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FACE RECOGNITION

DAISY: Advance in Artificial Intelligence

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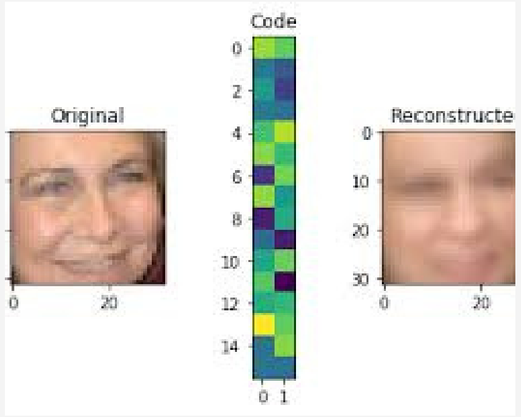
03

OBJECTIVE

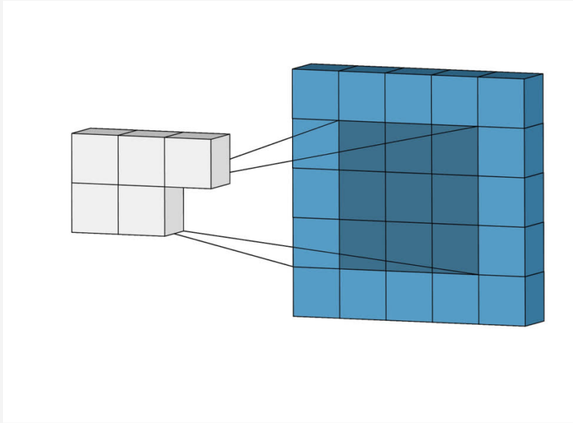
Exploration of two deep learning techniques for image datasets.

The goal is to implement both deep learning models in the face recognition system.



AUTOENCODER

Face reconstruction by using Autoencoder



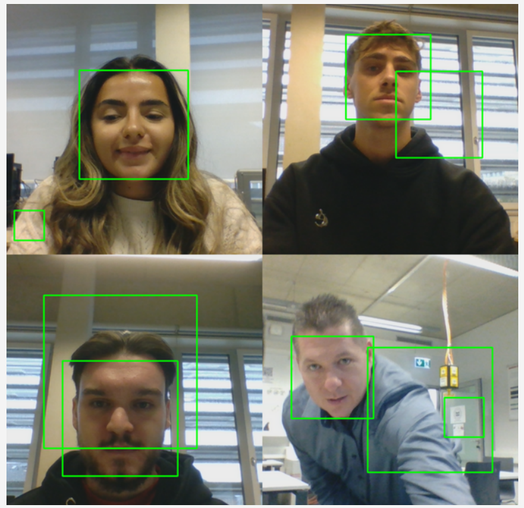
2D CONVOLUTIONAL NEURAL NETWORK

Label prediction on image datasets

DATA PREPARATION

04

- Datasets collection
  - Original images
  - Region of Interest (ROI) - cropped face
  - Total of 9 people with 12 different labels
- Data cleaning
- Metadata as .csv file

