

Face Recognition and Gender Classification

Task A: Gender Classification

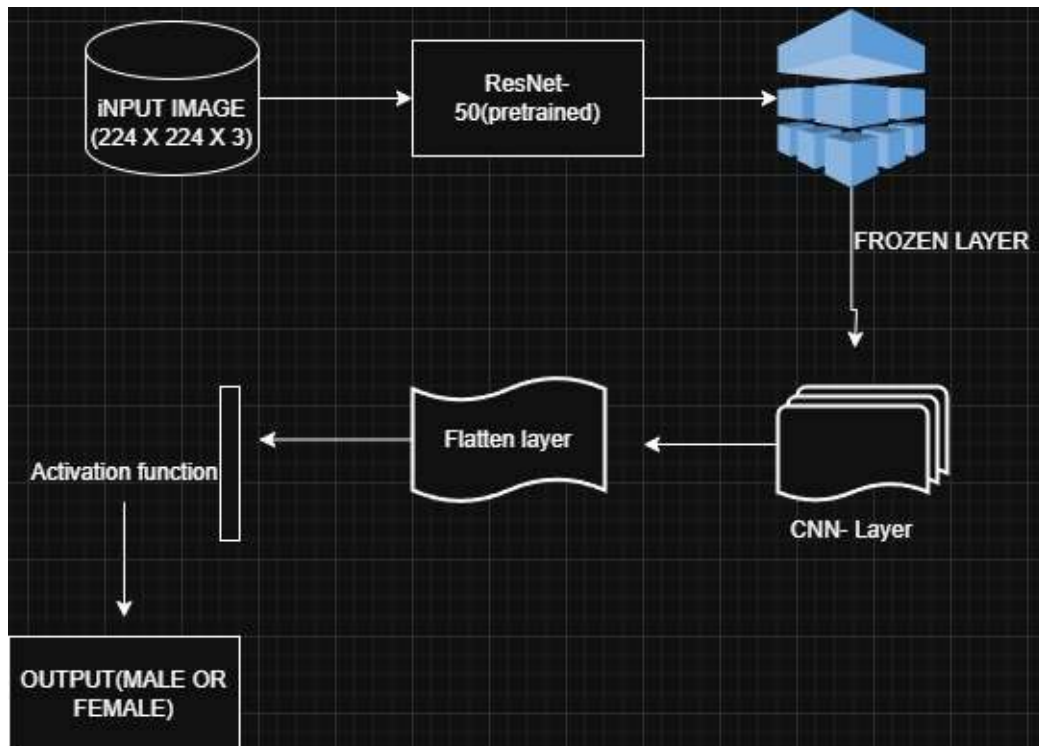
Methodology

1. Data Preprocessing

- Image Augmentation using `ImageDataGenerator` for the training set:
 - Rescaling pixel values to $[0, 1]$
 - Random shearing, zooming, and horizontal flipping
- Resize all images to 224×224

2. Model Architecture

- Used ResNet50 from Keras Applications as the base model, excluding the top classification layer:
- All base model layers were frozen to use pretrained features
- Unfroze the last 10 layers of ResNet50 to adapt to face features relevant to gender
- Flatten \rightarrow Dense(2, activation='softmax')
- Suitable for binary classification (2 output classes)



3. Training Strategy

- **Loss:** `categorical_crossentropy` (since output is one-hot encoded)
- **Optimizer:** Adam
- **Epochs:** 20
- **Batch Size:** 32
- **Metrics:** `accuracy`

4. Handling Class Imbalance

The dataset had a severe class imbalance where $\text{male} \gg \text{female}$. This caused the model to always predict "male".

To overcome that, we computed the class weights dynamically

5. Evaluation

- After training, the model was evaluated using:
 - Accuracy:
 - Precision
 - Recall
 - F1-Score
 - Confusion Matrix

Output



Task B: Face Verification

Methodology

1. Pair Generation

- Positive Pairs (label=1): Original image with its distorted variants (same folder).
- Negative Pairs (label=0): Original image with distorted image of a different person (different folders).
- Balanced dataset using equal number of positive and negative pairs.

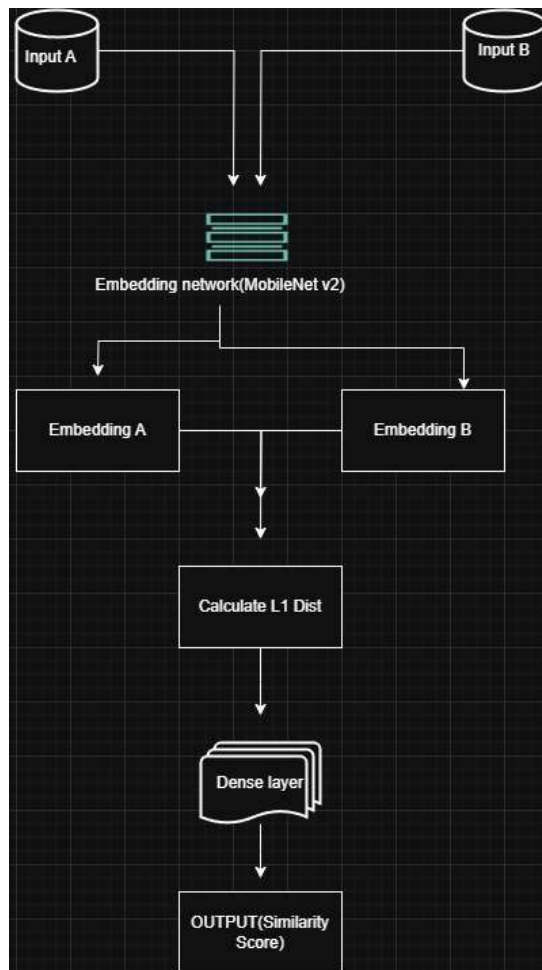
2. Preprocessing

- Resize all images to 160×160
- Normalize pixel values to $[0, 1]$

3. Model Architecture

A Siamese Neural Network composed of:

- MobileNetV2-based embedding model
 - Extracts 128-dimensional embeddings
- L1 Distance Layer
 - Computes absolute difference between embeddings
- Dense layer (sigmoid activation)
 - Predicts similarity score between 0 and 1



4. Training

- Loss: BinaryCrossentropy
- Optimizer: Adam (1e-4)
- Epochs: 5
- Batch Size: 16
- Unfreezes MobileNetv2 after two epochs

Evaluation

Evaluation on validation data includes:

- Prediction of similarity score
- Binarized label: $\text{score} > 0.5 \rightarrow \text{label} = 1$
- Metrics: Accuracy, Precision, Recall, F1 Score
- Visualization:
 - Paired image display with predicted score and true label
 - Confusion Matrix using seaborn

Output

Anchor



Pred: 0.99, Label: 1



Anchor



Pred: 0.26, Label: 0

