A Mini-Project Report
on
Face Recognition Based Attendance System Using Machine Learning

Submitted in partial fulfillment of the requirements

for the award of degree of

BACHELOR OF TECHNOLOGY

in

Information Technology

by

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(NAAC ‘A’ Grade & NBA Accredited- ECE, EEE, CSE & IT)

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DECLARATION

We hereby declare that the work presented in this project entitled "**FACE RECOGNITION BASED ATTENDANCE SYSTEM USING MACHINE LEARNING**" submitted towards completion of the project in IV year I sem of B.Tech IT at "BVRIT HYDERABAD College of Engineering for Women", Hyderabad is an authentic record of our original work carried out under the esteemed guidance of **Ms. J. Kavitha, Assistant Professor**, Department of IT.

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CERTIFICATE

This is to certify that the mini-project report on **"FACE RECOGNITION BASED ATTENDANCE SYSTEM USING MACHINE LEARNING"** is a bonafide work carried out by **Ms. P. Mrunalini (19WH1A1206), G. Raajitha (19WH1A1210), P. Tejaswini (19WH1A1211), R. Teja Sri (19WH1A1237)** in the partial fulfillment for the award of B.tech degree in **Information Techonology, BVRIT HYDERABAD College of Engineering for Women, Bachupally, Hyderabad** affiliated to the Jawaharlal Nehru Technological University Hyderabad under my guidance and supervision. The results embodied in the mini-project work have not been submitted to any other university or institute for the award of any degree or diploma.

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ABSTRACT

Biometric identification is a technique that measures an individual's physical or behavioral characteristics for identification purposes. In the past, passwords were the only method available to identify individuals. Passwords became obsolete due to obtaining password information and hacking into accounts. Biometrics emerged as a replacement for passwords that provide greater security that is not easy to hack into compared to passwords. Many biometrics are used for attendance; one widely used, secure, and easy method is the face recognition attendance system. In our world, Biometric face recognition is used everywhere. It is an advanced, automated, and sensible identification system that can identify a person by facial features. It uses a digital camera to capture the image of the face, a computer for processing and analysis, and an output device for displaying the identification result. It is straightforward to identify any person from different facial images. The face recognition system is a high-speed and reliable technology. This biometric is very safe because it can identify people without any mistakes. Face recognition is considered the first step toward building biometric access control-based application scenarios, where biometric features are extracted from the individuals. This system is used in many government offices, firms, banks, and other places.

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1. INTRODUCTION

Everywhere, technological advancements are happening to meet the level of a growing business. One such method that makes the process of attendance and admission instant is the biometric attendance system. Biometric identification is a technique that detects an individual's physical or behavioral characteristics for identification purposes.

In the past, passwords were the only available method to identify users. Passwords became obsolete due to acquiring password information and hacking into accounts. Biometrics emerged as a replacement for passwords that provide higher security that is not easy to hack into compared to passwords.Many biometrics are used for attendance, one widely used, secure, and effortless method is the face recognition attendance system. Biometric face recognition is used in many domains. It is an advanced, modern, automated, and practical identification method that can identify a person by the user's facial features. It uses a camera to detect the face of an individual, a computer for processing and analysis, and the result is displayed on the screen.

It is easy to identify any person from different facial images. This face recognition system is a high-speed and reliable technology. This biometric face recognition is very secure as it can identify people without any mistakes. Face recognition is considered as the initial step toward making biometric-enabled control-based application scenarios, where biometric characteristics are extracted from individuals. This system is used in many public offices, firms, banks, and other places.

The purpose of this system is to build a attendance system which is based on face recognition techniques. Here face of an individual will be considered for marking attendance. Nowadays, face recognition is gaining more popularity and has been widely used. In this paper, we proposed a system which detects the faces of students from live streaming video of classroom and attendance will be marked if detected.

1.1 Objective

The objectives of our project are as follows:

1. Detection of individual face amidst the other natural components for instance walls and backgrounds.
2. Detection of faces amongst different face characters like spectacles etc.
3. Extraction of distinctive features of a face useful for face recognition.
4. Effective recognition of unique faces in a crowd.

5. Automated update in the database without human intervention.

1.2 Problem Definition

Attendance is an important part of daily class evaluation. Face recognition-based attendance system is a method of recognizing face for taking attendance by using face recognition technology based on a monitor video. The concept of face recognition is to give a system the capability to detect and recognizing human faces fast and precisely in images or videos. In biometrics, features of human are matched to the existing data. Facial features are extracted and implemented through algorithms, which are efficient . The face recognition system generally involves two stages:

1. Face Detection :- In the input image system detects any face, and also image processing cleans up the facial image for easier recognition.

2. Face Recognition :– The detected and processed face is compared to the database of known faces to decide who that person is.

1.3 Aim of the Project

The main aim of our project is to make the attendance system easier and effortless. In our project the biometric facial features of the students are recognized. With the facial features we identify the student and attendance is marked automatically in the database. The student face is captured using a camera, the captured image is analyzed and the attendance is marked. In our project, we can detect multiple faces of students at once which makes it even more easier to mark the attendance.

2. LITERATURE SURVEY

2.1 Related Work

Now a days, there is increasing research interest on developing a face recognition based attendance system. K. Mridha, et al.[1] Study and Analysis of Implementing a Smart Attendance Management System Based on Face Recognition Technique using OpenCV and Machine Learning made a Attendance Management System (AMS) intelligent by using a face-to-face recognition strategy. They fixed a CCTV camera in the classroom at any best point, which makes a person's picture at a fixed time and tests a face-to-face image. Traditionally, student attendance at the institutes is manually reported on the attendance sheets. It's not a productive operation. For solving this big issue they proposed a novel automatic technique namely ”Face Detection with OpenCV”. The system is connected with their master database which includes the student's name, images, roll numbers, and time of attendance. This application mainly follows three steps. Firstly, it will take images. Secondly, compare them with the existing images which are storing in the master database. Thirdly, it will mark present all the matched images automatically on a spreadsheet and the remaining students will be absent from that class.

