



## FACE RECOGNITION ATTENDANCE SYSTEM

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**ABSTRACT:**The Face Recognition Attendance System using Machine Learning leverages advanced facial recognition algorithms to automate attendance tracking. This system extracts and analyzes facial features from images captured through a camera, identifying individuals and matching them against a pre-existing database. The facial recognition feature in the attendance system not only provides the accurate attendance but also eliminates the flaws. We can overcome defects by using face recognition feature in the attendance system, it not only saves resources but also reduces human intervention in the overall process by delegating all complex tasks to the system. The Student need to register first to use the system using their name, and id. The admin can log indirectly using their credentials. They can view the registered students and their details. The system will mark the attendance of students by detecting their faces using the webcam. The attendance list of all the students is accessible to everyone and cannot be modified by students. The front end involves Html, CSS and the back end involves Python. The framework used is flask. Libraries like OpenCV, Dlib, Numpy, MachineLearning KNN are used here.

### 1. INTRODUCTION

Facial recognition serves as a vital security purpose. It can be seen everywhere. The sensors in our mobile phone and camera in front of our houses are able to find the facial recognition system. For Human identity our face plays a crucial role in this system. Face recognition is an important technique as it is mainly distinguishes a person. Face recognition systems are used to unlock software on mobile devices. There are some conditions that the face recognition struggles to perform its operation like if there is a poor lighting, long hair, sunglasses or when the objects partially that covers the human face.

Using various techniques like including machine learning algorithms such as K- Nearest Neighbors (KNN) is one of the most popular algorithms used in face recognition. It is mainly for classification purpose which uses supervised learning approach. It works by finding the majority of its neighbours of a data points that are located in the nearest neighbours.

In face recognition, KNN uses the distance between facial feature points to classify a face .KNN algorithm uses the neighborhood classification as the predictive value of a good instance value. By using the closest data points the input data is classified in the KNN. By storing the previously stored image the facial features of an input image will be compared and for that KNN is used in face recognition system.KNN provides the features like computationally efficient and simple to implement .And also the experimental results demonstrate that KNN has a greater capacity to recognize frontal faces that aren't covered, with a success rate of 90%.

### 2. REVIEW OF LITERATURE

A literature review on a face recognition attendance system using K-Nearest Neighbors (KNN) algorithm would typically encompass studies, research papers, and articles that explore various aspects of this technology. Here's a structured breakdown of what you might include the concept where In Kawaguchi introduced a lecture attendance system with a new method called continuous monitoring, and by capturing the photos the students in the class It automatically marks

the attendance. As there are two cameras which are equipped with the wall of the class the architecture of the system is simple. The first camera is for capturing the student's images and another camera acts as a sensor camera for getting the seat of the students in the class and the image of the student will be snapped by capturing camera. In order to process the attendance the student's images that are captured by the camera will be compared to the images of the students in the database. Machine learning algorithm generally which are used in the computer vision are used by this system. For training the images from the capturing camera the HAAR CLASSIFIERS are used. These systems will do conversion to grayscale and do substration on the images after capturing the face snap by the camera and further transferred and stored on server for processing later.

Evaluation metrics used to assess system performance (e.g., accuracy, precision, recall). Comparative analysis with other face recognition algorithms. Real-world applications and case studies Proposed enhancements and optimizations for KNN-based attendance systems. Integration with other technologies (e.g., deep learning, IoT) for improved performance. Suggestions for further research and development in the field.

### 3. MOTIVATION

**Time-Saving For Your Workforce:** Saving time is the most important and efficient benefit. "time-saving equals to money saving." Said by great people is very true because saving time at work increases productivity. Here is the example: When workers get to the workplace, what is the first thing they do in the morning? Obviously, marking their attendance right? Workers should stand in line and wait for their turn to mark their attendance. Similarly, what would be the first thing that teachers do in class? Taking the attendance of students right? So teacher should call each student name or roll number to identify them and mark attendance. So, this is very time consuming process.

They could have spent that time for work. Using face recognition attendance system, this whole time can be saved and without wasting their time staff can do their work. Face recognition based attendance systems also help the employees to know the importance of work and time and give accurate attendance marking even if the employee or student covers his face with a mask.

