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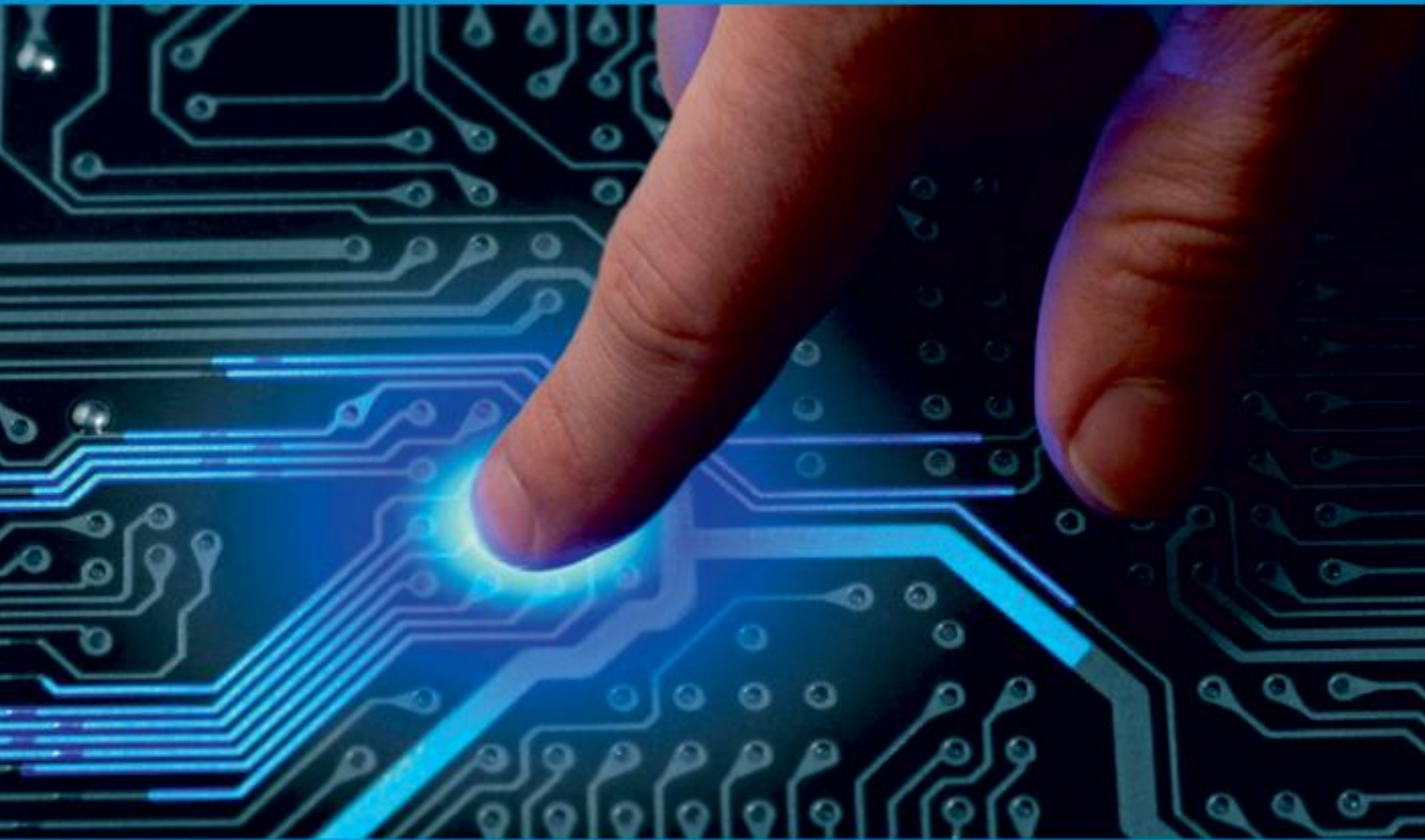

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Literature Review of Smart Attendance Systems

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ABSTRACT: The Smart Attendance, a sophisticated system that uses machine learning algorithms to streamline and automate attendance tracking, makes use of the strength of artificial intelligence and machine learning approaches. The time-consuming, inaccurate, manual technique of taking attendance that is currently used is intended to be replaced by this technology. The proposed system uses facial recognition technology to recognize and verify students' identities, and then records their attendance automatically in a database.

