Facial Attendance System

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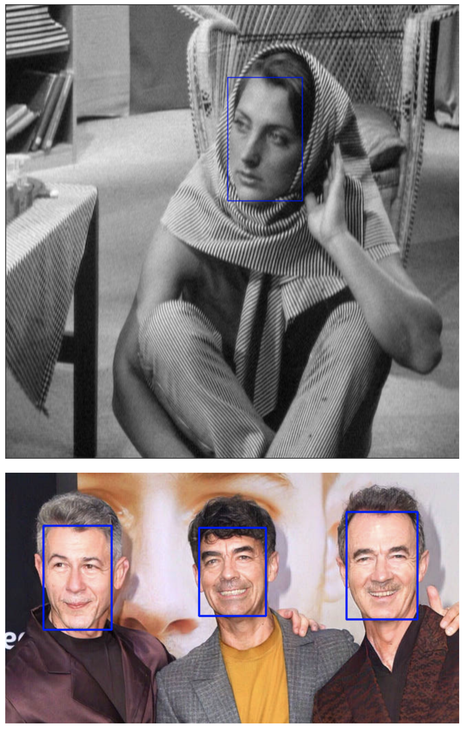
Objectives

For this Project we aim to complete the following objectives:

- Design a Facial way of marking student's/employee's attendance
- Implement state of the art models for face detection and recognition
- Make Model withstand the False Positives
- Avoid duplication in marking the attendance

Introduction

After the covid times, the fingerprint biometric attendance system has become difficult. Even the Physical attendance system has shown its limitations like Proxy before. So, the need of the hour is to go beyond physical and fingerprint biometric attendance systems, .
This statement requires citation [**?**].



Face Detection

Converting the whole image area into embeddings creates unnecessary features which not related to person's identity/face and adds to.
Hence, in the present context of facial attendance we should only keep the image area which correspond to identity(faces) and remove rest image areas.
Thus, we should detect the face regions from images and keep only them for further embeddings calculations.
Dual Shot Face Detector(DSFD) is presently the state-of-the-art face-detector. Here, we use the pre-trained DSFD Model to locate the face regions and return the respective bounding boxes.

No-Reference Image Quality Metric

We have used the **brisque** metric here while calculating the embeddings. If the score from the metric shoots above a certain value, the image is rejected and the user is prompted to add a better image to the dataset.

Extracting Embeddings

Face-detected image are provided as input to the Feature Extractor to calculate the image embeddings. In present case, we use the LightCNN-29V2 model which is the state-of-the-art Face Recognition model and is able to handle noisy images as well. Face Recognition models are trained to extract good face embeddings from the given face images, which then can be used in verification purposes.
Embeddings are extracted from the Face images and stored in DataEncoders. Mapping from the student's/employee's ID to their face's embedding is stored in the .csv file, which act as database for storing a student's ID image embeddings (Institute ID or Aadhar Card). While storing the embeddings, we check if the same person is already there in the database or not, thus removing redundancy.

Face Verification

We use the laptop's camera to continuously gather frames and detect images. If an image contains a face, it's respective bounding box is calculated and the image is cropped according to it. The cropped image is then passed as input to the face embeddings calculator which return an embedding, whose length is 256.
The encodings from DataEncodings.csv are read and stored locally. We use the cosine similarity metric to calculate the similarity between the detected face image and the one's present in the database. The metric ranges from -1 to +1. The higher the score, the higher is the similarity.

Result Calculation

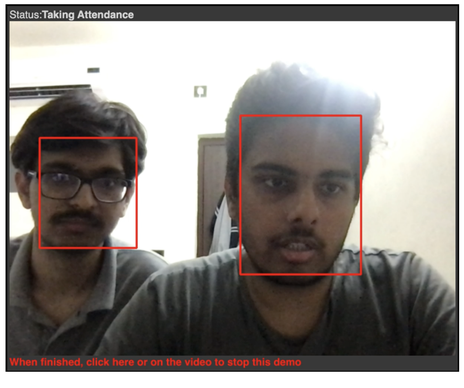


Figure 1:Figure caption

Finally, the similarity scores calculated above are compared and the highest value among them is chosen. If this value lies below a certain threshold, the matching is rejected. Otherwise, the attendance of the person is recorded in the Attendance.csv file, along with the corresponding date and time.

Conclusion

Thus, we have successfully developed a facial way of marking the attendance, which uses the state-of-art face-detection and face-recognition models, capable of adding student to the database with his Institute-ID/Aadhar-ID/other-IDs, marking genuine student's attendance simplistically and even rejecting Proxies by taking cosine score threshold into consideration.

Additional Information

Face Detection and Face Recognition Models are integrated in the system as plug and play. So, these could be changed to other detection or recognition models as per requirements.

References

1. Dual Shot Face Detector
   `https://arxiv.org/pdf/1810.10220.pdf`
2. LightCNN
   `https://arxiv.org/pdf/1511.02683.pdf`

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