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Face Recognition Based Attendance Software and Reporting using OpenCV

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Abstract: *The face is the identity of a person. The methods to exploit this physical feature have seen a great change since the advent of image processing techniques. The attendance is taken in every school, colleges and libraries. Traditional approach for attendance is professor calls student name and record attendance. It takes some time to record attendance. For each lecture this is a waste of time. To avoid these losses, we're going to use automatic process which is based on image processing.*

Identification of any people in any organization or colleges for the purpose of attendance marking is one of such software. Authentication is a significant issue in computer-based communication. Human face recognition is an important branch of biometric verification and has been widely used in many applications. The use of Attendance Management System is to perform the regular activities of attendance marking and analysis with less human intervention.

In this new approach, we are using face detection and face recognition system. This face detection distinguishes faces from non-faces and is essential for accurate attendance. The other strategy is facing recognition for marking the student's attendance. We have used OpenCV for this system. The camera will be connected using OpenCV module that converts the image into the RGB format which in turn is mapped to the pre-trained neural networks using HOG algorithm to recognize the face pixels. This system offers effective way to manage the attendance system which is time efficient and offers massive scaling for future purposes.

The image is processed as follows: first, faces are identified using a Haarcascade classifier, then faces are recognized using the LBPH (Local Binary Pattern Histogram) Algorithm, histogram data is checked against an established dataset, and the device automatically labels attendance. An Excel sheet is developed, and it is updated every hour with the information from the respective class instructor.

Keywords: Face Recognition, Image Processing, OpenCV, HaarCascade classifier, LBPH

I. INTRODUCTION

Face recognition is a technology that enables computers to identify people based on their facial features. A face recognition system uses a camera to capture images of faces and compares them to stored images of known individuals. If the computer finds a match, it can then determine who is present at the time of image capture. A smart attendance system combines both face recognition and an attendance system. It works similarly to a traditional attendance system, except that it can recognize students' faces instead of manually logging their attendance. The system can send out reminders to students if they fail to appear for a class. This is one way we can ensure students attend class.

This software can be used to record the attendance of students in class automatically. It does this by scanning the faces of students in the classroom and comparing them to a database of recorded attendance. This method is ideal because it eliminates the need for teachers to write down student attendance manually. It also eliminates the risks associated with collecting handwritten records. Plus, it reduces the amount of time required to verify student attendance. Institutions can save money and time by implementing an automated system for recording student attendance.

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Doing so frees up administrative staff to focus on more important tasks, such as grading assignments and filing paperwork. Furthermore, face recognition software helps schools identify repeat absentees. This allows them to of students. It has several uses in schools and colleges, primarily as an absenteeism management tool and a discipline strategy tool. In the first case, it helps teachers identify absent students in a timely manner. Attendance will be monitored by the face recognition algorithm by recognizing only the face of the students from the rest of the objects and then marking them as present. The system will be pre feed with the images of all the students and with the help of this pre feed data the algorithm will detect them who are present and match the features with the already saved images of them present in the database.

II. PROBLEM STATEMENT

In recent years, several research projects have sought to construct an automatic attendance system using biometric features. This project involves having students sit in columns in a classroom while using a variety of postures, gestures, and accessories.

Attendance is an important part of daily classroom evaluation. At the beginning and end of class, it is usually checked by the teacher. Face recognition-based attendance system is a problem of recognizing face for taking attendance by using high-definition video and other information technology. The concept of face recognition is to give a computer system the ability to find and recognize human faces quickly and precisely in images. Numerous algorithms and techniques have been developed to improve the performance of face recognition. Recently, deep learning has been highly explored for computer vision applications. Human brain can detect and recognize multiple faces automatically and instantly. But when it comes to computer, it is very difficult to do all the difficult tasks on the level of human brain.

III. PROPOSED METHODOLOGIES

The tools and methodology to implement and evaluate face detection and tracking are listed below.

A. OpenCV

Intel's OpenCV Library is an open source framework of programming functions that incorporate real-time computer vision, and it can run on various platforms. OpenCV can be ported to digital signal processors. It uses templates to automatically manage memory allocation and deallocation. OpenCV is used in many fields, including image processing, video analysis, machine learning, robotics, autonomous navigation, augmented reality, biometrics, and medical imaging.

