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Detection and Recognition of face using Haar Cascade and LBPH method for taking Attendance

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Abstract— Face recognition is a rapidly evolving technology that allows computers to identify human faces using algorithms and mathematical models. It has a wide range of applications, from security systems to social media platforms. Face recognition algorithms can be based on geometric or texture-based features and can be trained using large datasets of images. While the technology has many benefits, it also raises concerns around privacy, security, and bias. This technology is used for different types of purposes like taking attendance of students in classroom, employee attendance etc. There are different types of algorithms that have been designed for face recognition. Here we are using Haar Cascade and LBPH algorithms for detecting and recognizing the faces.

Key Words— Texture-based features, Haar Cascade, LBPH, detecting, recognizing.

1. INTRODUCTION

Face recognition is a technology that allows computers to identify human faces, and it has become increasingly popular in recent years. It involves using algorithms and mathematical models to analyze and compare facial features and patterns to determine if two faces match. The technology has a wide range of applications, from security systems that use facial recognition to identify individuals, to social media platforms that use it to tag people in photos. Face recognition algorithms can be based on different techniques such as geometric features, such as the distance between the eyes and the mouth, or on texture-based features, such as the patterns of lines and curves on the face [1]. These algorithms can be trained using large datasets of images, which can include variations in lighting, angles, and expressions [2]. In attendance system facial recognition is showing a wide responsibility of taking attendance and updating the attendance automatically according to the student details. It compares the input encoding frames of faces with the dataset of images in a manner in which algorithm is trained to recognize the faces. Here the purpose of designing this model is saving the time and increasing the technological modernization of classroom. This model is built using openCV and the tkinter GUI, for website framework django is used.

2. LITERATURE SURVEY

A study on automatic attendance system using face recognition based on deep learning techniques [3]. The study proposed a system that uses deep learning algorithms for face recognition and attendance management. The system was evaluated on a dataset of over 2,500 images of faces, and achieved an accuracy rate of over 95%.

A review of various face recognition techniques used in attendance management systems [4]. The review covers traditional techniques such as PCA, LDA, and SVM, as well as deep learning-based techniques such as CNN and DNN. The study also discusses the challenges and limitations of using face recognition technology for attendance management.

A study on the use of face recognition technology in classroom attendance management systems [5]. The study proposes a system that uses combination of Haar Cascade classifier and LBPH algorithm for face detection and recognition, respectively. The system achieved an accuracy rate of over 92% on a dataset of over 500 images of faces.

A comparative study of different face recognition algorithms used in attendance management systems [6]. The study compares traditional techniques such as PCA, LDA, and Gabor wavelets, with deep learning-based techniques such as CNN and DNN. The study concludes that deep learning-based techniques outperform traditional techniques in terms of accuracy and robustness.

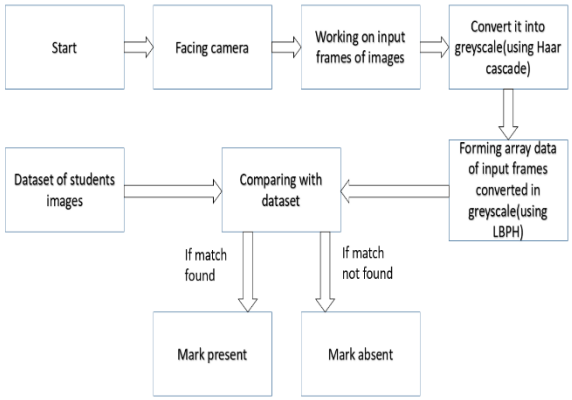
A study on a real-time attendance management system using facial recognition for educational institutions [7]. The system uses a combination of OpenCV and Dlib libraries for face detection and recognition. The system was tested on a dataset of over 2,000 images of faces, and achieved an accuracy rate of over 95%.

A study on a face recognition-based attendance management system using Raspberry Pi [8]. The system uses the OpenCV library for face detection and recognition, and is implemented on a Raspberry Pi board. The system achieved an accuracy rate of over 92% on a dataset of over 300 images of faces.

3. PROPOSED SYSYEM

The admin must have register the students in database by entering the required details and then their images will be captured and after creating dataset of their images, dataset in the form of xml as the dataset are in the form of array. During each session, faces will be detected from the mobile phone of class faculty through his/her Id. The faces detected will be compared with dataset present. If match found, attendance will be marked for the respective student. The technique is build using openCV and python. Tkinter GUI will be used to built the graphical environment. Django and tensor flow will be used for web framework.