P. Nagaraj, et al.[2] Real Time Face Recognition using Effective Supervised Machine Learning Algorithms used effective supervised machine learning algorithms to implement real time face recognition. Face detection is the initial and important part of face recognition. The facial recognition process solves this question by evaluating through four stages like detection, feature extraction, tracking and recognition. Face detection of pictures is usually complicated because of the features present in human faces like position, orientation, expression and skin color etc. Most of the face recognition procedures work by concentrating on the various nodal focuses on a person's face. Using these procedures and by applying various algorithms like KNN algorithm and openCV. They used the knowledge obtained from appearances to rapidly recognize target person. In this HaarCascade classifier is used. This is a technique focused on machine learning, during which a course work is prepared from a broad measure of positive and negative images. It's normal to identify issues in various images. It's a pretrained facial data model and it's popular to identify faces.

Rondik J.Hassan, et al.[3] Deep Learning Convolutional Neural Network for Face Recognition aimed to review a significant number of papers to cover recent innovations in the field of facial recognition. Current research demonstrates that new algorithms need to be built using hybrid soft computing techniques such as PCA, SVM, LBP, and HOG that produce better results for improved face recognition. In addition, it was obvious that the best algorithms for facial feature extraction and classification are PCA and SVM respectively. PCA is used for feature extraction and dimensionality reduction and SVM used for classification. Another approach is deep neural networks-based face recognition approach to test human face detection with livenessNet. It searches for the position and dimensions of all features belonging to a class called a face. The biggest value of this technique is that it is extremely precise and can be carried out in real-time. Open CV is used for the application of this facial recognition technology using deep neural networks. The primary principle of the detection paradigm is frontal face detection.

S. Kakarla, et al.[4] In Smart Attendance Management System Based on Face Recognition Using CNN, a novel CNN architectonics for face recognition framework is proposed including the way toward gathering face data of students. This paper officially presents the job of CNN in Face Recognition and adaption of CNN in attendance posting. Tentatively it is demonstrated that the proposed CNN architectonics gives 99% precision. Further, the proposed CNN structure is utilized to build up a “Smart Attendance Management System (SAMS)”, which is an online application, to provide attendance of students utilizing face recognition, progressively. The future extent of the paper is to fabricate a strong application for smart attendance management, for more number of students, progressively.

In Dhanush Gowda H.L, et al. [5] In Face Recognition based Attendance System, a smart and auto attendance management system is utilized. By utilizing this framework, the problem of proxies and students being marked present even though they are not physically present can easily be solved. This system marks the attendance using live video stream. The frames are extracted from video using OpenCV. The main implementation steps used in this type of system are face detection and recognizing the detected face, for which dlib is used. After these, the connection of recognized faces ought to be conceivable by comparing with the database containing student’s faces.

B. Tej Chinimilli, et al.[6] Face Recognition based Attendance System using Haar Cascade and Local Binary Pattern Histogram Algorithm proposed automated attendance management system dependent on Haar cascade for face detection and the LBPH algorithm for face recognition. Situations, for example, face recognition rate, false-positive rate for that and false-positive rate with and without utilizing a threshold in distinguishing obscure people are considered to assess the system. The creator got face recognition rate of students as 77% and its false-positive rate as 28%. The system perceived students in any event, when students are wearing glasses or grown a facial hear growth. Face Recognition of obscure people is almost 60% for both with and without applying limit esteem. Its false-positive rate is 14% and 30% with and without applying limit individually. Little dataset was the impediment of the proposed system. According to the creator an exertion could be made in future to fabricate a superior dataset that may essentially give a more precise outcome.

2.2 Major Issues

1. Almost all the research focused on single face recognition based attendance system.
2. Some research require multiple images of a person for training and recognizing.
3. Some research didn't mention the range for recognizing the face on the screen.

3. SYSTEM ANALYSIS & DESIGN

3.1 Proposed System

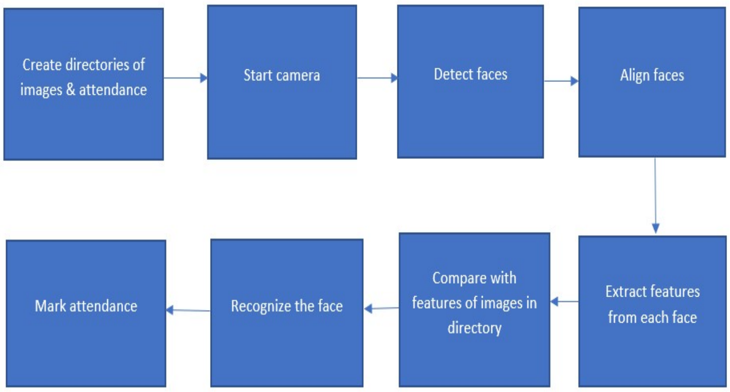

Figure 3.1: Block Diagram of the Proposed System

Traditional method of attendance marking is a tedious task in many colleges. To overcome the manual attendance method we are using biometric system. Biometric systems are an innovative time and attendance tracking system.Biometric identification is a technique that measures an individual's physical or behavioural characteristics for identification purposes. It helps to keep track of the schedule of students. It can accurately record the entry and exit times of the individual. Different types of biometric attendance are:Iris Recognition, Retina Recognition, Fingerprint Recognition, Face Recognition,Voice Recognition. Using biometric attendance data is accurate, easily accessible and we can generate quick attendance reports. One widely used, secure, and easy method is the face recognition attendance system. It is an advanced, automated, and sensible identification system that can identify a person by facial features. It uses a digital camera to capture the image of the face, a computer for processing and analysis, and an output device for displaying the identification result. The face recognition system is a high-speed and reliable technology. This biometric is very safe because it can identify people without any mistakes. In this project we are proposing face recognition to mark attendance for multiple users.