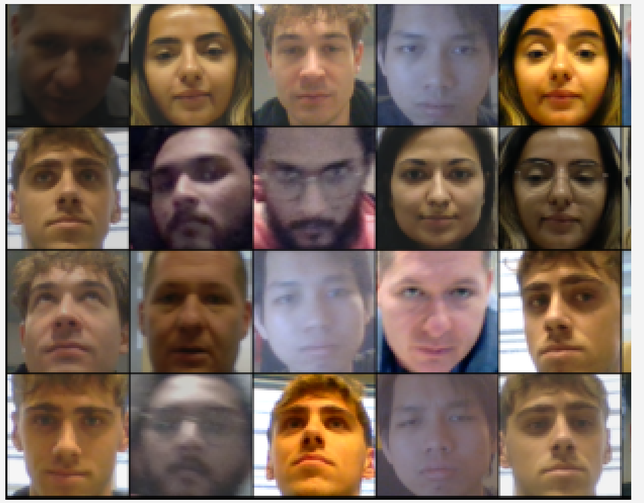


01

Problem in data collection

02

Noise in the datasets



03

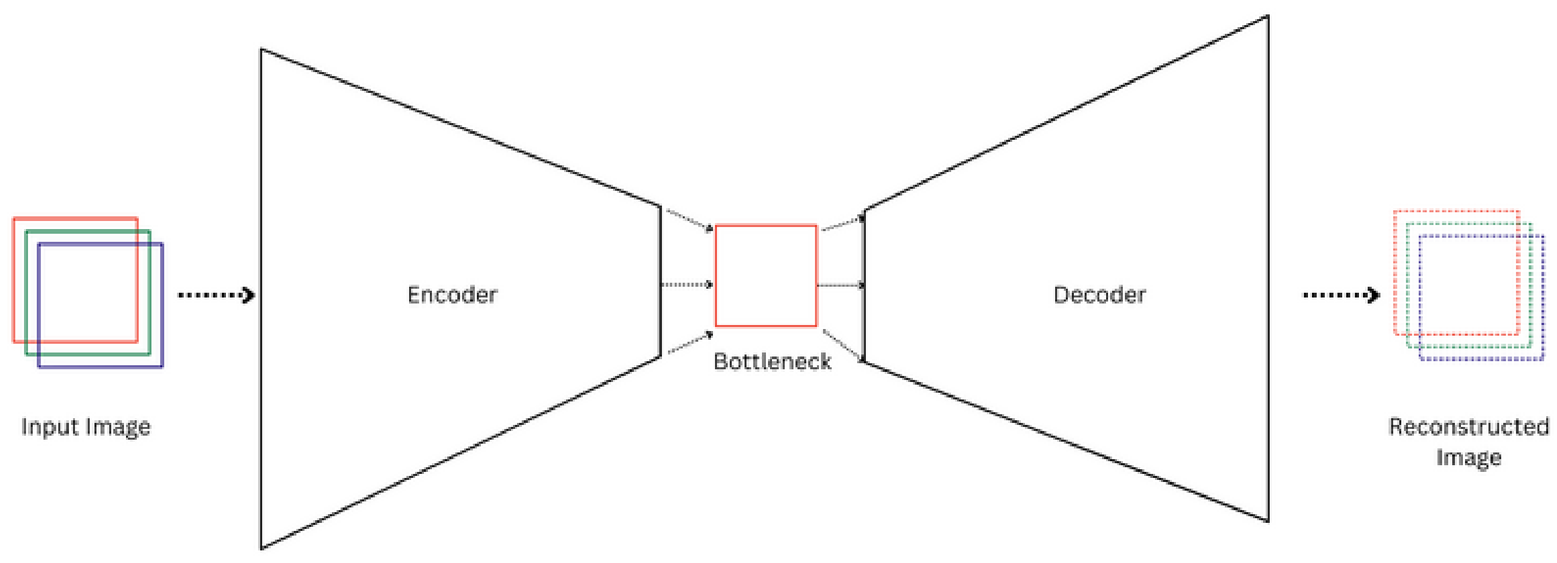
Clean datasets

AUTOENCODER

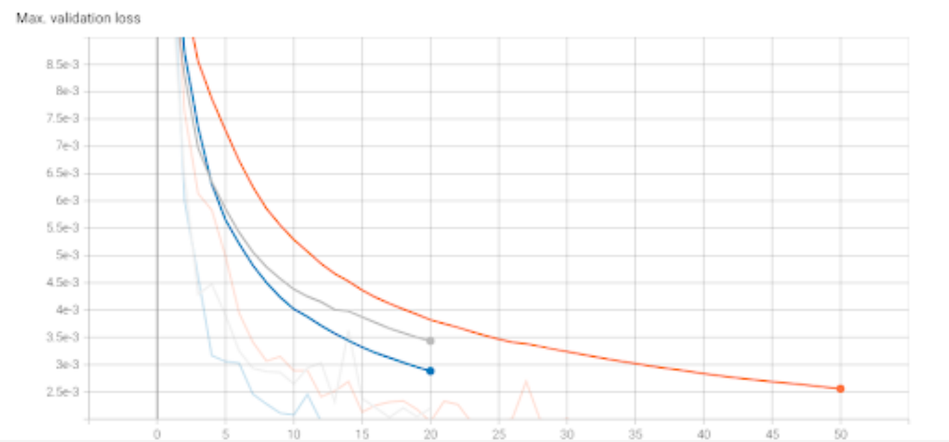
05

GOAL
Reconstruction of known face datasets

HOW-TO
Loss value is calculated between the input and reconstructed image. At the end, we aimed to minimize the loss value to get best reconstruction.