**Increased Efficiency and Capability:** Face recognition attendance system plays a important role in today's industry. For any organization, maintaining Employee/student attendance tracking on a daily basis is a difficult task. However, manual attendance tracking can be a time-consuming process and can cause human errors. So an automated attendance-management system like face recognition attendance system provides precise time records and reduces costly mistakes.

With an automated attendance system using face recognition, managers and teachers' workload is reduced and increases their speed and efficiency by freeing up energy and time for other critical activities. As a result, we will get accurate data in less time.

**Boosts Workplace Security:** After spending a significant amount of time working from home in their comfortable way, employees are likely to be wary about returning to the workplace. However, you may provide them a greater sense of security and protection when they return to work after COVID by putting in place a facial recognition attendance system. The face detection attendance system has the benefit of preventing unauthorized people from accessing your workplace. When an employee arrives, an attendance system that recognizes faces might be used to grant or deny access. This is particularly crucial if your business handles sensitive data or expensive inventory. This prevents access to a company's data by other employees or those outside of your corporation. The face attendancesystem records an employee's pay rate, work schedule, and all information.

**Simple To Manage Records:** It can be difficult to keep track of someone's everyday activities, entry and departure times. It's even harder to manage the same thing for hundreds of people. Consider being questioned about a worker's attendance records for the previous month. Going back and forth to obtain such facts will take some time. nonetheless, not using automated attendance tracking. With a few clicks, you can go back and view any employee's details at any time. The face attendance

system further minimizes the possibility of face authentication using still images or playing films by offering solution checks for face liveliness. Facial recognition-based attendance systems provide configurable workflows and analytics for reporting and finding anomalies.

## 4.METHODOLOGY

To develop a face recognition system using the k-nearest neighbors (KNN) algorithm for 20million images, a structured methodology is essential. Here's a breakdown of the approach:

**Data Collection and Preprocessing:** Collect a dataset of different face images of different people and, make sure that it covers the various poses, demographics, lighting conditions, and expressions.To standardize the factors such as size, orientation, and lighting. Preprocess those images using Techniques like normalization, histogram equalization, and alignment can be applied.

**Feature Extraction:**To represent each face numerically, extract the discriminative features from the preprocessed images. Common techniques include eigenfaces, local binary patterns (LBP), or deep learning-based feature extraction using Convolutional Neural Networks (CNNs) can be used.

Ensure that the representation of features that it captures the essential characteristics of each and every face while reducing the redundancy and noise.

**Dataset Partitioning:** In data partitioning, the dataset should be splitted into different sets. So, Split the dataset into training, validation, and testing sets. To train the KNN classifier, training set is used. if necessary, To fine-tune parameters the validation set is used and the testing set is used to evaluate the system's performance.

### **KNN Model Training:**

Now, the KNN model should be trained using the training dataset and the extracted features. This involves storing the feature vectors and corresponding labels (identities) in the memory for efficient retrieval during inference

### **Evaluation and Fine-tuning:**

Evaluate the trained model using the validation set to get accuracy, precision, recall, and other performance metrics. Fine-tuning the hyper parameters such as the distance metric used in KNN (e.g., Euclidean) or the number of features extracted to optimize performance.

### **Testing and Deployment:**

Evaluating the final model performance is important to know the ability, efficiency and significance of the model. To evaluate the performance we should integrate the trained KNN model into a real-world application or system, we should also consider the factors like computational efficiency, scalability, and security. Continuously monitoring and updating the system is needed to adapt to new faces or environmental changes.

### **Scalability Considerations:**

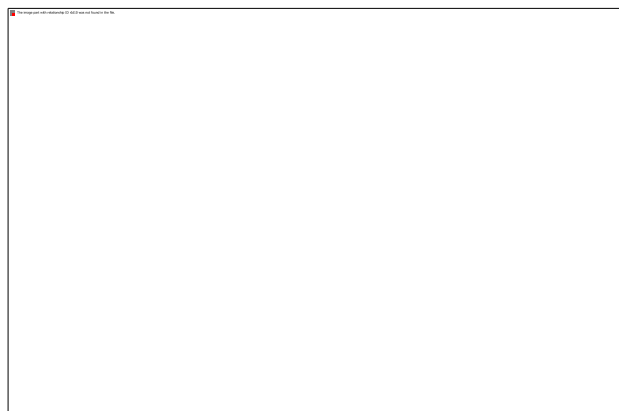
To know the scalability of the model, we should check it by giving the large dataset size (20 million images), and use techniques for efficient storage, retrieval, and computation.