B. Face Detection

This system can recognize faces from HD video collected images for the purpose of studying and detecting the face. Face from Section IV above, face detection detects where a face is in a picture, and it is accomplished by scanning the various picture scales and detecting the face by extracting the precise patterns. The A Haar-Like Feature function is used to build the prototype. Haar classifier facial detection is used in OpenCV to build a search window that scrolls over images and checks if a certain section of a picture resembles a face or not.

C. Feature Extraction

Face detection feature extraction involves locating the features of face components in an image. This process is done using a series of mathematical operations. First, the image is converted into grayscale. Then, the pixels are divided into blocks. Each block contains a small area of the image. Next, the image is examined for changes in color intensity. These changes indicate the presence of a face. Finally, the location of the face is determined by comparing the size and shape of the face to a pre-defined

template. This process is used in many applications, including face detection, facial expression recognition, and human activity recognition. This process is divided into identification and verification. This solution focuses on two terms: identification to detect the face in real-time video and verification application for facial recognition. The greatest matching score obtained in the previous stage is declared in the final phase of face detection. The configuration will define how the application should act.

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D. Attendance Marking

Attendance marking is the final step of the system procedures; in this stage, mark the attendance of the student; if the overall above development is done and recognize a copy adequately, then it will mark as a current in the system server; else, it will mark as absent. The database also stores the student's name, as well as the day and time of attendance. This information is then utilized to compile a student's cumulative attendance reports. The student is also notified if their attendance falls below a specific level.

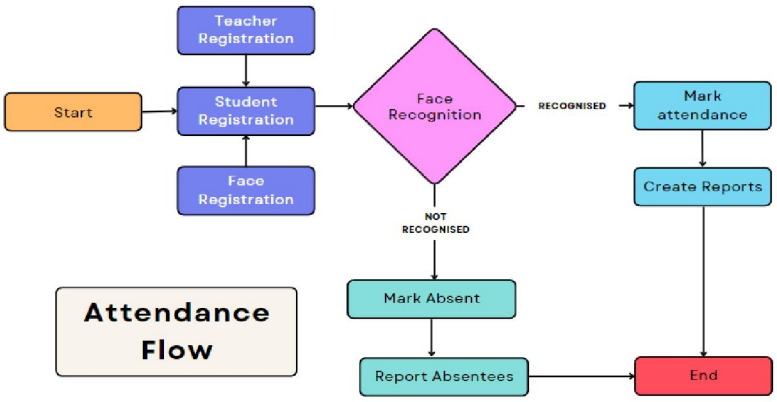

Fig: Attendance Flow Diagram

E. Report Generation

After the attendance is marked, visual reports and summaries can be viewed from the attendance records for any particular student. Bulk reports are also available to download from the dashboard and can be exported to an Excel sheet.

IV. WORKING PRINCIPLE and ALGORITHMS

- **INPUT**: Faces of students sitting in a classroom.
- **OUTPUT**: Automatic marking of attendance.
- **PROBLEM DESCRIPTION**: Recognizing the faces and marking attendance of present students accordingly.

1. Start.
2. To facilitate easy verifications, students are encouraged to enroll their personal details in the student database.
3. Install a webcam in the classroom. Students can be seen on it.
4. Face Detection using OpenCV.
5. The face recognition algorithm uses a binary code of how dark pixels are distributed in an image.
6. If the student's face is present in the database, Proceed.
7. If a person is recognized and matched, mark them present; otherwise, mark them as absent.

