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**Project Title:**

**Emotion Recognition from Facial Expressions Using Deep Learning**

**Problem Statement**

In human communication, facial expressions are critical for conveying emotions. Automating the recognition of emotions from facial images can significantly enhance applications in human-computer interaction, mental health monitoring, and customer feedback systems. This project aims to develop a machine learning model that accurately classifies facial expressions into one of seven emotion categories using the FER-2013 dataset.

**Objectives**

* To preprocess and explore the FER-2013 dataset for model training.
* To build and evaluate deep learning models (especially CNNs) for facial emotion recognition.
* To compare model performance using key metrics such as accuracy, precision, recall, and F1-score.
* To develop a system with an interactive interface that allows users to input a facial image and receive a reliable classification into one of the seven emotions.

**Proposed Methodology**

1. **Data Preprocessing**
   * Normalize pixel values and resize images if necessary.
   * Apply data augmentation techniques (rotation, flipping, zooming) to prevent overfitting.
   * Visualize class distributions to identify and address any class imbalance.
2. **Model Selection & Training**
   * Use Convolutional Neural Networks (CNNs) as the primary architecture due to their effectiveness in image classification tasks.
   * Experiment with different architectures such as:
     + Simple CNN
     + VGG-like CNN
   * Train models using cross-entropy loss
3. **Evaluation**
   * Evaluate model using validation and test sets.
   * Use confusion matrix and classification report for deeper insight into model performance.

**Dataset Description**

* **Source**: Kaggle - [FER-2013 Facial Expression Recognition Dataset]
* **Size**:
  + Training Set: 28,709 grayscale 48x48 images
  + Test Set: 3,589 images
* **Labels**:
  + Angry (0), Disgust (1), Fear (2), Happy (3), Sad (4), Surprise (5), Neutral (6)

**Expected Outcomes**

* A trained and validated deep learning model for facial emotion classification.
* A detailed evaluation report showcasing model performance on unseen data.
* Insight into which emotions are harder to classify and why.
* An interactive demo (e.g., using Streamlit) for real-time predictions.

| **Day** | **Activities** |
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| **Day 1** | Explore and preprocess the FER-2013 dataset (normalization, resizing, splitting). Apply basic data augmentation if needed. |
| **Day 2** | Build and train a baseline CNN model; tune architecture and hyperparameters. Evaluate performance using validation set. |
| **Day 3** | Develop a Streamlit-based interactive interface for emotion prediction. Integrate the model and test with sample inputs. |