The system should be designed in such a way to handle incremental updates and additions to the dataset efficiently, sothat the dataset grows over time and ensures scalability.

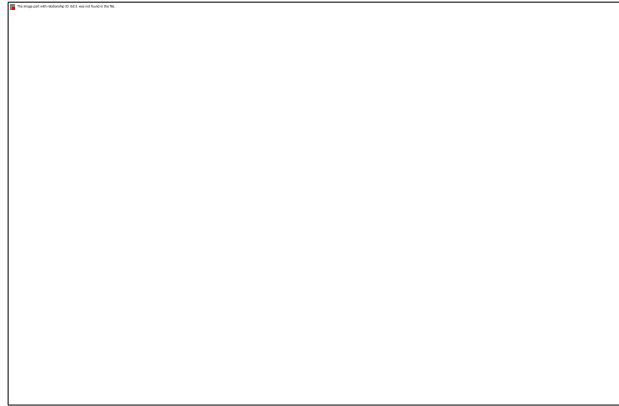
## 5. PROPOSED SYSTEM

The application of face identification using the PCA (Principal Component Analysis) method as feature extraction and KNN as a classification has been done before, so when compared to the previous system that it becomes a reference for the making system that can do activities. By referring to the various studies, one of them is "Multifaces Recognition process using the Eigen Faces and the Haar Cascades" and this is stated by the journal entitled in its one of its studies. It follows the Hybrid approach for carrying out the proposed facial recognition by using Haar Cascades and Eigenface method and at a time it is capable of detecting the many faces upto 55 faces. There are several steps such as grayscale conversion, training data and preprocessing with the Haar cascade etc in the image preprocessing. This enhanced face recognition approach is able to recognize many faces with an accuracy rate of 91.67. "Handwriting Recognition using Eccentricity and Metric Feature Extraction that is based on the K Nearest Neighbors". The above quoted text were the research examples those are listed in the Journal entitled. There are several stages such as thresholding, noise removal and removal and cropping before classification and feature extraction etc and these were proposed by journal in the recognition process. There is a division of the dataset they are training data and testing data. Eccentricity and the metrics are the two extraction method that are used in the feature extraction method. The value determining between the small elliptical focal distance and the main focus of the ellipse of an object is defined as Eccentricity. The ratio between the area and circumference of the object is defined as the metric. In the KNN, which uses the classification that is used to calssify the objects based on the training data with the distant nearest to the object where the Euclidean distance formula is used for the measuring or calculating the distance that is recently defined using the Euclidean formula used in this paper.

Based on the results of the testing obtained accuracy of 85.38% for the Handwriting Recognition using Eccentricity and Metric Feature Extraction based on K- Nearest Neighbors . There are some of the examples of the various other studies that are marked in the title of the "Voice Recognition using K Nearest Neighbor and Double Distance Method". The data outliers and the namely double distance both are involved in the improvement of the accuracy with the new method that was proposed by the journal studies among several ones. This KNN method is combined with the Doubled Distance method by defining the value of  $k=1$  as the center of voice Recognition. There is a involvement of two stages in this framework they are training and testing stages. Using KNN method through the entire process is beneficial while testing. There are two parts of the testing process they are the first part used the KNN method and second part uses method double distance



The Euclidean distance formula is used for finding the similarity between the testing data and training data. Based on the results of testing, the method of KNN with one data center is 84.85% and the accuracy of the doubled distance method is 96.97%. The accuracy of the voice recognition is improved by the double distance method from the final results that were obtained.