KEYWORDS: Facial Recognition, Attendance management system, Real time monitoring, OpenCv, Time and attendance tracking, Literature Review, Machine Learning.

I. INTRODUCTION

A crucial component of any school or classroom is attendance. Monitoring the attendance of students, teachers, and staff is important for a number of different reasons. Most school administrators or teachers have to call out students' names to keep track of who is in class. It takes too much time for a class to call on students by name. Some professionals write down who is there on paper by hand. Some teachers took to calling students' names in the middle of lectures, and others used biometric systems like RFID cards, fingerprints, and the Iris system and reader to keep track of who was there. The RFID card technology is used to give each student a card with their name on it. Even though it's possible to lose a card or Someone else could use the card to do something bad. As compared to other biometrics, each one has its own drawbacks and isn't always trustworthy, such as fingerprint, vocal, or iris recognition.

The attendance management system uses face recognition as a clever technique to monitor attendance. Face recognition is more accurate, faster, and less likely to lead to proxy attendance than other systems. Face recognition makes identification passive, which means that the person being identified doesn't have to do anything to show who they are. Face recognition has become one of the most important biometrics. It doesn't get in the way and is easy to get. Face-recognition systems usually don't know how different parts of the face look.A face recognition system consists of two components: face detection and face recognition. We're trying to figure out a method to use face recognition to collect attendance. In this case, the face of each person will be used to keep track of who is there. Face recognition is a technology that is used more and more these days. Our method uses machine learning and facial recognition to make up for what the current system doesn't do well.

II. MOTIVATION

The installation of a smart attendance system utilizing facial recognition is driven by a number of factors. Some of them are:

Improved accuracy: Traditional attendance systems that rely on manual data entry or biometric authentication methods like fingerprint scanning can be prone to errors or fraud. In contrast, face recognition technology offers a high level of accuracy and reliability, as it matches the unique facial features of each individual with their stored image.

Time-saving: Face recognition technology may automate the attendance monitoring process, doing away with the need for paper logs or physical sign-ins. This can save a significant amount of time for both students and teachers, allowing them to focus on more important tasks.

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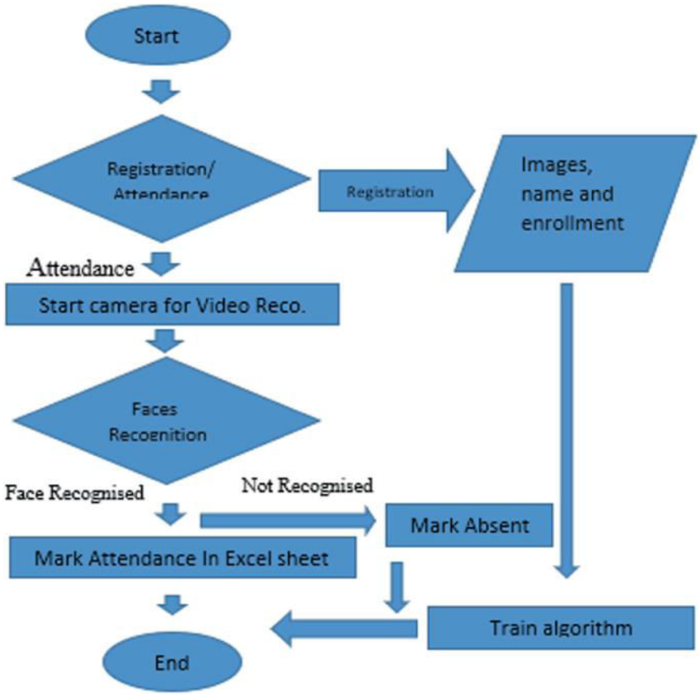
Enhanced security: The use of face recognition technology can also enhance the security of the school or college campus, as it can help identify individuals who are not authorized to be on the premises. In case of any security breach, the system can quickly alert the concerned authorities.