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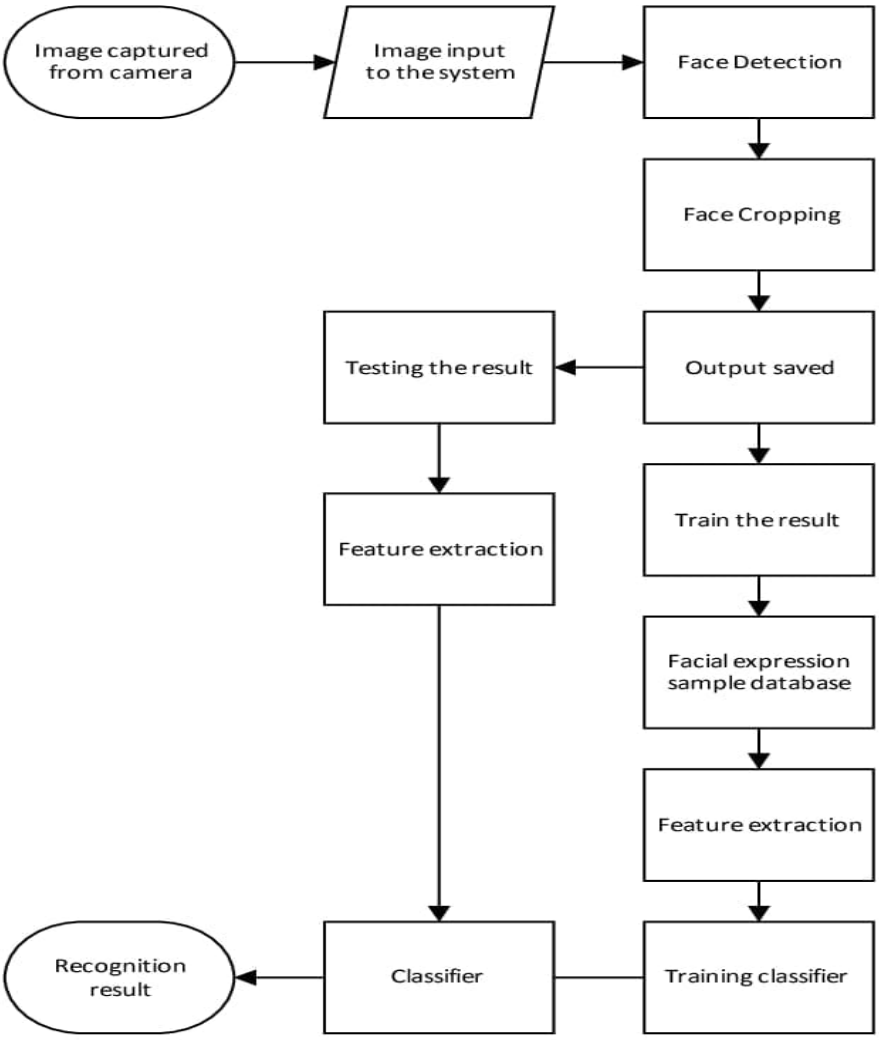

Fig 2: Work Flow

4.1 Haarcascade Classifier Algorithm:

Paul Viola and Michael Jones proposed Haar Cascade Algorithm, which is productively used for Object Detection. This Algorithm is based on a Machine Learning approach in which lots of images are used, whether positive or negative, to train the classifier.

- **Positive Images:** Positive Images are a type of image that we want our classifier to identify.
- **Negative Images:** Negative Images are a type of image that contains something else, i.e., it does not contain the objects we want to detect.

This involves Four Stages that include:

1. Haar Features Calculation
2. Integral Images Creation
3. Adaboost Usage
4. Cascading Classifiers Implementation

Haar Features Calculation: Gathering the Haar features is the first stage. Haar features are nothing but a calculation that happens on adjacent regions at a certain location in a separate detecting window. The calculation mainly includes

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adding the pixel intensities in every region and between the sum differences calculation. This is arduous in the case of large images because these integral images are used in which operations are reduced.

- **Integral Image Creation:** Creating Integral Images reduces the calculation. Instead of calculating at every pixel, it creates the sub-rectangles, and the array references those sub-rectangles and calculates the Haar Features. The only important features are those of an object, and mostly all the remaining Haar features are irrelevant in the case of object detection.
- **Adaboost Training:** The "weak classifiers" are combined by Adaboost Training to produce a "strong classifier" that the object detection method can use. This essentially consists of selecting useful features and teaching classifiers how to use them.
- **Cascading Classifiers Implementation:** It depends based upon the prediction. The classifier decides for indication of an object that was found positive or moved to the next region, i.e., negative. Because most windows do not contain anything of interest, stages are created to reject negative samples as quickly as feasible.

4.2 Local Binary Pattern Histogram(LBPH):

- **Local Binary Pattern** (LBP) is a simple yet very efficient texture operator which labels the pixels of an image by thresholding the neighborhood of each pixel and considers the result as a binary number.

