# Project Title:

**Facial Emotion Recognition using Deep Learning**

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## Project Description

This project aims to build a deep learning model capable of recognizing human emotions from facial expressions. Using the **FER2013 dataset**, which consists of 48x48 pixel grayscale images of faces categorized into seven emotions (**Angry, Disgust, Fear, Happy, Sad, Surprise, Neutral**), the project explores various model architectures, including:

1. **Custom CNN from Scratch**
    - A Convolutional Neural Network (CNN) is built from scratch to extract features from facial images and classify emotions.
2. **Custom CNN with Augmentation**
    - Image augmentation techniques are applied to the training data to improve the model's generalization ability and prevent overfitting.
3. **Transfer Learning with VGG16**
    - A pre-trained VGG16 model is used as a feature extractor, and a custom classification layer is added on top to classify emotions.
4. **Transfer Learning with ResNet50**
    - Similar to VGG16, a pre-trained ResNet50 model is employed for feature extraction followed by a custom classification layer.

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## Project Goals

- Develop a deep learning model to accurately classify emotions from facial images.
- Compare the performance of different model architectures.
- Evaluate the effectiveness of image augmentation techniques.
- Achieve high accuracy on the FER2013 dataset.

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## Methodology

1. **Data Preparation**

    - Download and preprocess the FER2013 dataset, including data cleaning and analysis.
2. **Model Development**
    - Construct and train CNN models using **TensorFlow** and **Keras**.
3. **Model Evaluation**
    - Evaluate model performance using metrics like **accuracy, precision, recall, and F1-score**.
    - Generate confusion matrices and classification reports to analyze the model's predictions.
4. **Model Optimization**
    - Tune hyperparameters and explore image augmentation techniques to improve model performance.
5. **Making Predictions**
    - Use the trained model to make predictions on new facial images and visually assess its performance.

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# Expected Outcomes

- A robust deep learning model capable of accurately recognizing human emotions from facial expressions.
- Insights into the strengths and weaknesses of different model architectures.
- Understanding of the impact of image augmentation on model performance.
- A system that can be further developed for real-world applications, such as human-computer interaction and emotion analysis.