



**Faculty of Engineering & Technology**

**Computer Science Department**

**COMPUTER SECURITY – COMP432**

**Facial Recognition System**

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**Section: 2**

# Facial Recognition System Report

## System Design Description:

The facial recognition system implemented in this project utilizes convolutional neural networks (CNNs) for feature extraction and classification of facial images. The system architecture consists of the following key components:

- 1. Data Preprocessing:** The input facial images are preprocessed using techniques such as resizing, data augmentation, and normalization to prepare them for training and testing.
- 2. CNN Architecture:** The model architecture comprises multiple convolutional and pooling layers followed by fully connected layers for classification. Batch normalization and dropout layers are incorporated to improve training stability and prevent overfitting.
- 3. Training:** The model is trained using the ImageDataGenerator to generate batches of augmented images. The training process involves optimizing the categorical cross-entropy loss function using the Adam optimizer.
- 4. Prediction:** Once trained, the model can predict the identity of individuals depicted in facial images by inputting them into the trained network.

## Evaluation Results:

The evaluation of the facial recognition system includes the calculation of various performance metrics such as False Match Rate (FMR), False Non-Match Rate (FNMR), Receiver Operating Characteristic (ROC) curve, and Equal Error Rate (EER). These metrics provide insights into the system's accuracy and efficiency in recognizing faces.

## Performance Factors and Improvements:

Several factors can affect the performance of the facial recognition system, including the quality and diversity of the training data, the complexity of the CNN architecture, and the choice of hyperparameters such as learning rate and batch size. To improve system performance:

- **Data Augmentation:** Further augmenting the training data with additional transformations to increase diversity and robustness.

Test in the application:

With Face Recognition Dataset Contains of Face Data of 31 different classes ( more than 5000 image ):

Model: "sequential"		
Layer (type)	Output Shape	Param #
conv2d (Conv2D)	(None, 222, 222, 32)	896
max_pooling2d (MaxPooling2D)	(None, 111, 111, 32)	0
batch_normalization (BatchNormalization)	(None, 111, 111, 32)	128
conv2d_1 (Conv2D)	(None, 109, 109, 64)	18,496
max_pooling2d_1 (MaxPooling2D)	(None, 54, 54, 64)	0
batch_normalization_1 (BatchNormalization)	(None, 54, 54, 64)	256
conv2d_2 (Conv2D)	(None, 52, 52, 64)	36,928
max_pooling2d_2 (MaxPooling2D)	(None, 26, 26, 64)	0
batch_normalization_2 (BatchNormalization)	(None, 26, 26, 64)	256
conv2d_3 (Conv2D)	(None, 24, 24, 96)	55,392
max_pooling2d_3 (MaxPooling2D)	(None, 12, 12, 96)	0
batch_normalization_3 (BatchNormalization)	(None, 12, 12, 96)	384
conv2d_4 (Conv2D)	(None, 10, 10, 32)	27,680
max_pooling2d_4 (MaxPooling2D)	(None, 5, 5, 32)	0
batch_normalization_4 (BatchNormalization)	(None, 5, 5, 32)	128
dropout (Dropout)	(None, 5, 5, 32)	0
flatten (Flatten)	(None, 800)	0
dense (Dense)	(None, 128)	102,528
dense_1 (Dense)	(None, 31)	3,999