Working of LBPH:

- **Parameters**: the LBPH uses 4 parameters:
    1. **Radius**: the radius is used to build the circular local binary pattern and represents the radius around the central pixel. It is usually set to 1.
    2. **Neighbors**: the number of sample points to build the circular local binary pattern. Keep in mind: the more sample points you include, the higher the computational cost. It is usually set to 8.
    3. **Grid X**: the number of cells in the horizontal direction. The more cells, the finer the grid, the higher the dimensionality of the resulting feature vector. It is usually set to 8.
    4. **Grid Y**: the number of cells in the vertical direction. The more cells, the finer the grid, the higher the dimensionality of the resulting feature vector. It is usually set to 8.
- **Training the Algorithm**: First, we need to train the algorithm. To do so, we need to use a dataset with the facial images of the people we want to recognize. We need to also set an ID (it may be a number or the name of the person) for each image, so the algorithm will use this information to recognize an input image and give you an output. Images of the same person must have the same ID. With the training set already constructed, let's see the LBPH computational steps.
- **Applying the LBP operation**: The first computational step of the LBPH is to create an intermediate image that describes the original image in a better way, by highlighting the facial characteristics. To do so, the algorithm uses a concept of a sliding window, based on the parameters **radius** and **neighbors**.
- **Extracting the Histograms**: Now, using the image generated in the last step, we can use the **Grid X** and **Grid Y** parameters to divide the image into multiple grids.
- **Performing the face recognition**: In this step, the algorithm is already trained. Each histogram created is used to represent each image from the training dataset. So, given an input image, we perform the steps again for this new image and creates a histogram which represents the image.

V. ADVANTAGES

- **Time-saving:** The system can automatically capture attendance by analyzing faces, eliminating the need for manual data entry.
- **Accuracy:** Face recognition technology ensures accurate attendance records by matching faces with existing data.

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- **Anti-spoofing measures:** Advanced algorithms can detect and prevent spoofing attempts, such as using photographs or masks.
- **Real-time data:** The system can provide real-time attendance data, allowing for better monitoring and analysis.

VI. CONCLUSION

Face recognition systems are part of facial image processing applications and their significance as a research area are increasing recently. Implementations of system are crime prevention, video surveillance, person verification, and similar security activities. The face recognition system implementation can be part of Universities. Face Recognition Based Attendance System has been envisioned for the purpose of reducing the errors that occur in the traditional (manual) attendance taking system. The aim is to automate and make a system that is useful to the organization such as an institute. The efficient and accurate method of attendance in the office environment that can replace the old manual methods. This method is secure enough, reliable and available for use. Proposed algorithm is capable of detect multiple faces, and performance of system has acceptable good.

REFERENCES

[1] Dadi, Harihara & Mohan, P.G.(2015). Enhancement of Face Recognition Rate by Data Base Pre-processing. International Journal of Computer Science and Information Technologies. 6.2978-2984.
[2] Buciu, Ioan & Grava, Cristian & Gacsadi, Alexandru. (2019). Facial Biometric Template Post-processing by Factorization. 1-4. 10.1109/ISSCS.2019.880173
[3] G.Satyanarayana Reddy,Rallabandi Srinivasu,Srikanth Reddy Rikkula,Vuda Sreenivasa Rao," Management Information System To Help Managers For Providing Decision Making In An Organization", International Journal of Reviews in Computing.
[4] Chen, Q., & Zhang, L. (2021). "Deep Learning-based Realtime Attendance Tracking System Using Facial Recognition." Journal of Computer Science and Technology, 36(2), 368-382.
[5] Zhang, L., et al. (2022). "IP and OpenCV-Based Facial Recognition for Attendance Tracking in Educational Settings." Journal of Computer Vision and Applications, 65(3), 312-324.
[6] Chen, J., et al. (2023). "IP and OpenCV-Based Face Recognition with Edge Computing for Attendance Tracking." International Journal of Computer Vision and Applications, 88(4), 432-446.
[7] Park, H., et al. (2023). "Multimodal Biometric Fusion for Advanced Attendance Tracking Using Face Recognition." International Journal of Computer Vision and Applications, 115(8), 812-826