3.2 Architecture Design

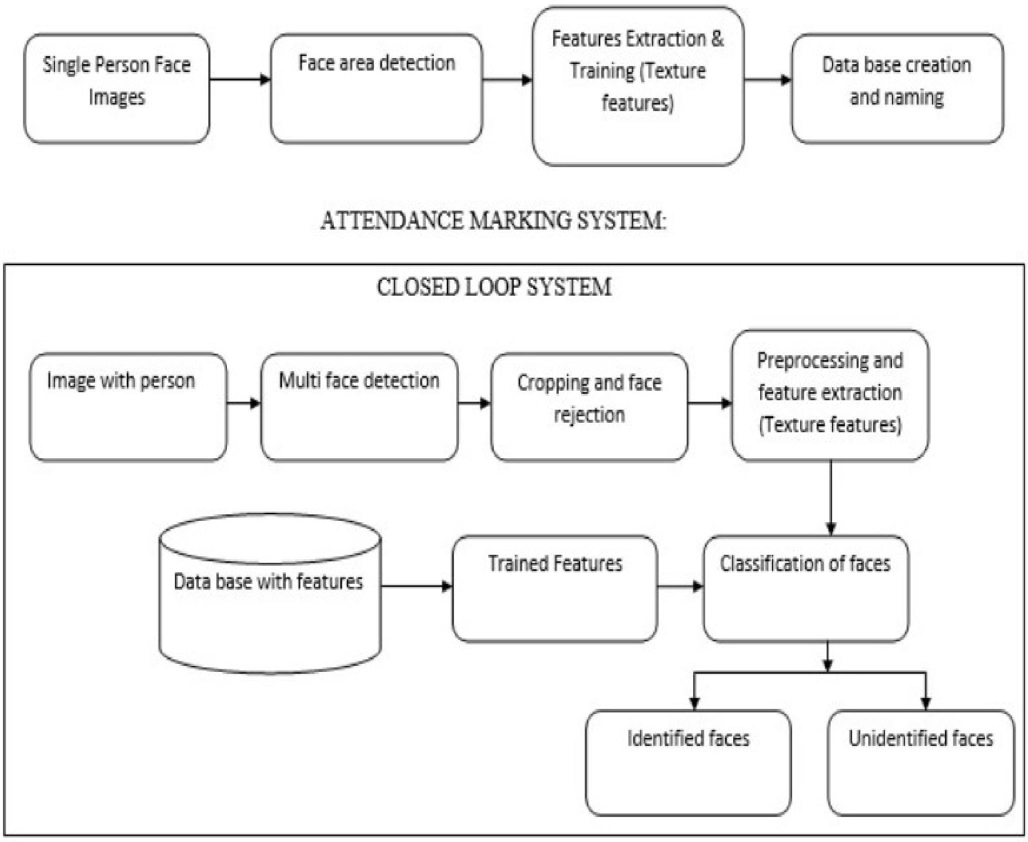

Figure 3.2.1: Architecture Design

In the above figure first a single face image is scanned and only the face area is detected, after this feature extraction and training is done, if the face is present in the system then attendance is marked. This all is done in the main system.In the closed loop system multi-face detection is done, like cropping out unwanted area in the image and face recognition process starts.The feature extraction and Prepossessing of feature is done. By doing this classification of faces is done. From the database trained image features is taken and it compares both the classification image and trained image, if the image matches then attendance will be marked for identified faces and for unidentified faces attendance is not marked.

1. **Face Detection**

   Face detection is a computer technology that determines the location and size of a human face in a digital image. Automatic face detection system plays an important role in face recognition, facial expression recognition, head-pose estimation, human–computer interaction etc. The face recognition library has many methods (functions) to deal with faces in images and one of them known as face_locations that will find the face's locations inside a particular image. This method will find those faces and return an array of coordinates of each face and we can print them out. First we load the image using cv2, and then convert it to RGB from BGR, as OpenCV and Dlib have different color orderings. Then, we use the face_locations function from face_recognition to get the coordinates of bounding boxes of faces in the image. The faces are found using the Histogram of Oriented Gradients (HOG) method. The face_locations function returns a list of tuples of found face locations in (top,right,bottom,left) order.

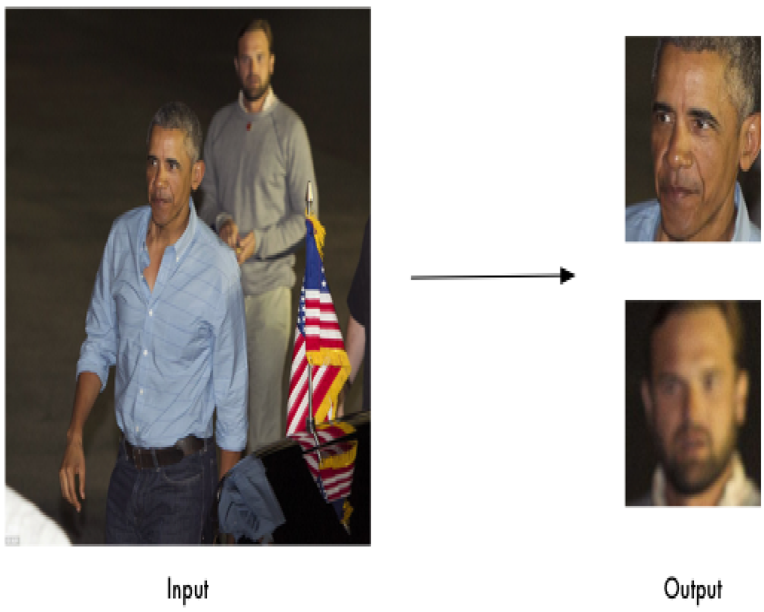

Figure 3.2.2: Face Detection

2. **Features Extraction**

   Encoding, his stage is about identifying key parts of a face (through the eyes of a computer) that will be similar for any photo of the same person and different for an image of anybody else. For humans this may be eye colour, hair style, nose shape etc but for computer vision, there is a highly effective set of 128 measurements for each face known as an embedding. These measurements have been found using machine learning by comparing thousands of images of labeled faces. We can then access a pre-trained network generated by this process to find the measurements we need.

