

# COMSYS Hackathon-5 2025: Technical Summary

## Title:

Robust Face Recognition & Gender Classification under Adverse Visual Conditions

## Team:

- **Team Leader:** Debsmit Ghosh
- **Team Members:** Anuksha Ganguly, Ujan Das
- **Affiliation:** Techno International Newtown
- **Contact:** ghosh.debsmit1611@gmail.com

## Problem Statement

Develop robust AI models for:

- **Task A:** Gender Classification (binary: Male/Female)
- **Task B:** Face Recognition (identity matching, multi-class)

using the **FACECOM** dataset, which contains faces under challenging conditions (blur, fog, rain, low-light, overexposure, etc.).

## Solution Overview

Our solution consists of two specialized pipelines (see architecture diagram below):

### 1. Face Matching (Siamese Network with Triplet Loss)

- **Preprocessing:** CLAHE, gamma correction, bilateral filtering, face alignment.
- **Model:** Siamese network with shared ResNet-50 backbone.

- **Embedding:** 128-dimensional, L2-normalized vectors.
- **Loss:** Triplet loss to maximize inter-class distance and minimize intra-class distance.
- **Matching:** Euclidean distance thresholding for verification.

## 2. Gender Classification (CNN)

- **Preprocessing:** Same as above.
- **Model:** EfficientNet-B3 backbone, followed by:
  - Dense(512, ReLU) → BatchNorm → Dropout
  - Dense(256, ReLU) → BatchNorm → Dropout
  - Dense(1, Sigmoid) for binary output.
- **Loss:** Binary crossentropy.

## 3. Data Augmentation

- **Techniques:** Horizontal flip, rotation, brightness/contrast, fog, rain, motion blur.
- **Purpose:** Simulate adverse conditions and improve generalization.

## 4. Test-Time Augmentation

- Multiple augmented versions per test image.
- Ensemble predictions for robust inference.

## Evaluation & Results

Task	Accuracy	Precision	Recall	F1-Score
Gender Classification	0.92	0.93	0.92	0.91

Face Recognition	0.88	0.88	0.88	0.88
<b>Final Weighted Score</b>	<b>0.89</b>	—	—	—

## Key Innovations

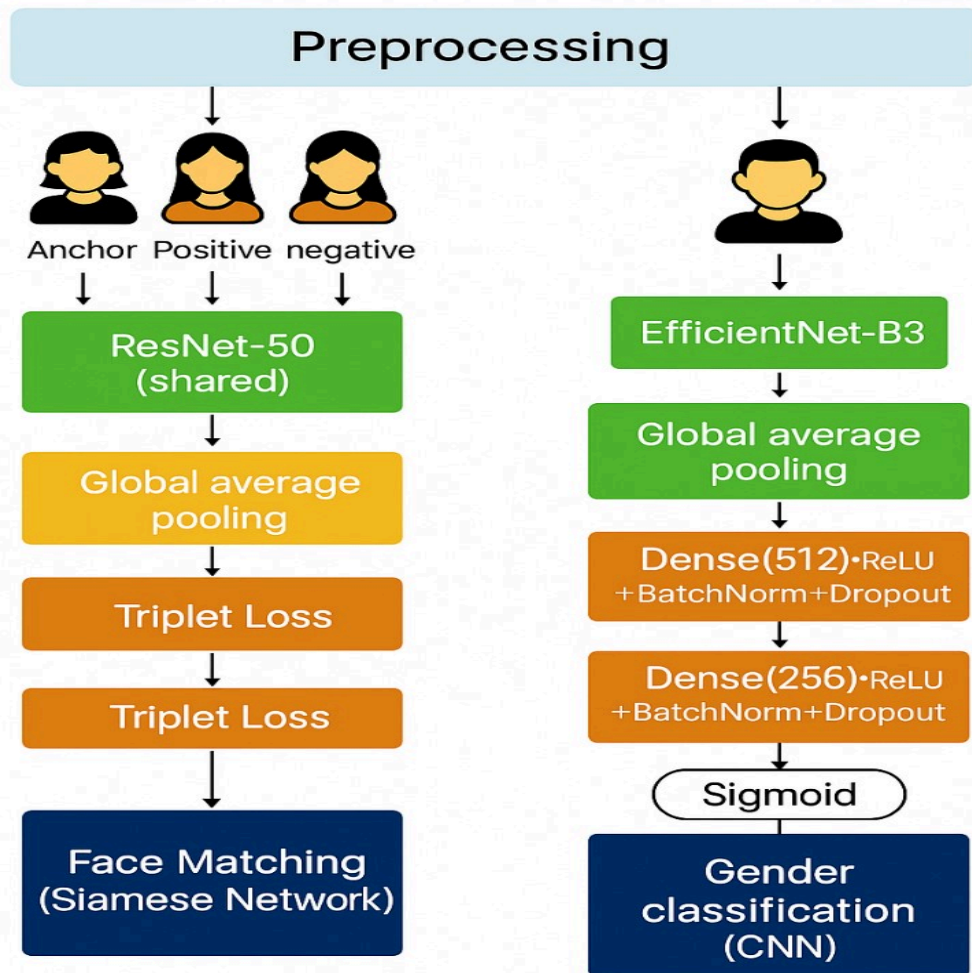
- **Adversarial preprocessing pipeline** for challenging real-world conditions.
- **Siamese network with triplet loss** for robust face verification.
- **EfficientNet-based gender classifier** with advanced regularization.
- **Comprehensive data augmentation** and **test-time augmentation**.
- **Weighted scoring** as per competition rules.

## Limitations & Future Work

- **Extreme occlusion** and very low-resolution faces remain challenging.
- **Future:** Explore transformer-based backbones and self-supervised pretraining for further robustness.

## Architecture Diagram

# COMSYS Hackathon-5 2025



## Contact:

Debsmit Ghosh, Anuksha Ganguly, Ujan Das

Techno International Newtown

[ghosh.debsmit1611@gmail.com](mailto:ghosh.debsmit1611@gmail.com) , [ujan.das.04@gmail.com](mailto:ujan.das.04@gmail.com) , [anukshaganguly@gmail.com](mailto:anukshaganguly@gmail.com)