FACECOM Technical Summary: Gender Classification & Robust Face Recognition

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Overview

This project addresses the dual objectives of the **FACECOM** challenge: (A) Gender classification and (B) Face recognition under distortions. A unified deep learning pipeline is developed using TensorFlow and pre-trained models in Colab.

Dataset

FACECOM contains >5,000 face images under distortions like motion blur, fog, glare, and low-light. Annotations include gender (binary) and identity (multi-class). Splits: 70% train, 15% validation, 15% test.

Approach

Task A – Gender Classification:

- Custom CNN and VGG-based transfer learning.
- Class weights to handle male-dominant skew.
- Augmentation: rotation, zoom, shift, flip.
- Two-stage training: freeze then fine-tune top conv layers.

Task B – Face Recognition:

- EfficientNetB2 with full fine-tuning.
- Unified DataFrame from both clear and distorted samples.
- Stratified 80-20 split for robust testing.
- Augmentation and dropout to prevent overfitting.

Architecture

Task A: Pretrained CNN (e.g., VGG16) $\rightarrow$ Flatten $\rightarrow$ Dense(256) $\rightarrow$ Dropout(0.5) $\rightarrow$ Sigmoid
Task B: EfficientNetB2 $\rightarrow$ GlobalAvgPool $\rightarrow$ Dropout(0.3) $\rightarrow$ Dense(#IDs, Softmax)

Innovations

- Distortion-aware data integration.
- Unified label encoding across variants.
- Two-stage fine-tuning for better generalization.
- Augmentation policies tailored to low-light and motion blur.

Results

Task A:

- Accuracy: **69%**, Macro F1: **0.50**
- Female class underrepresented, affecting recall.

Task B:

- Accuracy: **99.3%**, Macro F1: **0.994**
- Near-perfect classification despite visual distortions.

Conclusion

The proposed pipeline demonstrates high accuracy for both semantic and identity-based face tasks. Improvements for gender fairness and model compression are planned for future work.