COMSYS Hackathon-5 2025: Technical Summary

❑ **Title:** Robust Gender Classification & Face Recognition under Adverse Visual Conditions.

- **Team Leader:** Sobhan Roy
- **Team Members:** Annick Das, Suchismita Bakshi
- **Affiliation:** Techno International New Town
- **Contact:** roysobhan.sr@gmail.com

❑ **Problem Statement:**

Develop robust AI models to handle real-world face data under challenging visual conditions (blur, rain, overexposure, sunny glare, motion, noise).

❑ **Tasks:**

- ✅ Task A: Gender Classification (binary: Male/Female)
- ✅ Task B: Face Recognition (identity matching with multiple classes)

❑ **Solution Overview**

Our solution consists of two optimized pipelines designed to handle image distortions:

1️⃣ Gender Classification

- Backbone: MobileNetV2 (pre-trained on ImageNet).
- Preprocessing: Resizing, normalization, data augmentation.
- Class Imbalance: Weighted loss and oversampling of minority class.
- Head Layers:
  - Global Average Pooling → Dense(512, ReLU) → Dropout → BatchNorm
  - Dense(256, ReLU) → Dropout → BatchNorm
  - Dense(1, Sigmoid) for binary output.
- Loss: Binary crossentropy.

2 Face Recognition

- Backbone: InsightFace ArcFace (buffalo_l) for robust face embeddings.
- Preprocessing: Denoising, CLAHE, histogram equalization for distorted images.
- Embeddings: Normalized 512-dimensional vectors, averaged across multiple images per identity.
- Classifier: SVM with GridSearchCV for hyperparameter tuning.
- Matching: Cosine similarity with thresholding for unknown faces.

3 Data Augmentation

- Horizontal flips, brightness/contrast shifts, fog, rain, motion blur.
- Simulates real-world conditions for improved generalization.

4 Test-Time Augmentation

- Generates multiple augmented versions at inference time.
- Ensemble predictions for more robust output under distortions.

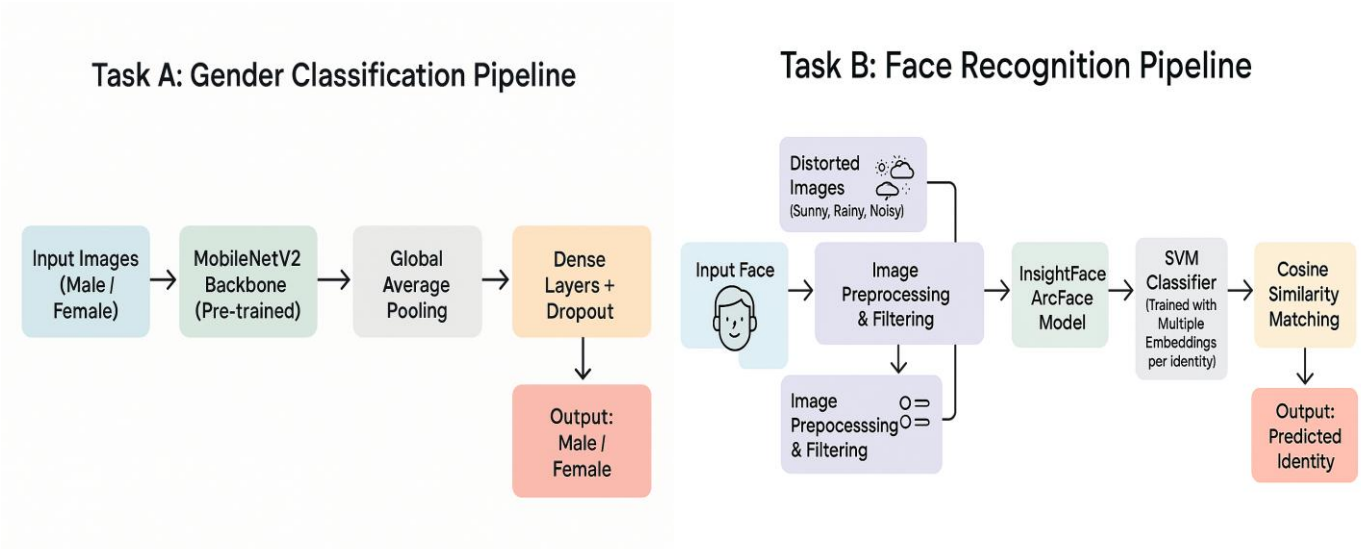
Evaluation & Results

Task	Accuracy	Precision	Recall	F1-Score
Gender Classification	**0.91**	**0.91**	**0.91**	**0.91**
Face Recognition	**0.97**	**0.98**	**0.97**	**0.97**
Final Weighted Score	**0.94**	—	—	—

❑ Key Innovations

- Embedding-based face recognition for higher robustness than plain classification.
- Advanced preprocessing pipeline to handle rain, glare, and blur distortions.
- MobileNetV2 + class weighting for balanced gender prediction.
- Automated SVM tuning for better identity matching.
- Clear separation of pipelines for modular improvements.

Architecture Diagram



Contact

Sobhan Roy , Annick Das, Suchismita Bakshi

Techno International New Town

roysobhan.sr@gmail.com , annickdas017@gmail.com , suchismitabakshi25k@gmail.com