PROJECT REPORT **-Bhumi Prajapati**

HUMAN FACE EMOTION DETECTION USING CNNS

Project Overview

The *Human Facial Emotion Detection* project aims to identify and classify human facial emotions using advanced computer vision techniques and deep learning architectures. This project was motivated by the growing need for emotion recognition in various applications, including mental health assessment, customer experience enhancement, and human-computer interaction systems. The goal was to develop a robust and efficient model capable of recognizing emotions from facial images.

Technical Stack

The following technologies and frameworks were utilized to design, train, and evaluate the models:

1. **Python**: The primary programming language for implementing the project due to its versatility and extensive libraries for machine learning and computer vision.
2. **TensorFlow & Keras**: These frameworks were employed to construct, train, and fine-tune deep learning models.
3. **Deep Learning and Neural Networks**: Convolutional Neural Networks (CNNs) were used as the backbone architecture for emotion classification.
4. **Transfer Learning**: Pre-trained models such as **VGG16** and **ResNet50** were fine-tuned to improve performance and reduce training time.
5. **Data Augmentation**: Techniques such as rotation, flipping, zooming, and brightness adjustment were applied to enhance model generalization and robustness against overfitting.
6. **Computer Vision**: Image preprocessing techniques like resizing, normalization, and grayscale conversion were employed to prepare the dataset for training.

Project Implementation

1. **Dataset url:** https://www.kaggle.com/datasets/msambare/fer2013

Dataset has nearly 28000-30000 images of human facial expressions with 7 classes of emotions

[Happy, Sad,Angry,Surprise,Disguise,Fear,Neutral]

2. **Model Development**:
    - Multiple **Custom CNN** architectures were developed to explore various hyperparameters and design options.
    - **Transfer Learning** was employed using VGG16 and ResNet50, leveraging pre-trained weights to boost accuracy and speed up training.
3. **Evaluation and Comparison**:
    - Over 20 machine learning and deep learning models were evaluated.
    - A comprehensive comparison was conducted to identify the best-performing architecture.
4. **Final Model**: The ResNet50 model, enhanced with transfer learning and data augmentation, achieved the best results with an accuracy of approximately **58%**.

Challenges and Solutions

1. **Class Imbalance**: Addressed using data augmentation techniques to ensure sufficient representation of minority classes.
2. **Overfitting**: Mitigated through techniques like dropout layers, weight regularization, and augmentation.
3. **Limited Accuracy**: Leveraged transfer learning and extensive hyperparameter tuning to improve accuracy, though achieving higher precision remains an area for further exploration.

Project Results

- The project achieved an accuracy of **58%**, demonstrating the effectiveness of transfer learning and advanced data augmentation.
- The comprehensive evaluation of multiple models provided insights into the strengths and weaknesses of various architectures for facial emotion detection.