## 6. EXPERIMENTAL RESULTS

The main key factor that affecting face recognition is lightning condition. We know that Faces have three-dimensional structural features. The original facial features can be obviously affected by the intensity of light and shadows. The accuracy of the face recognition system can be reduced by the insufficient light ,which will reduce the practicability of the face recognition system.

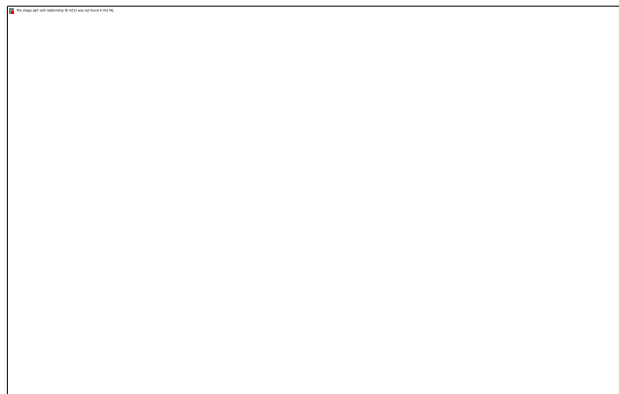
Accuracy of the experimental group is greater than the control group, which shows the accuracy of the recognition in facial recognition system that it is improved significantly after using the genetic algorithm to improve the KNN algorithm. The recognition accuracy in the KNN facial recognition system exceeds that of the improved KNN facial recognition system.

During the experimentation and considering it results we can see that accuracy of control group is low compared to the accuracy of experimental group. It may be due to the specialization of sample individuals or the individuals that are arranged and combined which can affect the experimental data, but it does not affect the scientifically and rationally of the experimental results.

From an individual point of view, the improved KNN facial recognition system has a maximum accuracy rate of 98% in a low-light environment, while the KNN facial recognition system has a maximum of 90%, a difference of 8%. It shows that the KNN facial recognition system can play a good role in a low-light environment and the face recognition feature using knn has good recognition and adaptability. Compared with the control group, the accuracy rate of the recognition of experimental group on an average increases by 5.71%, indicating that the improved KNN facial recognition system can play better roles in the insufficient lighting environment and has more practical values.

During the experimentation of the face recognition attendance system, we can observe the changes like how face recognition is done and how it is recognizing the human faces and which features can affect the accuracy of face recognition. Here we are using the KNN(k-Nearest Neighbors) for face recognition. There are many other algorithms that can be used to recognize the faces and mark the attendance. The results of the experimentation shows the recognized persons names and results can vary due to some factors like more dataset, different facial expressions of a person and lightning conditions and poses.

In addition to considering lighting conditions, facial recognition systems should also need to consider that how facial expression impacts on face recognition. Emotions such as crying, laughing, sorrow and anger will greatly affect facial features, which greatly changes the judgment of the facial recognition system. The specific research content is shown



Here is the example of how the attendance will be captured.

Here we can observe the result of the face recognition attendance system like how it is recognizing the faces and marking the attendance. So the system works in this way like firstly it captures all images of persons and create dataset and then dataset will be trained using the KNN classifier and extract the features of the persons and after that the persons can be recognized using the features that map with. The system will recognize the person whose facial similar to the K-Nearest data points, it shows their name and recognize the person using k-nearest data points. So we can observe that the results may vary based on expressions and nearest data points by whose features it matches with.

## 7. CONCLUSION

Face recognition attendance system using KNN with opencv and Haar Cascades Classifier helped improve the system by selecting the most accurate model with an accuracy of 90% and train the model by collecting the images of people and test it with different people. The face detection model used is Haar Cascade Classifier and open cv to detect the faces from the video and extract the features from it and KNN model is used to recognize the faces from it. This way the system is used to avoid human errors and saves time. we used a KNN model to identify faces and recognize them. There is decrement in the accuracy and loss when there is a huge dataset.

## 8. FUTURE SCOPE

Further research in another direction is to develop a real time face recognition system and applying that in every possible field like offices, exam centers. which captures a video by a camera, detects and recognize the faces in real time and give the result to the system within a sufficient time frame in order to take the right action. More research can be done to make a system that can verify reports, images and videos without human intervention automatically and make the entire process smooth and fast

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