during training, which helps

optimize the model's convergence and efficiency.

6. Model Compilation and Training

The model is compiled with categorical crossentropy as the loss function and the Adam optimizer. Training is conducted over 50 epochs to achieve high accuracy on the validation set.

7. Saving and Loading the Model

After training, the model architecture and weights are saved separately. They can be loaded for further use, enabling emotion detection in real-time video feed.

8. Real-time Video Feed and Emotion Detection

OpenCV's VideoCapture captures the webcam video feed. A Haar cascade classifier detects faces, and the emotion model predicts emotions on the detected face regions in real-time.

9. Emotion Prediction and Display

The model output is a softmax probability across seven emotions. The label with the highest probability is displayed on the screen using OpenCV, allowing real-time emotion recognition.

10. Conclusion and Future Enhancements

This Facial Emotion Recognizer is a practical application of deep learning in computer vision. Future improvements could include expanding emotion classes, optimizing the model for better performance, and integrating with other real-time applications.