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Facial Emotion Recognition

Motivation:

Recognizing human emotions from facial expressions is a core component of intuitive human–computer interaction. While many state-of-the-art approaches rely heavily on pre-trained models, this project focuses on designing and training a CNN from scratch, to better understand the core mechanisms of feature extraction, optimization, and representation learning in deep networks.

Problem:

The objective is to classify facial images into basic emotion categories (happiness, sadness, neutral…). The task presents significant challenges due to intra-class variability and subtle differences between emotions.

Methodology:

- *Dataset*: RAF-DB. Standard preprocessing steps include face detection/alignment, resizing, and normalization.
- *Model*: A custom CNN architecture with stacked convolutional blocks, batch normalization, ReLU activations, pooling, and a final global average pooling classifier.
- *Training*: Cross-entropy loss, mini-batch SGD/Adam optimization, data augmentation (flips, slight rotations, brightness variations), and early stopping to reduce overfitting.
- *Evaluation*: Accuracy and macro-F1 score on a held-out test set, along with confusion matrix analysis.

Expected Outcome:
A robust and interpretable emotion classifier demonstrating the performance over a baseline model.

Perspective (Future Work): Extend the architecture to a multi-task setup predicting emotion, age group, and gender jointly.