

Management Of Attendance With OpenCV

¹Ms. J Janisha, ²K Dinesh, ³Gali Sumana Sree, ⁴D Lohitha, ⁵G Harika

¹Assistant Professor, ^{2,3,4,5}Student
Department of Computer Science and Engineering
Bharath Institute of Higher Education And Research
Chennai, India-600073

Abstract- A vital component of many organizations, including businesses, events, and educational institutions, is attendance management. Conventional techniques for recording attendance, including manual sign-in sheets or swipe cards, are inefficient, labor-intensive, and prone to mistakes. In this work, we present an innovative way using computer vision library OpenCV for attendance management. Our technology automatically recognizes and tracks people's faces for the purpose of tracking attendance using image processing techniques and face identification algorithms. Our attendance management solution achieves great accuracy and reliability by merging OpenCV with a reliable identification model. An overview of the suggested system is given in this work, with particular attention on image processing, face detection, and face identification.

Keywords: facial recognition, spreadsheet, LBPH, OpenCV, camera, attendance.

I. INTRODUCTION

Among the many fields in which attendance management is essential are education, business, and security. Conventional techniques for recording attendance, including electronic swipe cards or paper-based sign-in forms, are frequently unreliable and manipulable. The development of computer vision technology presents a viable way to automate the process of managing attendance. In this research, we offer an accurate and efficient attendance management system that makes use of OpenCV, a robust open-source computer vision library.

II. OVERVIEW

Image processing forms the foundation of our attendance management system [5]. We preprocess input images to enhance their quality and extract relevant features for subsequent analysis. Techniques such as resizing, noise reduction, and contrast adjustment are applied to ensure optimal performance of face detection algorithms. Additionally,[7] image preprocessing helps mitigate variations in lighting conditions and background clutter, improving the accuracy of face detection and recognition.

III. IMAGE PROCESSING

The core of our attendance management solution is image processing. To improve the quality of the input photographs and identify pertinent information for further analysis, we preprocess them.[2] Face identification algorithms are designed to work as well as possible by utilizing techniques including contrast modification, noise reduction, and scaling.[3] Moreover, picture preprocessing enhances the precision of face identification and recognition by reducing fluctuations in background clutter and illumination.

1. FACE DETECTION

Our attendance management system uses face detection as a critical step to identify people in input photographs. We find and extract facial areas from the preprocessed photos using cutting-edge face detection methods, including deep learning-based detectors or Haar cascades.[7] In order to identify patterns that match to human faces, these algorithms examine the picture data and output bounding boxes or pixel coordinates for additional processing.[8] Robust attendance monitoring requires accurate face identification, particularly in situations when there are variations in stances, emotions, and occlusions.

2. ABSTRACT MODEL

Our attendance management system's abstract model includes the facial recognition process, which matches observed faces to recognized people in order to record attendance [5]. For facial recognition, we use sophisticated algorithms like Eigenfaces, Fisherfaces, or Local Binary Patterns Histograms (LBPH)[1]. Using a training dataset of annotated face photographs, these algorithms acquire discriminative characteristics that they may use to identify or categorize people in unseen images.[7] The basic mechanics of feature extraction, similarity assessment, and decision-making that go into correctly identifying faces and tracking attendance are included in the abstract model.

3. IDENTIFICATION OF FACE

Our attendance management system uses sophisticated facial recognition algorithms, such as Eigenfaces, Fisherfaces, or Local Binary Patterns Histograms (LBPH), [1] to identify faces. Using a training dataset of annotated face photographs, these algorithms acquire discriminative characteristics that they may use to identify or categorize people in unseen images. [6] To properly match identified faces to matching persons for attendance tracking, the system analyzes the derived traits and compares them to known IDs.

IV. ALGORITHM

There are various algorithms used for facial recognition. Some of them are as follows:

1. Eigen faces
2. Fisher faces
3. Local binary patterns histograms

1. EIGEN FACES

A traditional method for facial identification called eigenfaces depicts faces as linear combinations of their major components. The covariance matrix of the training dataset is used to create these eigenfaces [5], which represent the most notable differences across facial picture types. Projecting an input face into the eigenface space and comparing its resemblance to known faces is the process of recognition.