III. LITERATURE SURVEY

In [3], authors developed a prototype for a computerized attendance system. The example shows how RFID and face recognition may be used in conjunction to track and count authorized students as they enter and leave the classroom. Every student who signs up is tracked precisely by the system. The system provides the necessary details and maintains a record of all the information for each student enrolled in a certain course in the attendance log.The iris biometric attendance system was developed and deployed by the study's authors [4]. First, participants had to sign up using a unique iris template and their personal data. At the beginning of class, the system took a picture of each student's eyes, identified their irises, and looked up matches in a database to determine their attendance. The prototype was created online. Paper[1] states that authors created the system for smart attendance . The front end is created by electron JS and the backend consists of logic and python. First of all, taking an image requires a high-quality camera to collect the photographs of the students, and a histogram of oriented gradient is used in the identification process. The technology employs machine learning to improve the limitations of the current system using a facial recognition technique. deep learning performance recognition, too. They produced a dataset for teachers and students prior to testing.Daily timetable uploaded by administration. The administrator must first enter the student's name, department, and roll number in order to initialize the system. For testing purposes, they have constructed a training dataset of 6 kids, each with a total of 120 photos. Subjects are to be filled out in accordance with the timetable. Once the time for the related topic arrives, the system begins to take pictures, detects faces, and compares them to existing databases. It also records attendance and generates an excel sheet to help identify pupils. Images may be recognized by the attendance system in a variety of lighting and angle situations. Unknown faces are those that are not included in our training dataset. Real-time attendance tracking is done for students with identifiable photos. and automatic system saving and importing to an Excel sheet. In article [2], The Haar-Cascade classifier and the Local Binary Pattern Histogram methods are used to detect and identify faces, respectively. In the live-streamed video from the classroom, faces are picked out and recognised. Attendance reports will be forwarded to the concerned instructors after the session. Before their photos are taken and included to the dataset, each student in the class must register by giving the required information. Things in accordance with those wants will be faces. Each lesson's live streaming footage from the classroom allowed for recognition. The visual data from the dataset will be contrasted with the recognised faces. If a match is found, the attendance of the relevant student will be recorded. A list of absentees will be delivered to the faculty member in charge of that specific class at the conclusion of each session. Face recognition involves the preparation of training data,

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training of a face recognizer, and prediction in three phases. Contains a database picture as training data.This system uses the Local Binary Pattern Histogram as a face recognizer. First, the full face's list of local binary patterns (LBP) is compiled. LBP is converted to decimal, and then a histogram is generated. *The best choice is returned once this value is contrasted with the* dataset value.In paper[5] The project's main guideline is that the video that was recorded by the camera is turned into an image for viewing. Also necessary is the provision of a known code picture; otherwise, the system will flag the site as unknown. Use face detection, face recognition, and attendance tracking to record a video of people, divide it into frames, and then utilize the frames to create a video of people, split it into frames, and connect it to a database to verify their presence or absence.This will allow you to mark the presence of a real student so you can keep a record of it. The system fails when the Automated Attendance System is utilized in larger spaces, like the seminar, to help feel like there are more people there. Poor lighting in the classroom can occasionally have an impact on image quality, which in turn affects system performance. This can be fixed afterwards by enhancing video quality or utilizing certain algorithms. Other related systems are similar systems that are used in many colleges, institutions, and schools. These systems use biometrics (like fingerprint recognition, RFID, etc. to identify end users. But these systems raise even more privacy concerns. These systems can also be hurt by the people who use them. Because of this, they cost more to keep up. Our idea is to make sure that no one can physically get into the automated system.

IV. ALGORITHMIC SURVEY

Principal Component Analysis (PCA): to make the data's dimensions smaller, a typical approach is Principal Component Analysis (PCA), and it can be applied to image recognition using machine learning. Here are the basic steps involved:

Data preparation: Collect a set of images that you want to use for training your model. Each image should be of the same size and represented as a matrix of pixels.

Flatten the images: To apply PCA, you need to represent each image as a 1-dimensional vector. Flatten each image so that it is a row vector of pixel values.

Normalize the data: Subtract the mean pixel value from each pixel in every image. This centers the data around zero.

Apply PCA to the dataset of flattened and normalized images. This will give you a set of principal components that capture the most important features of the images. The eigenvectors of the data's covariance matrix make up the major components.