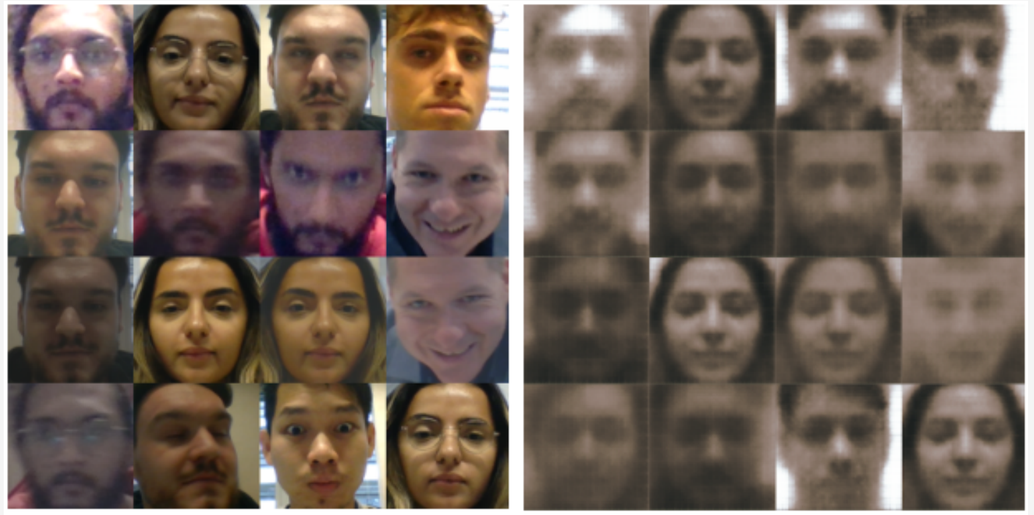
Network structure



Max. validation loss: 0.0015

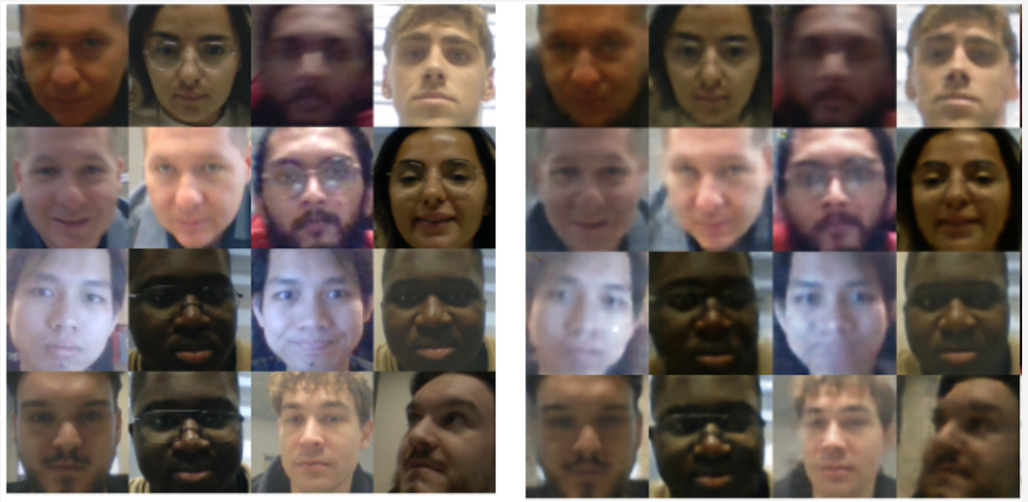
This value is taken as benchmark to determine the best threshold value to distinguish known and unknown faces.

RESULTS



Input image *Reconstructed image*

Face reconstruction at first epoch (1)



Input image *Reconstructed image*

Face reconstruction at last epoch (50)