Figure 3.2.3: Feature Extraction

3. **Face Recognition**

   We start by comparing the 128-dimensional encoding of the current face (in the current frame), to the known encodings we got from the reference images. The compare_faces function calculates the euclidean distance between the current face encoding and the known encodings and returns a list of True/False depending on whether the distance is over 0.4 or not. Then, we use the face_distance and argmin functions to find the known face with the smallest euclidean distance to the current face. If one of the known faces are close enough to the current face, we set the name to match that known name, otherwise the name will remain “Unknown”.

3.3 Use Case Diagram

A use case diagram is used to represent the dynamic behavior of a system.It encapsulates the system's functionality by incorporating use cases, actors, and their relationships.It depicts the high-level functionality of a system and also tells how the user handles a system.

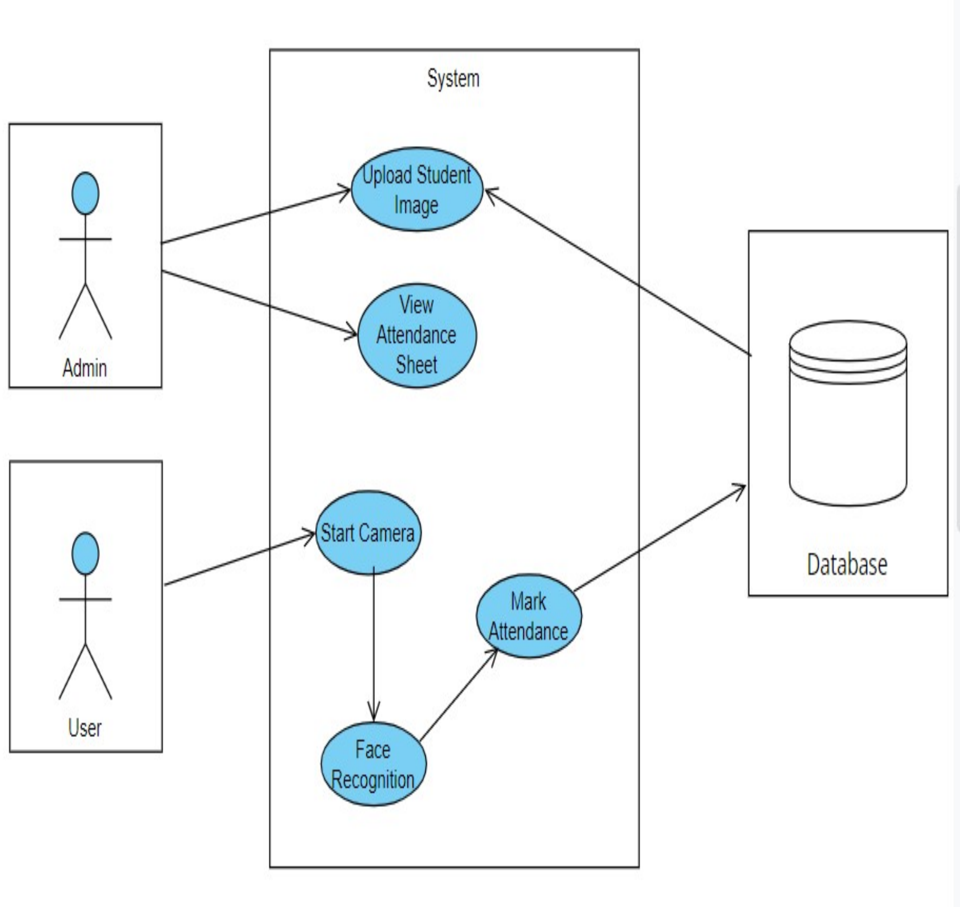

Figure 3.3: Use Case Diagram for Face Recognition based Attendance System

In this the admin needs upload student image into the database.Admin can view the attendance sheet stored in the database to check attendance.This attendance sheet is in the form of csv file.The user's attendance is taken by staring the camera, the system detect the face and face recognition process is done, if the user's data is stored in the database then attendance would be marked otherwise not.