Choose the number of components: Determine how many principal components you want to keep. You can use a scree plot or other statistical tests to help you decide.

Project the data: Use the chosen principal components to project the data onto a lower-dimensional space. A vector with fewer dimensions is now used to represent each image.

Train a classifier: Train a machine learning classifier using the reduced-dimensional vectors as input. You can use any classification algorithm you like, such as logistic regression, k-nearest neighbors, or a neural network.

Evaluate the classifier: Test the performance of your classifier on a separate set of images that were not used for training. You may use metrics like accuracy, precision, recall, and F1 score to evaluate the performance.

Preprocessing: Preprocessing is done on the input face photos to reduce noise and improve contrast. This can involve techniques such as histogram equalization, Gaussian filtering, or median filtering.

Feature Extraction: Then, in a high-dimensional space where each dimension is equivalent to a pixel in the image, the faces are represented as vectors.Calculating the eigenfaces, the primary components of the face pictures, is a phase in the feature extraction process.

Dimensionality Reduction: The dimensionality of the feature space is subsequently decreased using the eigenfaces.The eigenvectors of the covariance matrix of the training set must be projected onto the face images in order to achieve this. The resulting projection coefficients make up the reduced feature space.

Classification: The input face photos are categorized using the reduced feature space. This might make use of techniques like K-Nearest Neighbor (KNN), Support Vector Machines (SVM), or Neural Networks, which identify a connection between the identification of the individual and the condensed feature space.

The equations for PCA in face recognition are as follows:

Covariance matrix:

$Cov(X) = 1/(n-1) * (X - mean(X)) * (X - mean(X))'$ where $Cov(X)$ is the covariance matrix of the input face images, X is a matrix where each row corresponds to a flattened face image, n is the number of face images, and ' denotes matrix transposition.

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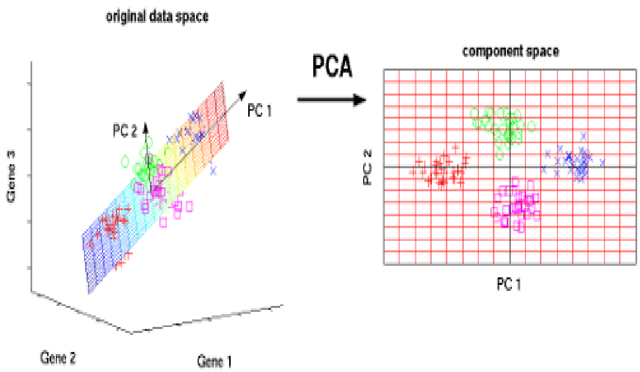
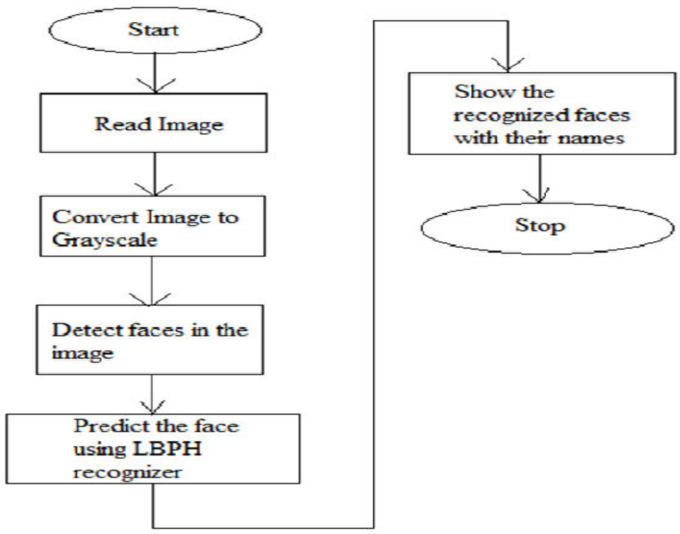
Eigenvectors and eigenvalues:
[eigvecs, eigvals] = eig(Cov(X)), where eigvecs are the eigenvectors and eigvals are the associated eigenvalues of the covariance matrix, and eig() is the eigendecomposition function.