2D CNN

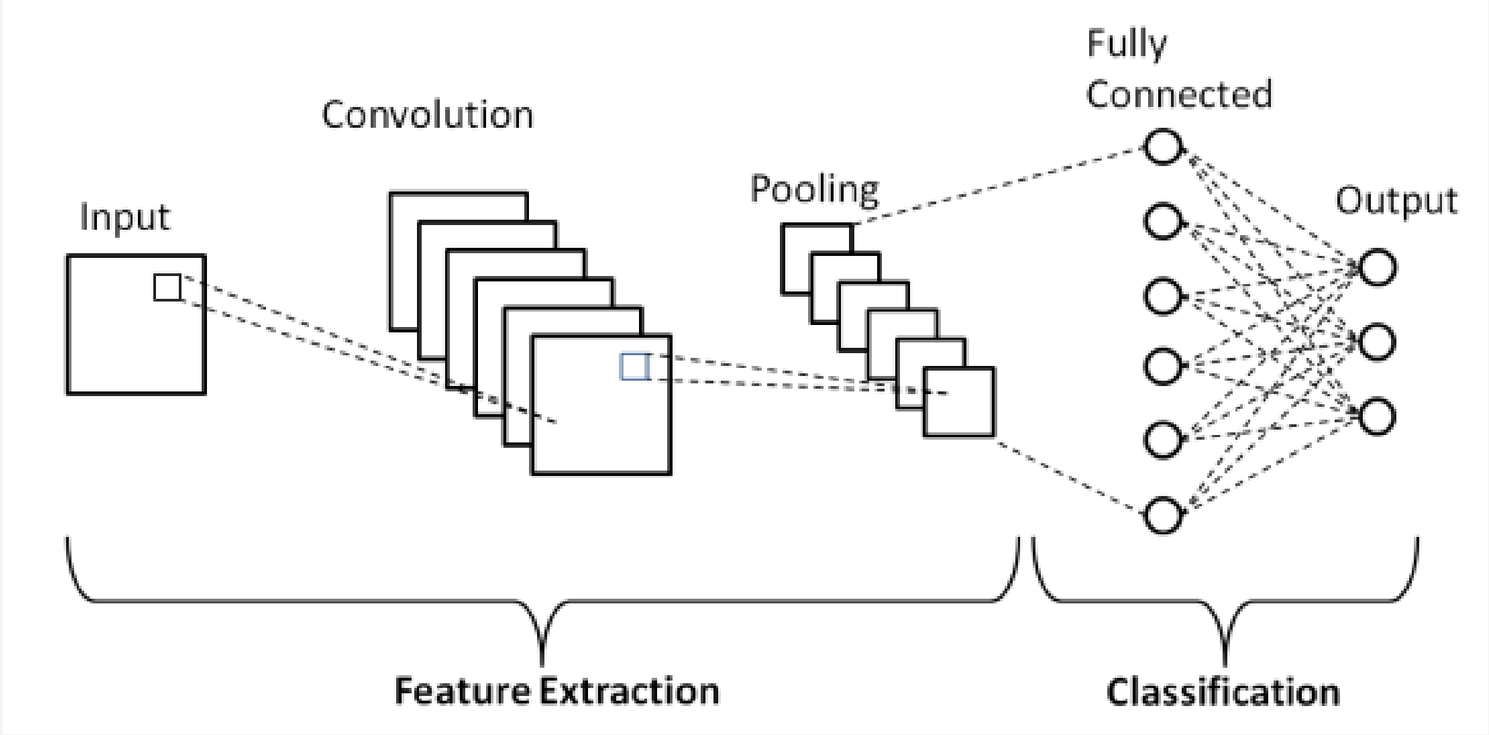
07

GOAL
Label prediction by learning image features

HOW-TO
Cross entropy loss values and accuracy scores calculated for the multilabel (12 labels) predictions. “Best” model is the model with the lowest loss value and highest accuracy score.

INPUT:

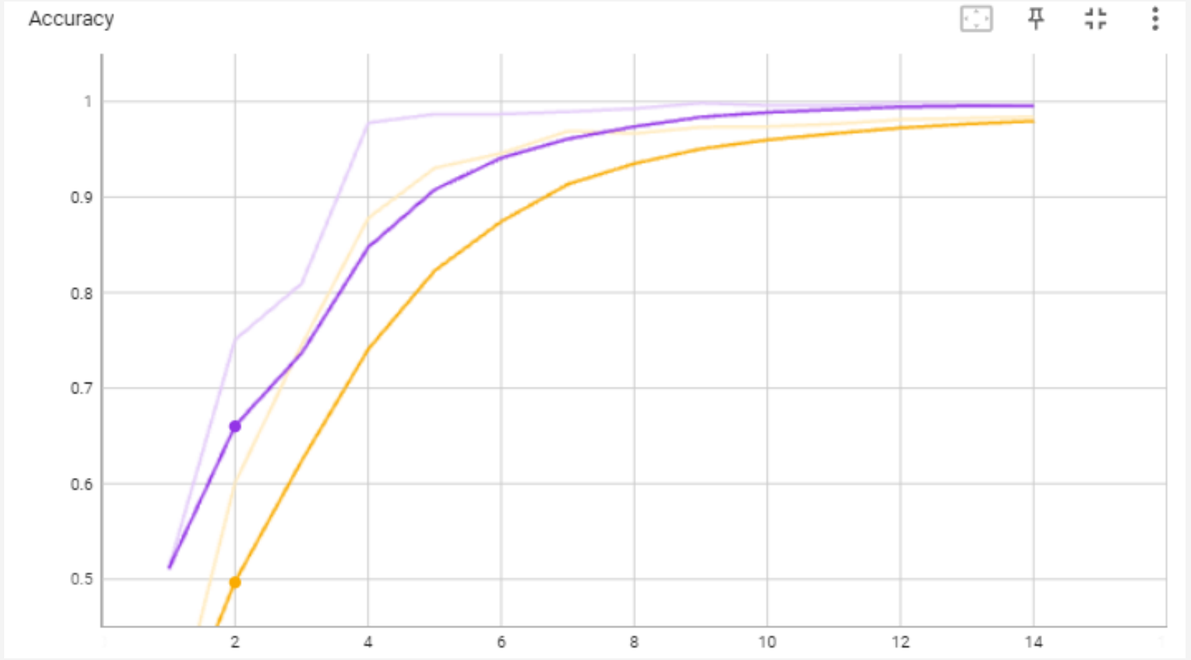
3 CHANNELS (RGB) OF TRANSFORMED IMAGES



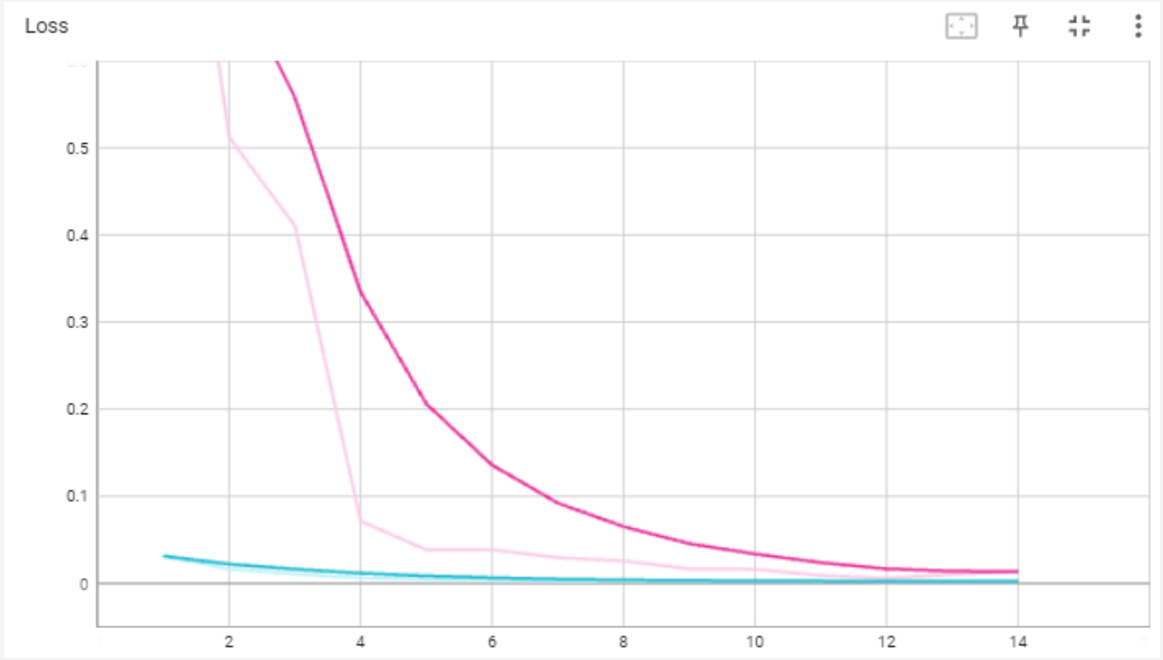
NETWORK STRUCTURE

OUTPUT:

12 VALUES REPRESENTING PREDICTIONS FOR 12 LABELS



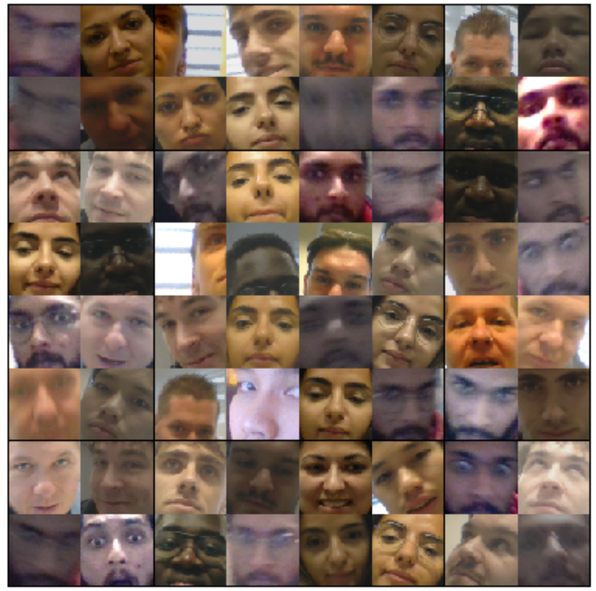
BEST VALIDATION ACC: 99.83%



BEST VALIDATION LOSS : 0.0157

These are the training performances according to our evaluation metrics (CrossEntropyLoss and prediction accuracy). They are obtained by comparing the one hot encoded labels against the model's outputs. After 14 epochs, the samples producing the highest losses are collected.

TOP LOSS SAMPLES
AFTER 14 EPOCHS



RESULTS

FACIAL RECOGNITION

*Launched from main.py script

09

MAIN.PY

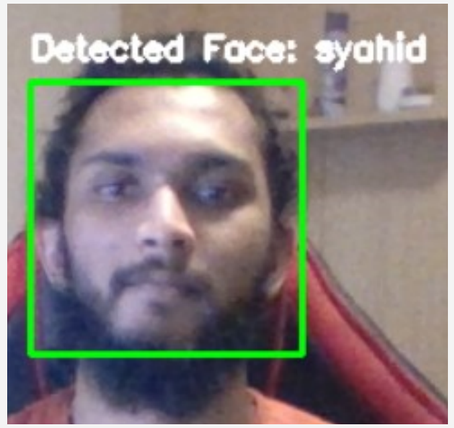
1. The script uses OpenCV for face detection in webcam footage, extracting the face as a region of interest (ROI).

2. Depending on the user's choice, it applies either a CNN or an Autoencoder model, loaded from a checkpoint, to recognize or reconstruct the face.

3. It then evaluates the model's label prediction or image reconstruction against a threshold to label the face as 'Known' or 'Unknown', visually indicating the result with a colored rectangle and text overlay on the footage.

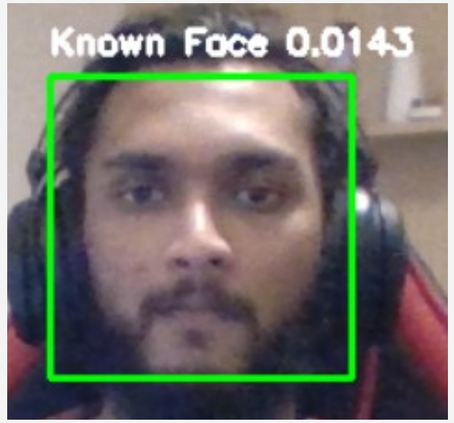
GO TO LIVE DEMO →

EXAMPLE RESULTS

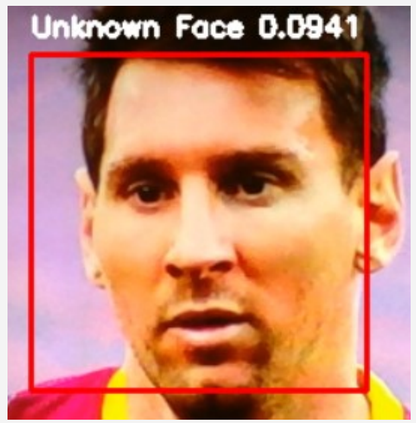


known label for cnn

unknown label for cnn



known face for autoencoder



unknown face for autoencoder

ROOM FOR IMPROVEMENTS

- IMPLEMENT MORE DATA AUGMENTATION TECHNIQUES ON THE AUTOENCODER MODEL.
- RECORD PREDICTIONS FROM EACH LABEL IN A GRID AT CNN'S VALIDATION STAGE TO VISUALIZE MODEL PERFORMANCE BETTER.
- IMPROVE DATA COLLECTION PROCEDURES BY INDUCING MORE IMAGE VARIANCES.
- STANDARDIZE DEPENDENCIES AT AN EARLY STAGE TO AVOID TECHNICAL ERRORS.

THANK YOU

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