3.4 Sequence Diagram

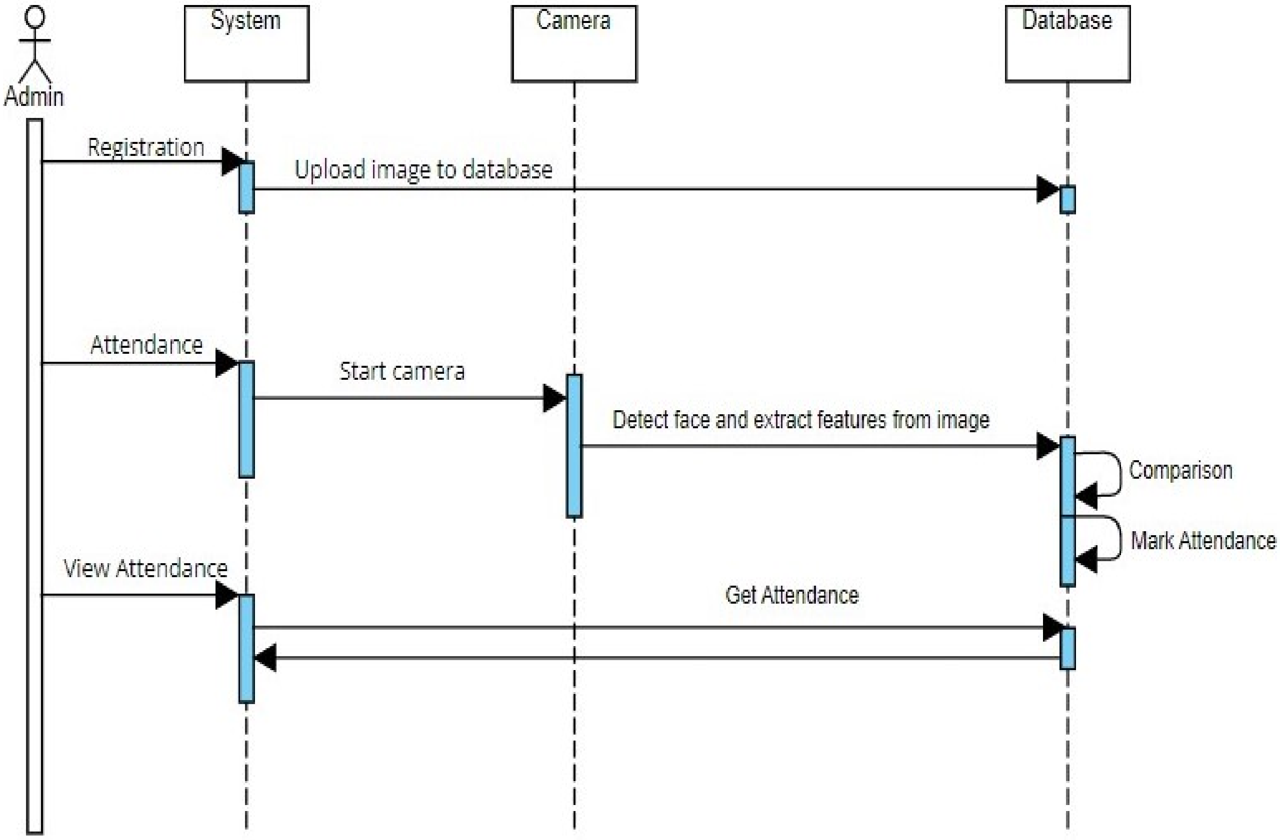

Figure 3.4: Sequence Diagram for Face Recognition based Attendance System

A sequence diagram is used to show how operations are carried out. Sequence Diagrams are time focus and they show the order of the interaction visually by using the vertical axis of the diagram to represent time what messages are sent and when.

In this the admin registers the users by uploading the images to the database.To take attendance, the admin starts camera and camera detects face and extract features from image, if the user image matches with database image then attendance is marked. To view attendance the admin directly can get attendance from the database in the form of csv file.

4. IMPLEMENTATION

4.1 Modules

1. **Face Detection**

   Face detection is important as the image taken through the camera given to the system, face detection algorithm applies to identify the human faces in that image, the number of image processing algorithms are introduce to detect faces in an images and also the location of that detected faces. We have used HOG method to detect human faces in given image.

2. **Face Encoding**

   Once the faces are detected in the given image, the next step is to extract the unique identifying facial feature for each image. Basically whenever we get localization of face, the 128 key facial point are extracted for each image given input which are highly accurate and these 128-d facial points are stored in data file for face recognition.

3. **Face Recognition**

   One of the best learning technique that is deep metric learning which is highly accurate and capable of outputting real value feature vector. Our system ratifies the faces, constructing the 128-d embedding (ratification) for each. Internally compare_faces function is used to compute the Euclidean distance between face in image and all faces in the dataset. If the current image is matched with the 60 % threshold with the existing dataset, it will move to attendance marking.

4. **Marking Attendance**

   After face recognition and detection, the program creates an entry in the .csv file and exports and name and time in which the face was detected and marks the attendance. The system does not allow overwriting of a single entry.

4.2 Techniques

In order to mark attendance, we follow a series of steps which includes enrolment, face detection, face recognition, and then marking the attendance in a database. Unlike Eigenfaces and Fisherfaces, where in most modern face verification systems, training and enrolment are two different steps. Training is performed on millions of images. On the other hand, enrolment is performed using a small set of images. In case of Dlib, enrolling a person is simply passing a few images of the person through the network to obtain 128-dimensional feature descriptors corresponding to each image. In other words, we convert each image to a feature in a high-dimensional space. In this high dimensional space, features belonging to the same person will be close to each other and far away for different persons.

Dlib's Face Recognition Model :

In a traditional image classification pipeline, we convert the image into a feature vector (or equivalently a point) in higher dimensional space. This was done by calculating the feature descriptor (e.g. HOG) for an image patch. Once the image is represented as a point in higher dimensional space, we then use a learning algorithm like SVM to partition the space using hyperplanes that separated points representing different classes.

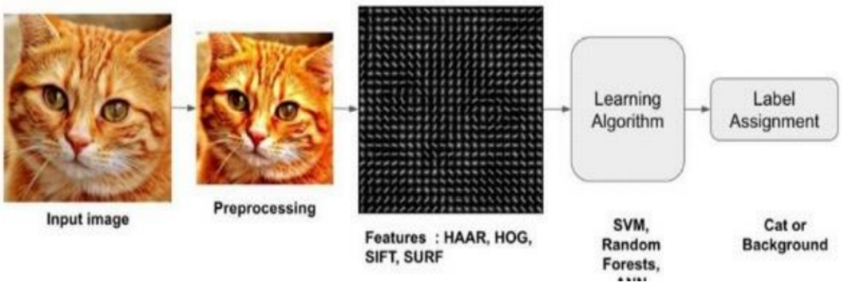

Figure 4.2.1: Traditional Image Classification Pipeline

Even though on the surface Deep Learning looks very different from the above model, there are conceptual similarities.

Figure 4.2.2 reveals the Dlib's Face Recognition module is based on an CNN architecture called ResNet. ResNet contains a bank of Convolutional Layers followed by one Fully Connected Layer.