Fig.1. System Architecture



3.1. Database creation:

Student database is created using the details of students storing in the database and also store the images of students with respect to their details. Teacher database is also there where the teacher login details is stored. Through this login teacher can reach to the website where he/she can take the attendance.

3.2. Creation of dataset of student images

Images of students are captured using a camera or webcam. Near about 100 images of students is stored in cropped form to obtain Region of Interest (ROI), it will be further used in recognition process. These images are in the form of greyscale images which is converted from RGB before while capturing. And then these images will be trained and stored.

3.3 Face Detection

Face detection is being performed using Haar-Cascade Classifier with OpenCV. Haar Cascade algorithm needs to be trained and the extract the features for the face this is known as feature extraction. haarcascadefrontalface_default is the predefined xml file used in openCV which stores the face features. We are using detectMultiScale module from OpenCV. It is ude to draw a rectangle around the input frace frames. It uses three parameters to consider- scaleFactor, minNeighbors, minSize. scaleFactor is used to indicate how much an image must be reduced in each image scale. minNeighbors specifies how many neighbors each candidate rectangle must have. Higher values usually detects less faces but detects high quality in image. minSize specifies the minimum object size. By default it is (30,30). The parameters used in this system is scaleFactor and minNeighbors with the values 1.3 and 5 respectively [9].

3.4. Face Recognition

Face recognition is done using Linear Binary Pattern Histogram (LBPH).

Image Preprocessing: The first step is to preprocess the input image from the camera or webcam. This typically involves resizing the image and converting it to grayscale.

Feature Extraction: The next step is to extract features from the preprocessed image using local binary patterns (LBP). LBP is a texture descriptor that encodes the local structure of an image by comparing each pixel with its surrounding pixels. In LBPH, we divide the image into small regions and compute the LBP values for each region. We then combine these LBP values to create a histogram for the entire image.

Training: Once we have extracted the features from the image, we need to train a classifier to recognize the faces. This involves selecting a suitable machine learning algorithms and training it on a set of labeled face images. During training, the classifier learns to recognize the unique features of each face.

Recognition: To recognize a face, we first preprocess the input image and extract the LBP features as described above. We then use the trained classifier to predict the identity of the person in the image.

3.4. Marking of Attendance

Using login teachers can take the attendance of students by recognizing the faces using the algorithm running in the background. After face recognition process, the recognized faces will be marked as present in the excel sheet and the rest will be marked as absent and the list of absentees will be mailed to the respective Teachers. Teachers will be updated with monthly attendance sheet at the end of every month [9].

4. RESULT AND DISCUSSION

- Login: Teacher logged-in, have an option to take attendance, by clicking that option model redirect to the camera.

- By facing the camera towards the students algorithm for face recognitions running in the background starts recognizing the faces using LBPH algorithm.
- By using the input frames of images algorithms works on those frames and forms the array of the images and compare them with the dataset of students.
- **If** best match found
  Attendance will be marked
  Elif
  Mark absent which do not matched.
- Stop camera processing

4.1. Detecting human face: Here we used webcam for detection process and we found that it can easily and accurately detecting the human face even if it is not in dataset. Showing in fig.2.

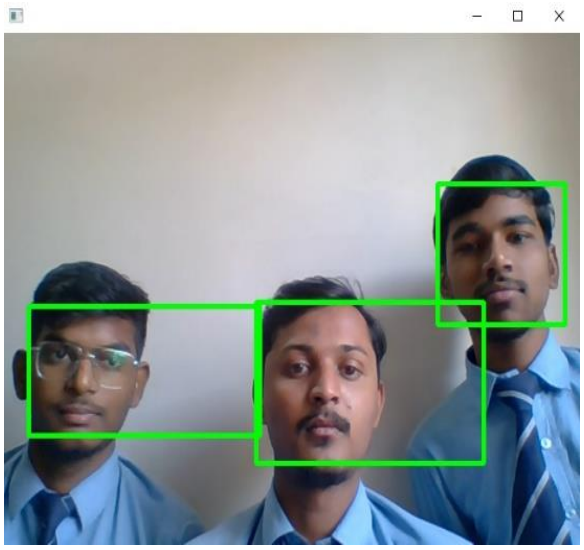


Fig.2.Detecting Face

4.2. Creating and training dataset: In fig.3. It is showing that the webcam is taking the cropped frames of images from RGB to grayscale. It takes total 100 samples of images, store them in database and train them using the training algorithm. After training the best features extracted using LBPH algorithm and store these features in the form of array of binary numbers in xml file.