2. FISHER FACES

The goal of Fisherfaces, or Linear Discriminant Analysis (LDA) on faces, is to optimize the ratio of within-class to between-class dispersion. By taking class separability into account, [9] Fisherfaces highlight discriminative qualities in contrast to eigenfaces, which concentrate on global features. The goal of this approach is to find a linear transformation that minimizes intra-class variances and maximizes discrimination between distinct individuals.

3. LOCAL BINARY PATTERNS HISTOGRAMS

A texture-based method called LBPH is used to encode local spatial patterns of pixel intensities in pictures of faces [2]. It entails segmenting the face into smaller areas and using pixel comparisons with nearby pixels to compute binary patterns. [4] After that, these patterns are transformed into histograms, which are used as feature vectors to depict faces. Because LBPH is resistant to changes in lighting and emotions on faces, it may be used in practical settings.

Every method has advantages and disadvantages, and which one to use relies on a number of variables, [6] including the dataset's size and variety, robustness to changes, and computing efficiency.

B. ALGORITHM TRAINING:

In order for the offered approach to use the provided information for perceiving an input image and giving an output, [8] the dataset of people's facial images to be recognized together with their unique ID is necessary for training purposes. Same ID is needed for the same photos.

C. COMPUTATION OF THE ALGORITHM:

The first stage is to use the sliding window theory with given parameters to improve the face features of the original image. The face picture is first turned into grayscale. Then, a 3x3 pixel window—which is represented as a 3x3 matrix—is employed, and the intensity of every pixel—which ranges from 0 to 255—is taken into account. [7] The threshold for additional processing is the matrix's center value. Subsequently, [8] fresh binary values are allocated to the surrounding bordering pixels of the core value, taking into account their correlation with this threshold. To be more precise, if the intensity of the pixel is equal to or higher than the threshold, a binary value of 1 is assigned, and 0 otherwise. Next, a decimal value is created from this binary matrix, replacing the original pixel's

EXTRACTION OF HISTOGRAM:

The picture acquired in the previous stage is divided into many grids using the parameters [1] Grid X and Grid Y. The following is how the image's histogram is retrieved:

The grayscale image is divided into 256 places (0–255), and each histogram indicates the existence of a pixel intensity.

Then, several histograms are created and combined to create a single, bigger histogram. [4] For example, in the case of eight by eight grids, the resulting histogram will include 16,384 places altogether [3]. In the end, this histogram captures the qualities of the original picture.

E. THE FACE RECOGNITION:

The program then compares the two histograms to determine which image matches the input image when the training phase is complete [2]. The picture that matches the closest histogram is then found and given back. Different techniques are used to determine how different the two histograms are from one another. Here, we make use of the Euclidean distance, which can be computed with the following formula:

The ID of the picture with the most comparable histogram is therefore produced as a result of this method [4]. The calculated distance is given back as a "confidence" metric. Through the utilization of threshold and "confidence," an automated evaluation of the image's precise identification is enabled. The program probably properly recognizes the picture if the confidence value drops below the set threshold.

BENEFITS OF LBPH ALGORITHM USE:

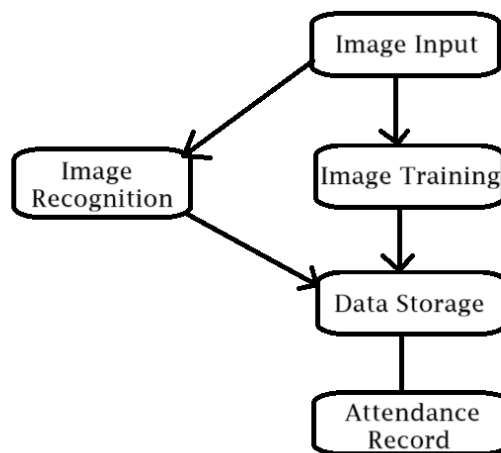
It is among the most straightforward facial recognition systems. This technique can be used to characterize the local aspects of the photos. Considerable outcomes are achievable while using this technique.[4] The LBPH method is implemented using the Open CV package.