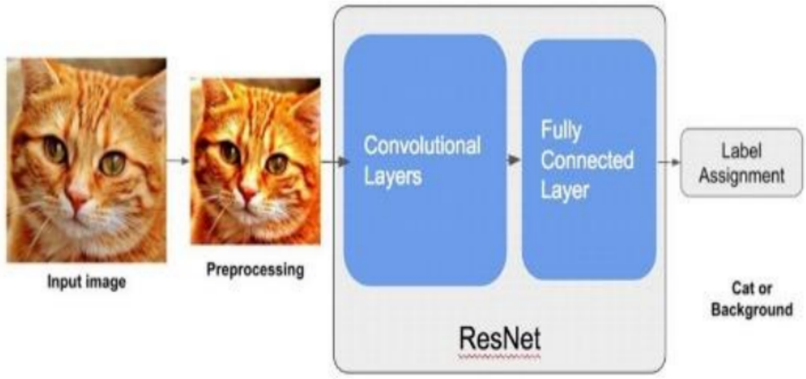

Figure 4.2.2: Dlib's Face Recognition module

As most CNN architectures, ResNet contains a bank of Convolutional (Conv) Layers followed by a Fully Connected (FC) Layer.

The bank of convolutional layers produces a feature vector in higher dimensional space just like the HOG descriptor. The most important differences between bank of convolutional layer and HOG descriptor are:

1. HOG is a fixed descriptor. There is an exact recipe for calculating the descriptor. On the other hand, a bank of conv layers contains many convolution filters. These filters are learned from the data. So unlike HOG, they adapt based on the problem at hand.

2. The FC layer does the same job as the SVM classifier in traditional approaches. It classifies the feature vector. In fact, sometimes the final FC layer is replaced by an SVM. Usually, when we want to use the word "distance" between two points we are talking about the Euclidean distance between them. For example, the distance between 3D points (1, 0, 1) and (1, 3, 5) is

$$\sqrt{(1-1)^2+(3-0)^2+(5-1)^2} = 5 \qquad (1)$$

In general, if we have an n dimensional vectors x and y the L2 distance (also called the Euclidean distance) is given by

$$d_{L2} = ||x-y|| = [(x-y)^T(x-y)]^{\frac{1}{2}} = (\sum_{i=1}^{n}(x_i-y_i)^2)^{\frac{1}{2}} \qquad (2)$$

1. **Deep Metric Learning :** Any image can be vectorized by simply storing all the pixel values in a tall vector. This vector represents a point in higher dimensional space. However, this

space is not very good for measuring distances. In a face recognition application, the points representing two different images of the same person may be very far away and the points representing images of two different people may be close by.

Deep Metric Learning is a class of techniques that uses Deep Learning to learn a lower dimensional effective metric space where images are represented by points such that images of the same class are clustered together, and images of different class are far apart. Instead of directly reducing the dimension of the pixel space, the convolution layers first calculate the meaningful features which are then implicitly used to create the metric space. Turns out we can use the same CNN architecture we use for image classification for deep metric learning.

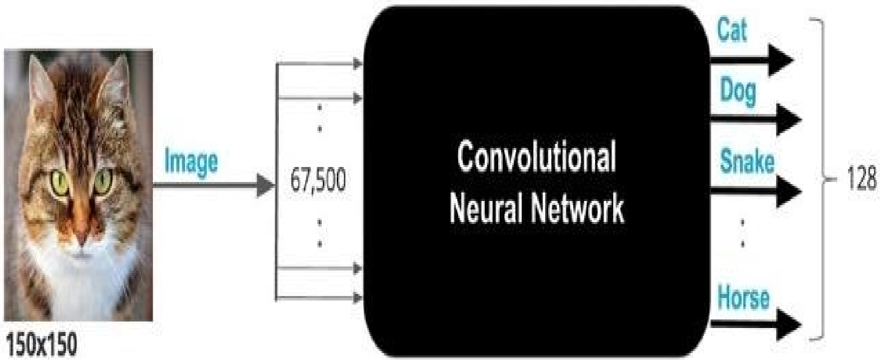

Figure 4.2.3: CNN for Clarification Task

Figure 4.2.3 depicts a CNN that is trained to take as input a 150x150 colour image (which is the same as a vector of size 150x150x3 = 67,500) and output the probability that it belongs to one of the 128 different animal classes. In Deep Metric Learning, the architecture remains the same, but the loss function is changed.

Figure 4.2.4 reveals Deep Metric Learning, the architecture remains the same as for CNN classification task, but the loss function is changed. In other words, you input an image and the output is a point in 128-dimensional space. If you want to find how closely related two images are, you can simply find the pass both images through the CNN and obtain the two points in this 128-dimensional space. You can compare the two points using simple L2 (Euclidean) distance between them.

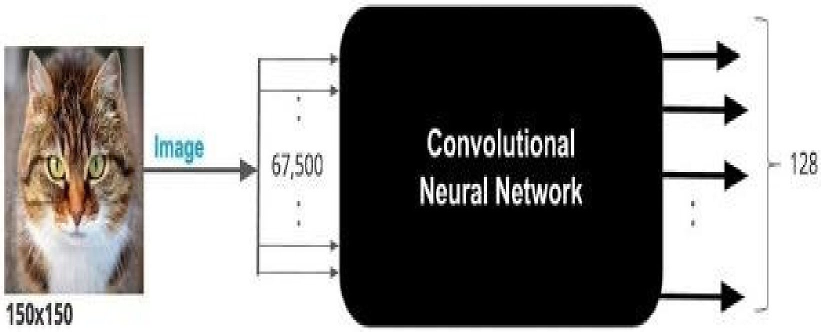

Figure 4.2.4: CNN for Metric Learning

2. **Metric Loss :** Millions of images are typically used to train a production ready CNN. Obviously, these millions of images cannot be simultaneously used to update the knobs of the CNN. Training is done iteratively using one small batch of images at a time. This small batch is called a mini batch. As mentioned in the previous section, we need to define a new loss function so that the CNN output is a point in this 128-dimensional space. The loss function is defined over all pairs of images in a mini batch.

