Task A – Gender Classification (Binary)

OBJECTIVE: To build a deep learning-based model that accurately classifies facial images as either **Male (0)** or **Female (1)** while accounting for variations in lighting, pose, and facial expressions.

MODEL ARCHITECTURE:

- **Backbone:** EfficientNetV2-S (transfer learning via timm)
- **Classifier Head:**
  - Linear (in_features → 256)
  - ReLU + Dropout(0.5)
  - Linear (256 → 1)
  - Sigmoid activation for binary probability

TRAINING STRATEGY:

Loss Function: Binary Cross-Entropy with Logits (BCEWithLogitsLoss) and class imbalance weighting
Optimizer: AdamW
Scheduler: CosineAnnealingWarmRestarts
Transformations (Albumentations):

- RandomCrop, HorizontalFlip, Brightness/Contrast adjustments
- CoarseDropout for robustness

EVALUATION RESULT: Evaluation was performed on the best-performing checkpoint selected by F1-score on the validation set.

Dataset	Accuracy	Precision	Recall	F1-Score	Correct / Total
Train	99.79%	98.99%	100.00%	99.49%	1922 / 1926
Validation	97.87%	94.44%	97.14%	95.77%	413 / 422

The model shows excellent generalization with nearly perfect accuracy on training data and strong performance on unseen validation samples.

Task B – Face Recognition (Multi-class)

OBJECTIVE: To develop a face recognition model that generates **512-dimensional embeddings** capable of identifying individuals—even under heavy **image distortions** like blur, noise, low-light, and fog—using **similarity-based matching**.

MODEL ARCHITECTURE:

- **Backbone:** ResNet50 (no final classification head)
- **Feature Output:** 2048-D vector from final layer
- **Embedding Projection:** Linear layer → 512-D embedding
- **Normalization:** L2 (unit vector embeddings) for cosine similarity
- **Output:** 512-D normalized embedding used for FAISS-based retrieval

TRAINING STRATEGY:

- **Loss Function:** Triplet Margin Loss (Anchor, Positive, Negative)
- **Dataset Strategy:** Triplet sampling from both original and distorted images
- **Data Augmentations:** Blur, CoarseDropout, Contrast, etc.
- **Evaluation Pipeline:**
  - Embeddings indexed using **FAISS**
  - Identity matching via cosine similarity
  - Threshold-based verification (best @ **0.80**)

EVALUATION RESULT: Evaluation metrics were computed using FAISS similarity search on the best model (selected via macro-F1 score on validation set).

Dataset	Accuracy	Precision	Recall	Macro-F1	Threshold
Train	85.83%	85.95%	85.04%	85.38%	0.80
Validation	88.39%	88.23%	88.58%	88.32%	0.80

The model performs robustly on identity recognition despite distortions, maintaining high generalization and precision in a multi-class scenario.