# **Approach Report**

## **Task A – Gender Classification**

The objective was to classify gender based on image data provided in separate training and validation sets. The dataset exhibited a significant **class imbalance**, which we addressed through **upsampling** of the minority class to ensure balanced input during training.

For feature extraction, we used **EfficientNet-B3** (EffNetB3) to generate deep, high-quality representations of input images. These features were **normalized** to bring consistency across the feature space and improve model convergence.

We opted for a **Voting Classifier** as the final model, combining the strengths of three diverse ensemble learners:

* **Random Forest**
* **XGBoost**
* **CatBoost**

Each model was assigned equal weight, and the final prediction was based on majority voting with a decision threshold set at **0.5**. This ensemble strategy leveraged both bagging and boosting methods to generalize well across data variations.

**Result:** The best validation accuracy achieved was **93.8%**, with performance consistent across validation runs.

## **Task B – Face Recognition**

For face recognition, we employed a **Siamese Network** trained using **Triplet Loss**, a metric-learning approach that encourages the network to learn an embedding space where images of the same identity are close and those of different identities are far apart.

The **embedding model** was based on **MobileNetV2**, modified to output **128-dimensional embeddings** via a final dense layer. The base model was stripped of its classification head and used with global average pooling.

We implemented a **Triplet Generator** that constructs batches containing:

* An **anchor** image
* A **positive** image from the same identity
* A **negative** image from a different identity

This generator dynamically sampled from the dataset to create informative and diverse triplets during training.

The model was trained for **10 epochs** using the **Adam optimizer** with a learning rate of **0.0001**. For evaluation, embeddings were generated for all validation images and compared using **cosine similarity** to find the most similar identities.

**Results:**

* **Top-1 Accuracy:** 98.25%
* **F1 Score:** 0.9826