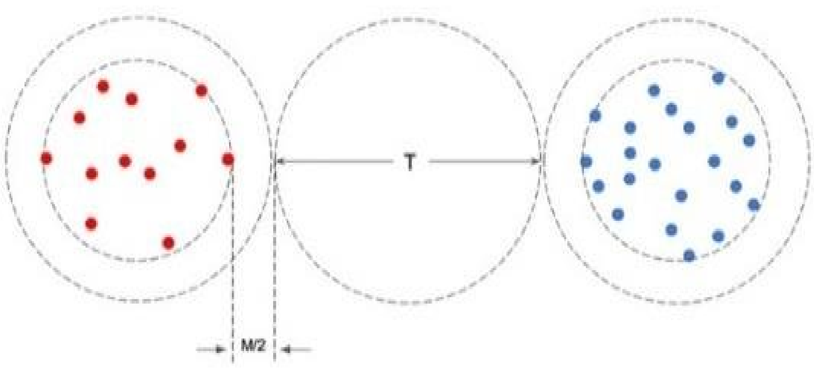

Figure 4.2.5: Metric Loss Defined by Dlib's Face Recogniser

For simplicity, the concept is shown in 2D. The loss is defined in terms of two parameters: 1) Threshold (T) and 2) Margin. The blue and the red dots present images of two different classes. For the metric loss to be 0, the maximum distance between any two points of the same class should be (T - M) and the minimum distance between any two points of different classes should be (T + M) Let p1 and p2 represent the points corresponding to images l1 and l2 in the 128- dimensional space. If the images belong to the same class, the loss is given by max (0, p1-p2-T+M)

On the other hand, if l1 and l2 have two different class labels then their contribution to the loss function is: max (0, T- p1-p2+M). Figure 7 shows how this loss function prefers embedding where images of the same class are clustered together, and images of different classes are separated by a large margin.

3. **Hard Negative Mining :** In a mini batch, there are many non-matching pairs (images from different classes) than matching pairs (images from the same class). It is important to take this imbalance into account while calculating the metric loss function. If there are N matching pairs that share the same class in a mini batch, then the algorithm includes ONLY the N worst non-matching pairs in the loss computation. In other words, performs hard negative mining on the mini batch by picks the worst non-matching pairs.

Enrolment

For enrolment we define smaller ResNet neural network. Training was also done using this network. A Persons' images we are going to enrol are structured in following way: We will be having folder of users, each file in this folder is an image of one user. We will store this mapping of images and their corresponding labels to use it later in testing. Then we process enrolment images one by one, convert each image from BGR to RGB format, because Dlib uses RGB as default format. Then convert OpenCV BGR image to Dlib's cv_image and then Dlib's cv_image to Dlib's matrix format since Dlib's cv_image format is not recognized by neural network module. Detect faces in the image. For each face we detect facial landmarks and get a normalized and warped patch of detected face. Compute face descriptor using facial landmarks. This is a 128-dimensional vector which represents a face. Then save labels and names to disk and face descriptors and corresponding labels to disk.

Face Detection And Recognition

Given a new image of a person, we can verify if it is the same person by checking the distance between the enrolled faces and the new face in the 128-dimensional space. Read name-labels mapping and descriptors from disk. Then read the query image that is an image of classroom with multiple students and convert it from BGR to RGB format. Because Dlib uses RGB as default format. Then convert OpenCV RGB image to Dlib's cv_image, and then Dlib's cv_image to Dlib's matrix format. Dlib's cv_image format is not recognized by neural network module. Detect faces in query image. For each face detect facial landmarks. Get a warped and patch of 150x150 for each face. Now compute face descriptor for each face. Now we calculate Euclidean distance between face descriptors in query images versus face descriptors of enrolled images. Find the enrolled face for which distance is minimum. Dlib specifies that in general, if two face descriptor vectors have a Euclidean distance between them less than 0.6 then they are from the same person, otherwise they are from different people. This threshold will vary depending upon number of images enrolled and various variations (illumination, camera quality) between enrolled images and query image. We are using a threshold of 0.4. If minimum distance is less than threshold, find the name of person from index, else the person in query image is unknown.