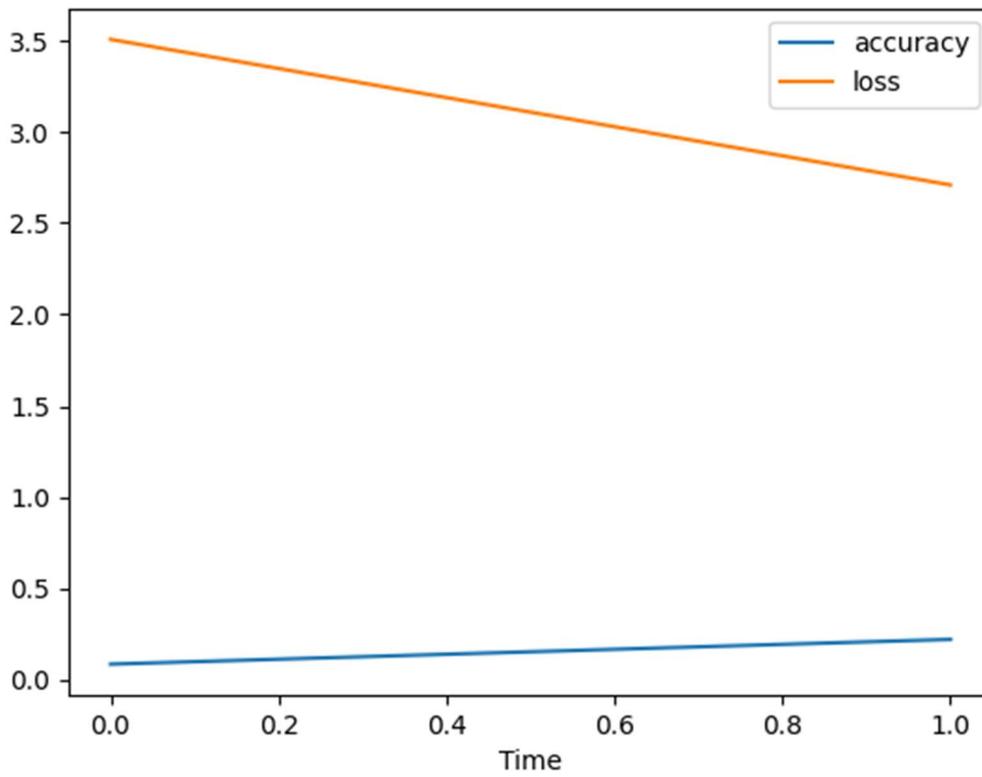
- Total params: 247,071 (965.12 KB)
- Trainable params: 246,495 (962.87 KB)
- Non-trainable params: 576 (2.25 KB)

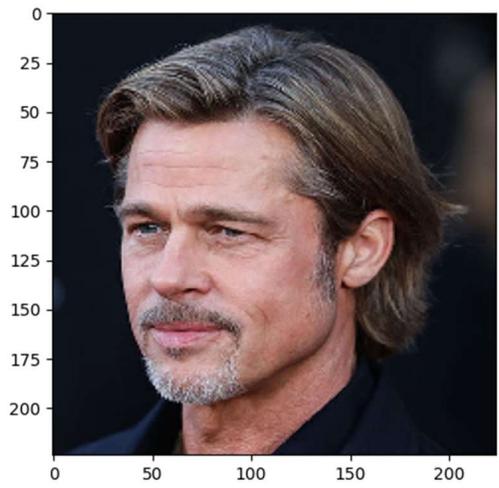
Epoch 1/2

81/81 ————— 70s 787ms/step - accuracy: 0.0649 - loss: 3.7519

Epoch 2/2

81/81 ————— 73s 843ms/step - accuracy: 0.2064 - loss: 2.7671

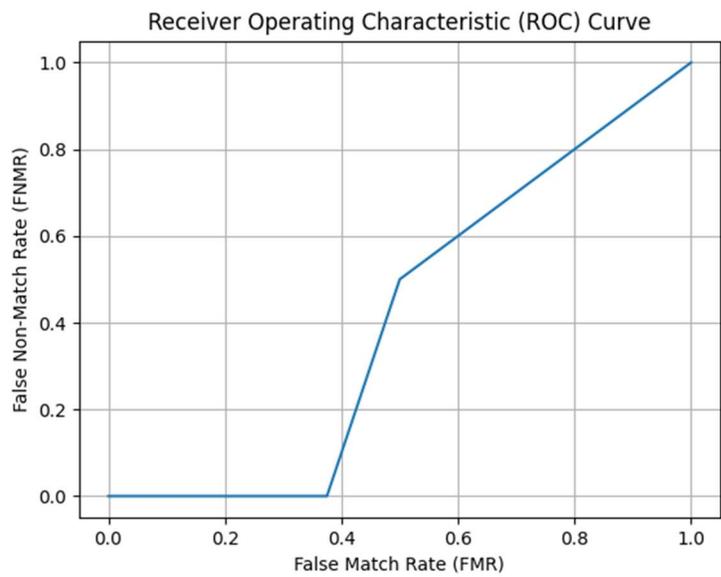




Actual: Brad Pitt

Predicted: Billie Eilish

1/1 ————— 0s 26ms/step



Equal Error Rate (EER): 1.0000 at threshold 0.0000