Technical Summary: COMSYS 5 Competition

Task A: Gender Classification\ Objective: Classify facial images into male or female categories.

Data Exploration:

- Class imbalance observed: 1623 male vs. 303 female images.

Preprocessing:

- Random undersampling applied to balance the dataset.
- Augmentations used: resizing, horizontal flips, color jittering, and random rotations.

Model Architecture:

- Backbone: ConvNeXt-tiny (from timm), pretrained.
- Classifier: Single-layer linear head.

Loss:

- Focal Loss with label smoothing (smoothing=0.1, gamma=2, alpha=1).

Training Setup:

- Optimizer: AdamW (lr=1e-4).
- Scheduler: CosineAnnealingLR.
- AMP (Automatic Mixed Precision) enabled.

Results:

- Highest validation accuracy: 98.93%.
- Best model checkpoint saved.

Frameworks & Tools: PyTorch, timm, torchvision, PIL.

Task B: Face Verification (Siamese Network)\ Objective: Determine whether two facial images represent the same individual.

Data Exploration:

- Variations observed: distorted, blurred, and augmented images under same identity folder.

Approach:

- Reformulated as a similarity task using image pairs.
- Pairs labeled as same (1) or different (0).

Preprocessing:

- Flattened distortion subfolders.
- Augmentations: resize, brightness/contrast shifts, rotation, normalization (Albumentations).

Model Architecture:

- Siamese Network with ConvNeXt-Atto encoder.
- Projection head: 512 → 128 with ReLU and L2 normalization.

Loss Function:

- Contrastive Loss (margin = 1.0).

Training Setup:

- Optimizer: AdamW (lr=1e-4).
- Scheduler: CosineAnnealingLR.
- AMP-enabled training.

Evaluation Metrics:

- Accuracy, Precision, Recall, F1-score on pairwise predictions.

Results:

- Highest validation accuracy: 97.4%.

Frameworks & Tools: PyTorch, timm, albumentations, sklearn.

General Notes:

- ConvNeXt-Atto and ConvNext-Tiny served as a lightweight and effective backbone.
- Undersampling and contrastive learning strategies addressed data imbalance and variation.
- All models trained and evaluated on compact datasets with efficient architectures.