

Semester 5 (Hack-O-Week 1)

Emotional Recognition from Facial Video

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The core idea of this project is to develop a system that can detect and classify human emotions by analyzing facial expressions captured in real-time video. Emotions like happiness, sadness, anger, surprise, fear, and neutrality will be identified using computer vision and deep learning techniques. Applications include online education, mental health monitoring, customer feedback analysis, and interactive AI systems. The aim is to build a lightweight, accurate, and real-time model that runs locally or on a web interface.

1. Problem Understanding

Humans express emotions through subtle facial movements. While easy for people to interpret, machines require training to recognize these cues. This project aims to build a system to classify live-streamed facial expressions into predefined categories using computer vision and AI.

2. Approach Overview

- Dataset Selection
- Face Detection & Preprocessing
- Model Training for Emotion Classification
- Real-Time Video Integration
- User Interface Development
- Testing & Optimization

3. Step-by-Step Plan

Step 1:

Dataset Selection

Using FER-2013 (48x48 grayscale images, 7 emotions) and CK+ datasets. Starting with images, later exploring video sequences if time allows.

Step 2:

Face Detection & Preprocessing

Use OpenCV Haar Cascades or Dlib for face detection, convert to grayscale, resize to 48x48 pixels, normalize for better convergence.

Step 3:

Emotion Classification Model

Train a CNN with convolution, pooling, and dense layers. Optionally fine-tune a pre-trained model like MobileNet or VGG16 for faster and more accurate results.

Step 4:**Real-Time Video Integration**

Capture webcam feed, detect faces, preprocess, predict emotions, and overlay labels on video frames using OpenCV.

Step 5:**User Interface**

Build with Tkinter (desktop) or Streamlit (web). Show live video feed, emotion labels, and real-time emotion trend charts.

Step 6:**Testing & Optimization**

Evaluate accuracy, F1 score, FPS, and memory usage. Apply pruning, quantization, or faster face detection methods to optimize.

4. Summary & Future Scope

This project will deliver a real-time emotion recognition system. Initial focus is on building a working pipeline and achieving smooth real-time performance. Future improvements may include time-series emotion tracking for mood trend analysis.