Computer Vision Based Attendance System

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Introduction

•Traditionally, Students attendance are marked manually by teachers and make sure correct attendance is marked for respective students. This process wastes a considerable amount of time from teaching process

•The RFID card system, each student assigns a card with their corresponding identity but there is chance of card loss or unauthorized person misuse the card for fake attendance.

•Biometrics such as fingerprint, iris, or voice recognition are expensive to install in all classrooms. This system requires to collect students' personal data which is also a privacy concern

Approach

•Using CV-based Attendance System will reduce the cost of traditional biometric systems, punching machines, and procurement and maintenance of smart card.

•It will reduce any option of duplicity for attendance monitoring as the Person's individual face marks his/her attendance

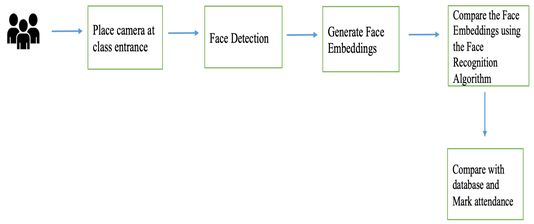
•The system is simpler compared to old methods and saves time and effort in logging attendance thereby increasing productivity.

Why it is hard?

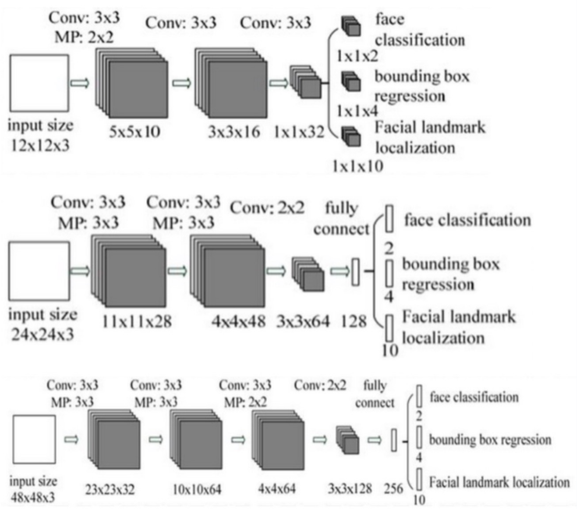
The model faces challenges as images obtained from real time CCTV are mostly occluded, rotated or zoomed out faces, which would require image correction measures

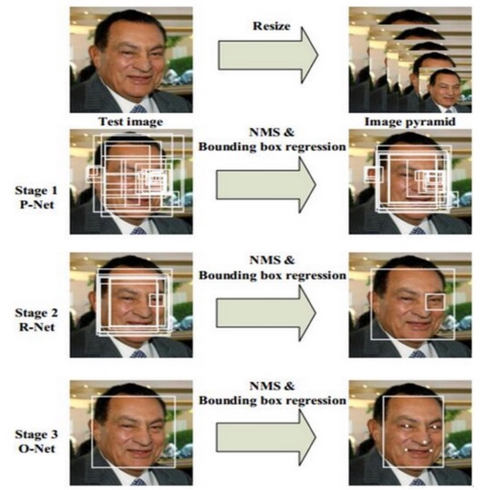
Methodology

To implement the system a Face detection system which identifies and extracts the face of students entering the classroom. This extracted face image of the student is the region of interest which further will be input to face recognition system and will be compared to our database and mark the presence of students. The video of students entering the classroom will be converted as digitalized image using OpenCV library in python and given as input to face detection algorithm and the extracted region of interest will be used in face recognition system. To implement this multi-task convolution neural network (MTCNN) and Arc Face Machine learning model is used.



MTCNN (Face Detection)





ArcFace (Face Recognition)

SoftMax Loss:

$$L_1 = -\log \frac{e^{W_{y_i}^T x_i + b_{y_i}}}{\sum_{j=1}^{N} e^{W_j^T x_i + b_j}}$$

ArcFace Loss Function:

$$L_3 = -\frac{1}{N}\sum_{i=1}^{N} log \frac{e^{s(\cos(\theta + m))}}{e^{s(\cos(\theta + m)) + \sum_{j=1, j \neq y_i}^{n} e^{s \cos \theta_j}}}$$

Results

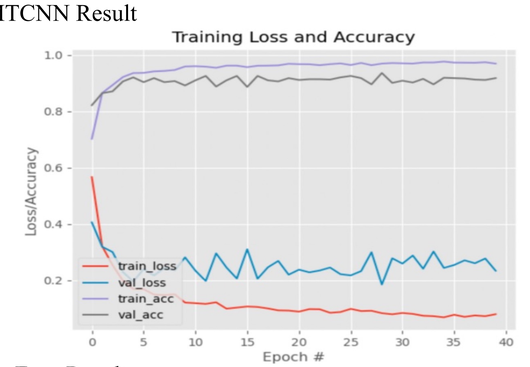
Comparison of Face Detection Algorithm

Methods	Accuracy	Drawback
Eigenface algorithm, PCA and ANN	80%	High computational cost due to combining PCA and ANN
LBP, HOG and SVM	92%	Light sensitivity issues because of LBP
CNN, FaceNet and SVM	95.40%	High computational cost due to combining SVM and CNN
Viola-Jones and CNN	80%	Initial performance on lookalike faces was poor because of the self-learning feature
Haar cascade and LBPH	98.20%	Light sensitivity issues because of LBPH, and Accuracy of 98.20% at 24 lx light and distance of 40 cm
KNN and LBP	95%	Low accuracy in low lighting as pixels change the value with light

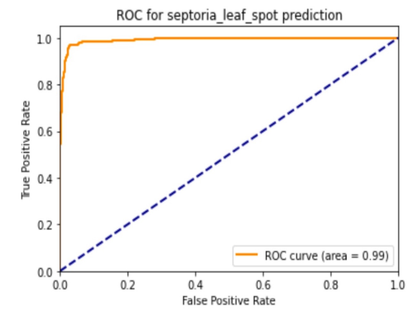
Comparison of Face Recognition Algorithm

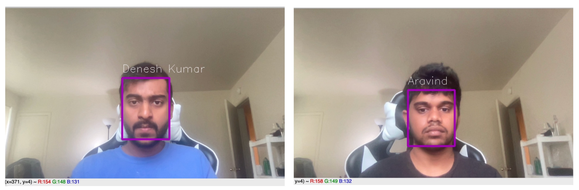
Methods	Accuracy	Drawbacks
Eigenface and PCA	90%	Sensitive to variation in lighting, pose, and expression
Fisherface	95%	Sensitive to light and pose change
LBP	85%	Sensitive to change in illumination and face expression
CNN	98%	Requires large amount of data and computation power
Siamese network	96%	Computationally complex and take more time to compute

MTCNN Result



ArcFace Result





Reference

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