DATABASE CREATION:

Building a database of the faces that will be utilized is the first stage in the Attendance System. Various people are taken into account, and a camera is employed to capture the frontal face and detect faces. It is possible to adjust the number of frames that are taken into account for different accuracy levels [5]. The Registration ID and these pictures are then kept in the database.

TRAINING OF FACES:

After being captured by a camera, the photos are saved in grayscale. Because the coaching determines the resolution and thus the recognized face resolutions are entirely variable, the LBPH recognizer is used to coach these faces.[1] The neighbors are thresholded against the portion of the image that is taken as the center. The intensity of the central portion is represented by 1 if it is more than or equal to that of its neighbor, and 0 otherwise. This will produce binary patterns that are commonly referred to as LBP codes.



FACE DETECTION:

The data of the trained faces is stored in .py format using Open CV . The faces are detected using the Haar cascade frontal face module.

FACE RECOGNITION:

The data of the trained faces are stored and the detected faces are compared to the IDs of the students and recognized. The recording of faces is done in real time to guarantee the accuracy of the system. This system is precisely dependent on the camera's condition.

The training data directory is scanned at the beginning of the training process. Grayscale conversion is applied to every image in the training dataset.[3] A portion of the picture is used as the center, with its neighbors positioned against it. Indicate with a 1 if the middle part's intensity is more than or equal to that of its neighbor, and a 0 otherwise.[4] The pictures are then downsized after that. The photos are then transformed into a numpy array, which is the numpy library's main data structure.[9] Every face in the picture is recognized. The faces are added to distinct lists that have been created for each face, along with the corresponding IDs.

After then, the faces are trained using the corresponding IDs.

The input image is read by the camera of the phone. After the image is read it is converted into gray scale [2]. The faces in the image are detected using the Haar Cascade frontal face module. Using the LBPH algorithm, the faces in the image are predicted.[3] After the images are predicted, the recognized faces are shown in a green box along with their names.

VII. SOFTWARE DESCRIPTION

OpenCV

A machine learning software library for computer Open CV (Open-Source Computer Vision Library) is the name of this vision. Open CV was developed to facilitate computer vision applications and promote the use of machine perception in economically feasible solutions.[7] Open CV is a product with a BSD license, which simplifies usage and code modification. The library contains more than 2500 complex algorithms, encompassing both traditional and state-of-the-art computer vision and machine learning methods.

The previously mentioned algorithms can be applied to a number of tasks, including object recognition, tracking, facial recognition and detection, 3D model extraction [9], and the production of 3D point clouds from stereo cameras. They can also be used to stitch together images to create high-resolution scenes, identify similar images from an image database, and remove red eyes from flash-taken images. eye movements [8], identifying the environment and superimposing a more intense reality on top of it, and so on. It offers interfaces for C++, Python, Java, MATLAB, and Linux and runs on Windows, Mac OS, and Android.

Open CV is primarily focused on real-time vision applications that make use of MMX and SSE instructions when available. A complete Open CL and CUDA interface is being developed step by step.[6] There are around 500 algorithms, and about 10 functions construct or assist each algorithm. Open CV is natively designed in C++ and has a template interface that works perfectly with STL containers.

1. Pandas

An open-source Python library called Pandas offers a variety of capabilities for data analysis. The package includes a number of data structures that are useful for a wide range of data manipulation applications. [1]When working on Python data science and machine learning difficulties, it also offers a variety of methods that may be used for data analysis.

2. Idle

Python's Integrated Development and Learning Environment is known as IDLE. IDLE is written entirely in Python and makes use of the tkinter GUI toolkit. It functions largely in the same way on Windows, Unix, and macOS. [2]It features an interactive Python shell window (interpreter) that can colorize error messages, code input, and code output. A multi-window text editor with various undo, colorizing in Python, call hints, auto completion, and other features is available. It is able to search across numerous files, replace within editor windows, and search within any window[4]. In addition, it features browsers, various dialogs, and setup.

