

Project Proposal: Facial Emotion Recognition Analysis

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1. Problem Description

The objective of this project is to build a computer vision model capable of classifying human facial expressions into discrete emotion categories. This is a multi-class classification problem. I aim to compare the effectiveness of Deep Learning (which captures spatial features) against a traditional Machine Learning baseline on raw pixel data.

2. Dataset

I will use the **Human Face Emotions** dataset available on Kaggle.

- **Link:** <https://www.kaggle.com/datasets/samithsachidanandan/human-face-emotions>
- **Description:** The dataset consists of folder-separated images of human faces.
- **Target Variable:** There are 5 emotion classes: *Angry*, *Fear*, *Happy*, *Sad*, *Surprise* with approximately 60k examples total.

3. Modeling Algorithms

I intend to implement and compare two distinct approaches:

- **Baseline Model (Decision Tree):** To demonstrate the difficulty of image classification without feature extraction, I will use a Decision Tree Classifier (Scikit-Learn).
- **Primary Model (CNN):** I will build a Convolutional Neural Network using Keras/TensorFlow.

4. Expected Outcomes

- **Quantitative Evaluation:** I will primarily compare the models using accuracy. I hypothesize the CNN will achieve a high accuracy, while the Decision Tree will struggle to generalize on raw pixels.
- **Training Diagnostics:** I will plot training vs. validation loss curves to analyze the learning process. I expect to observe overfitting in the Decision Tree (high training accuracy, low test accuracy) compared to the regularized CNN.
- **Error Analysis:** Beyond a simple score, I will generate **Confusion Matrices** to identify specific emotional overlaps (e.g., distinguishing *Fear* vs. *Surprise*). I will also visually display the "top 5 worst misclassifications" to understand where the model fails.