Projection coefficients:
Coeff = eigvecs' * (X - mean(X))
where Coeff is a matrix where each row corresponds to the projection coefficients of a face image, eigvecs' is the transpose of the eigenvectors, and mean(X) is the mean face image.

Reconstruction:
When X rec is the reconstructed face image, mean(X) is the mean face image, eigvecs is the matrix of eigenvectors, and Coeff' is the transpose of the projection coefficients, the equation reads:
X rec = mean(X) + eigvecs * Coeff'.

Classification:
The reduced feature space, represented by the projection coefficients, can be used to train a classifier such as KNN or SVM, which can then be used to classify new face images based on their projection coefficients.



LBPH:
A variation of the Local Binary Pattern (LBP) method that is frequently used for face recognition is called the Local Binary Pattern Histogram (LBPH). By creating a histogram of Local Binary Patterns (LBPs) at each image pixel, LBPH encapsulates the spatial distribution of texture information in a picture.

Here are the steps for implementing the LBPH algorithm for face recognition:

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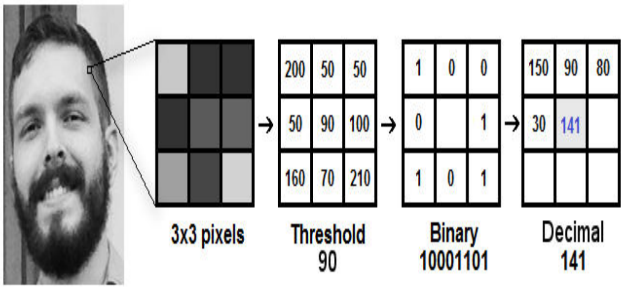
Preprocessing: Preprocessing is done on the input face photos to reduce noise and improve contrast. This may entail methods like median filtering, Gaussian filtering, or histogram equalization.

Feature Extraction: The LBPH operator is applied to each pixel in the image, resulting in a binary code for each pixel. The binary codes are then used to create a histogram of local binary patterns. For a block of size n x m, the LBPH operator is defined as:



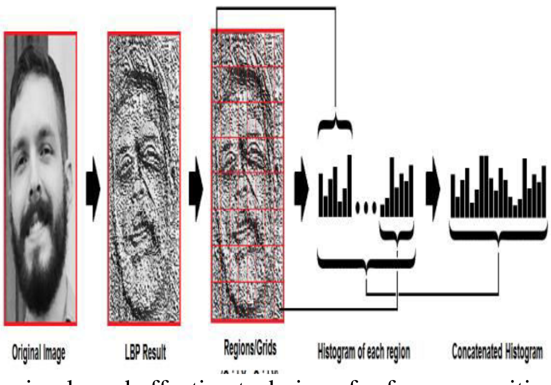
LBPH(x, y) = sum_{i=0}^{n-1} sum_{j=0}^{m-1} s(LBP(x+i, y+j) - LBP(x, y)) * 2^{i*m+j}

where (x, y) is the location of the block, and s() is the sign function. The spatial distribution of the block's texture characteristics is encoded in a decimal number that is the value of the LBPH operator.

Feature Vector: Each block of the face picture is subjected to the LBPH operator, producing a histogram of LBPH values. Each LBPH value's frequency in the image is represented by a count in the histogram. The feature vector for the facial picture is taken from the resultant histogram.

Classification: A classifier like (KNN) or (SVM) after being trained with the feature vector, can be used to classify fresh face images based on their LBPH feature vector.

The LBPH algorithm has several advantages over other face recognition techniques. It is computationally efficient, and it is robust to illumination changes and noise in the image. However, it can be sensitive to facial expressions and occlusions in the image.



Overall, the LBPH algorithm is a simple and effective technique for face recognition.

V. Conclusion and Future Work

An automatic attendance management system deals with the issues that manual processes in current systems cause.We have used the idea of facial recognition to build a system that detects and records people's presence by recognising their faces. Regardless of the subject's attitude, lighting, or facial expression, these technologies work well.There is potential for improvement because these systems don't always recognise every student's face in the classroom. The portable form enables comfortable usage even during active sessions without interfering with instruction. Future possibilities include developing a tool that is easier to use, more ergonomically compact, and will help improve the academic atmosphere.

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