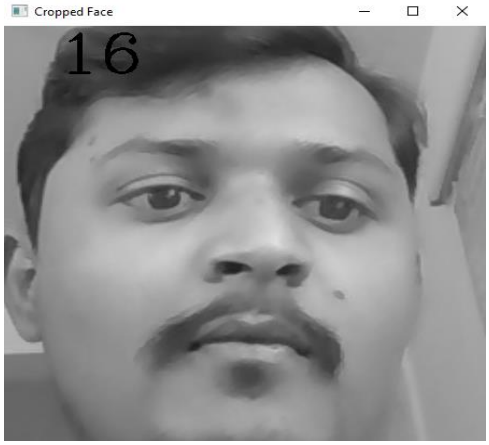


Fig.3.Taking training samples

4.3. Taking attendance: After successfully training the 8 students sample images. We then took the attendance accurately and it is detecting the faces and updating the attendance into excel sheet successfully. Showing in fig 4 and 5. Green rectangle around the faces of shows that faces have been recognized and attendance is updated successfully

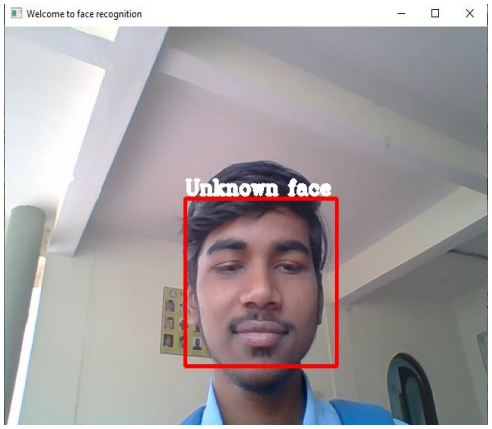
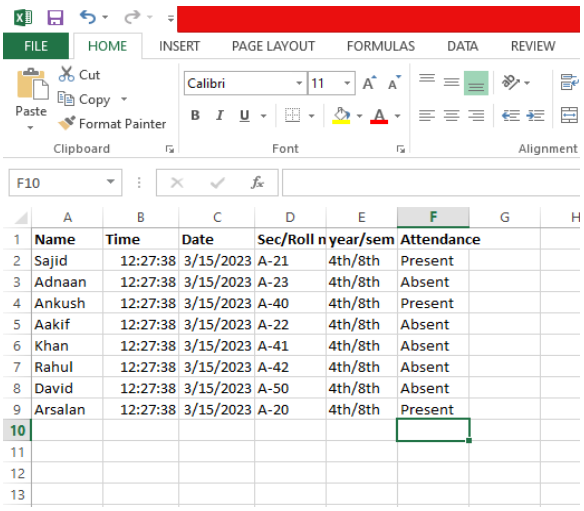


Fig.4.Face recognized

We have successfully implemented the model and have found the result better and fast, it is updating attendance using the information of student from the database as shown in fig.5.



	A	B	C	D	E	F	G	H
1	Name	Time	Date	Sec/Roll n	year/sem	Attendance		
2	Sajid	12:27:38	3/15/2023	A-21	4th/8th	Present		
3	Adnaan	12:27:38	3/15/2023	A-23	4th/8th	Absent		
4	Ankush	12:27:38	3/15/2023	A-40	4th/8th	Present		
5	Aakif	12:27:38	3/15/2023	A-22	4th/8th	Absent		
6	Khan	12:27:38	3/15/2023	A-41	4th/8th	Absent		
7	Rahul	12:27:38	3/15/2023	A-42	4th/8th	Absent		
8	David	12:27:38	3/15/2023	A-50	4th/8th	Absent		
9	Arsalan	12:27:38	3/15/2023	A-20	4th/8th	Present		
10								
11								
12								
13								

Fig.5.Updated attendance

5. CONCLUSION

We have successfully implemented the Face Recognition Attendance System model. It is working very fast, recognizing the faces accurately and updating the attendance successfully. We have tested the model with 3 student faces out of 8 student faces, it recognized very easily and found that that it is recognizing faces accurately and updating the attendance. The lightening condition while recognizing was normal as shown in fig.4.

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