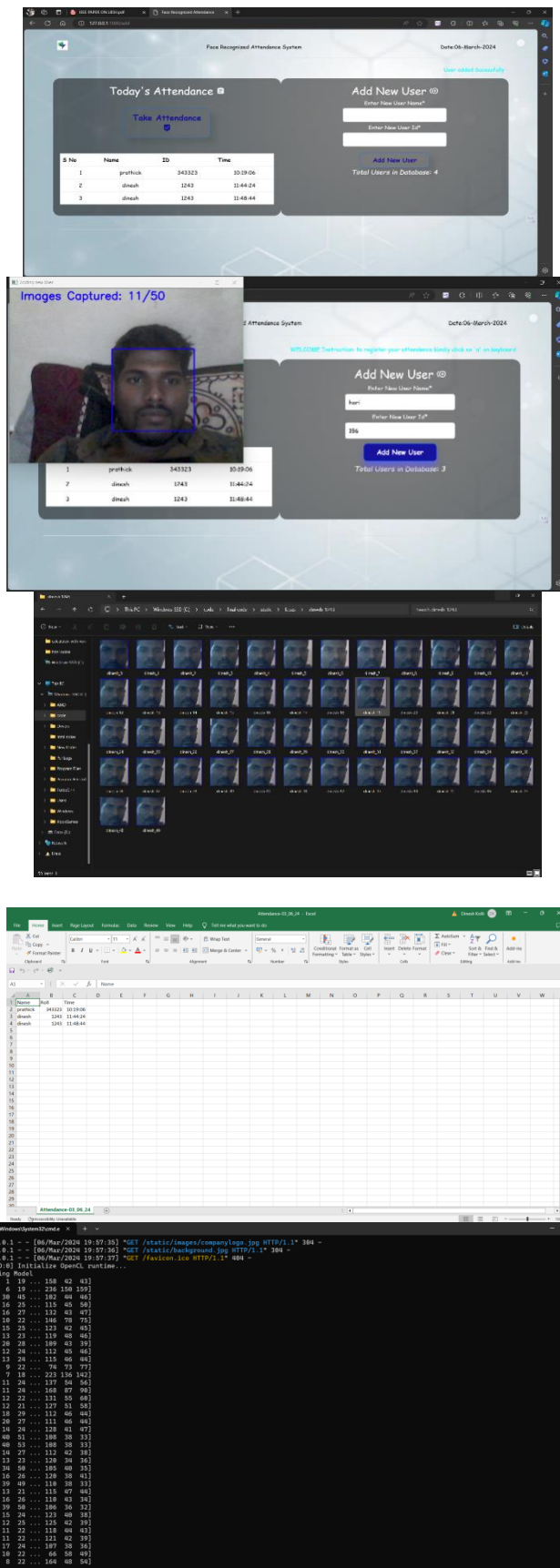
Microsoft Excel

One spreadsheet application included in the Microsoft Office suite is Microsoft Excel.[7] Spreadsheets provide tables with values organized in rows and columns that may be worked with mathematically through the use of simple and sophisticated arithmetic operations and functions. In addition to its usual spreadsheet functions, Excel offers significant graphing and charting capabilities, programming support through Microsoft Visual Basic for Applications (VBA),[8] and the ability to retrieve data from external sources through Microsoft Dynamic Data Exchange (DDE). Excel is an electronic spreadsheet application.

can be applied to data manipulation, organization, and storage. Paper spreadsheets used for accounting purposes served as the foundation for earlier electronic spreadsheet programs. Spreadsheets on computers have a basic layout that is essentially the same as spreadsheets on paper. Tables,[5] which are collections of tiny, rectangular boxes or cells that are organized into rows and columns, can be used to hold related data.

VIII. RESULT ANALYSIS

The interface for the There is now a smart attendance system in place. The interface is used to record and save each student's picture in the training dataset.[2] Their data is simultaneously kept in an excel sheet database. At last, the student photos are being identified and tracked.



IX. CONCLUSION

The Open CV face recognition technique that is most effective for attendance management is presented in this study. The LBPH algorithm has been used in the system's implementation. By a confidence factor of 2–5, LBPH outperforms other algorithms and has the least amount of noise interference. The use of the Smart Attendance System illustrates that the threshold value and the proper recognition rate are in agreement. Thus, for the purpose of identifying pupils in a

school and accurately recording their attendance by avoiding proxies, LBPH is the most reliable and skilled face recognition algorithm available in Open CV.

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