4.3 Results

Code: AttendanceProject.py

```
#Importing Required Libraries
import cv2
import numpy as np
import face_recognition
import os
from datetime import datetime
from datetime import date
import pandas as pd

#Initialising variables for list of images, list of names, path of images
path = 'Images_Attendance'
images = [ ]
classNames = [ ]
myList = os.listdir(path)
print(myList)

#Appending images and name to the lists
for cl in myList:
    curImg = cv2.imread(f'path/cl')
    images.append(curImg)
    classNames.append(os.path.splitext(cl)[0])
print(classNames)

datetoday = date.today().strftime("%d_%m_%y")
def totalreg():
return len(os.listdir('Images_Attendance'))
#Creating Attendance folder
if not os.path.isdir('Attendance'):
    os.makedirs('Attendance')
```

```
#Creating day-wise Attendance .csv file in Attendance folder
if f'Attendance-datetoday.csv' not in os.listdir('Attendance'):
    with open(f'Attendance/Attendance-datetoday.csv','w') as f:
        f.write('Name, Roll, Time')

#Finding Encodings of registered images
def findEncodings(images):
    encodeList =[]
    for img in images:
        img = cv2.cvtColor(img, cv2.COLOR_BGR2RGB)
        encode = face_recognition.face_encodings(img)[0]
        encodeList.append(encode)
    return encodeList

def extract_attendance():
df = pd.read_csv(f'Attendance/Attendance-datetoday.csv')
names = df['Name']
rolls = df['Roll']
times = df['Time']
l = len(df)
return names,rolls,times,l

Function to mark attendance to recognised faces
def markAttendance(name):
    username = name.split('_')[0]
    userid = name.split('_')[1]
    current_time = datetime.now().strftime("%H:%M:%S")
    df = pd.read_csv(f'Attendance/Attendance-datetoday.csv')
    if username not in list(df['Name']):
        with open(f'Attendance/Attendance-datetoday.csv','a') as f:
```

```
                f.write(f‘{username},{userid},{current_time}’)

#Creating List of Encodings of Known Faces
encodeListKnown = findEncodings(images)
print(‘Encoding Complete’)

#Starting Camera
cap = cv2.VideoCapture(0)

while True:
    #Taking Frame
    success, img = cap.read()
    #Resizing image
    imgS = cv2.resize(img, (0, 0), None, 0.25, 0.25)
    #Converting img from BGR to RGB
    imgS = cv2.cvtColor(imgS, cv2.COLOR_BGR2RGB)

    #Detecting/Locating Faces in the image
    facesCurFrame = face_recognition.face_locations(imgS)
    #Finding the encodings of all the faces detected and storing them in a var
    encodesCurFrame = face_recognition.face_encodings(imgS, facesCurFrame)

    #Take the encodings and location of each face detected and compare with encoding of known faces
    for encodeFace, faceLoc in zip(encodesCurFrame, facesCurFrame):
        matches = face_recognition.compare_faces(encodeListKnown, encodeFace)
        faceDis = face_recognition.face_distance(encodeListKnown, encodeFace)
        print(faceDis)
        matchIndex = np.argmin(faceDis)
        #Finding closest match
        if faceDis[matchIndex] ¡0.4:
```

```
                name = classNames[matchIndex].upper()
                print(name)
                #Once a match is found draw a rectangle around face and add name at the bottom
                y1, x2, y2, x1 = faceLoc
                y1, x2, y2, x1 = y1*4, x2*4, y2*4, x1*4
                cv2.rectangle(img, (x1, y1), (x2, y2), (0, 255, 0), 2)
                cv2.rectangle(img, (x1, y2-35), (x2, y2), (0, 250, 0), cv2.FILLED)
                cv2.putText(img, name.split('_')[0], (x1+6, y2-6),
                cv2.FONT_HERSHEY_COMPLEX, 1, (255, 255, 255), 2)
                markAttendance(name)
            #If no nearest matches found, naming the face as unknown
            else:
                print(Ünknown")
                y1, x2, y2, x1 = faceLoc
                y1, x2, y2, x1 = y1*4, x2*4, y2*4, x1*4
                cv2.rectangle(img, (x1, y1), (x2, y2), (0, 255, 0), 2)
                cv2.rectangle(img, (x1, y2-35), (x2, y2), (0, 250, 0), cv2.FILLED)
                cv2.putText(img, "Unknown", (x1+6, y2-6),
                cv2.FONT_HERSHEY_COMPLEX, 1, (255, 255, 255), 2)
        cv2.imshow('webcam', img)
        #If we press Esc camera stops
        if cv2.waitKey(33) == 27:
            break
cap.release()
cv2.destroyAllWindows()
```

Output

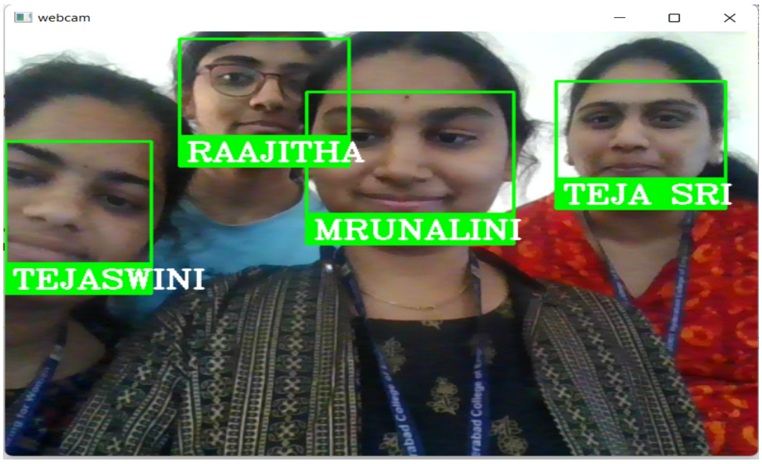

Figure 4.3.1: Face Recognition

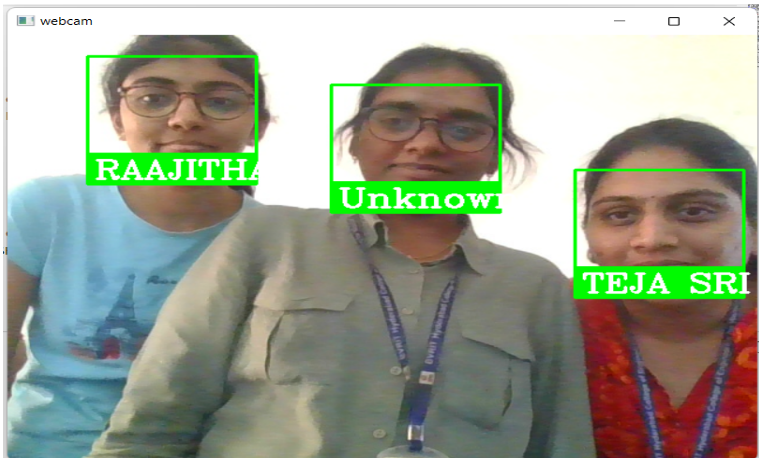

Figure 4.3.2: Unknown Face Detection

Attendance > Attendance-02_01_23.csv

```
Name, Roll, Time
TEJA SRI,1237,14:36:09
RAAJITHA,1210,14:36:15
TEJASWINI,1211,14:36:36
MRUNALINI,1206,14:36:38
```

Figure 4.3.3: Marking Attendance

5. CONCLUSION & FUTURE ENHANCEMENTS

We conclude that by designing a Face Recognition based Attendance System Using Machine Learning which is cost-effective and efficient when contrasted to other biometric solutions. The cost and time saved are even larger because the data acquired from the face recognition attendance system is accurate in real-time. Because the overall process is automated, human intervention is limited.

Moving forward, there are few things which we can improve further and tune our model. First we need to train our model Attendance System is used in larger areas such as the seminar where it helps to mark attendance at once. Second, sometimes due poor classroom lighting may affect image quality that indirectly reduces system performance, this may be overcome by improving video quality. Lastly we want to train more images to improve efficiency, this can be done by taking large dataset or more no of users images.

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