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An Overview on Multiple Face Recognition System Using Image Processing

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ABSTRACT

A Multiple face recognition system using image processing is a computer-based application designed to detect and identify multiple human faces from images or real-time video streams. The system captures images through cameras and applies pre-processing for the images obtained to make the pictures look better. Pre-processing is done using algorithms for reducing noise, enhancing image quality etc. A computer program that uses image processing to recognise and identify more than one human face from pictures or live video streams is called a multiple face recognition system. After that, face detection algorithms are used to find more than one face in a single frame. During feature extraction, each detected face is examined to find unique features like the shape of the face and key points. Using recognition algorithms, these features are compared to a stored database to figure out who they belong to. The system can handle multiple faces at once, which makes it useful for things like security systems, surveillance, and attendance tracking. Machine and Deep Learning are used in modern implementations to make image recognition more accurate and faster. It also lets you track things in real time, get notifications, and manage data, which makes things more efficient and cuts down on the work that needs to be done by hand.

KEYWORDS: Image Acquisition, Pre-Processing, Feature Extraction, Classifiers, Algorithms.

INTRODUCTION

The fast growth of digital technologies and AI has changed traditional attendance management systems a lot. Traditional methods like ID cards, manual registers, and manual systems can take a long time, make mistakes, and allow people to attend on behalf of others. In today's fast-paced schools and businesses, there is a growing need for automated, accurate, and contactless attendance solutions that make things more efficient and reliable.

Using computer vision and image processing together, a multiple face recognition system for marking attendance is a good way to do it. The system uses cameras to take pictures or videos and find multiple faces at once in real time.

Feature extraction methods are used to look at each face, and then the unique features of each face are compared to a database to find a match. When a match is found, attendance is automatically recorded and saved in a digital format. The system improves accuracy by using cutting-edges technologies like machine learning, deep learning and real time processing.

REVIEW OF PAPERS

[1] Face Recognition Based Attendance System

The authors have given a short overview of the main parts of the system in this paper. These include face detection using the Viola-Jones algorithms, features extraction, and face recognition. The proposed system takes pictures of students in a classroom setting and compares them to a database that already exists to keep track of attendance. It is built to work with changes in light, facial expressions, poses, which makes it more robust.

Experimental results show that the system cuts down on the amount of work that needs to be done by hand and makes it less likely that someone will attend on behalf of someone else. The study also stresses how important it is to process data in real time and identify people correctly. The proposed method shows that it is a good and scalable way to automate attendance management in schools.

[2] Face Recognition based Attendance Management System

This paper discusses the importance of biometric authentication systems for attendance management in institutions such as schools, colleges, and offices. It highlights several identification technologies, including RFID (Radio Frequency Identification), iris recognition, and facial recognition techniques. The paper specifies facial recognition algorithms such as Eigen face and Fisher face implemented using OpenCV 2.4.8.

The authors also emphasize image-processing techniques like DWT (Discrete Wavelet Transform) and DCT (Discrete Cosine Transform), which are commonly used for feature extraction and improving recognition accuracy in biometric systems. The proposed system in the paper comprises of the steps such as Dataset creation, Face detection, Face recognition, Attendance Updating and Results.

[3] Face Detection and Recognition System using Digital Image Processing

In the above paper, the authors have provided a concise overview of a facial detection and recognition system created through digital image processing methodologies. There are two main parts to the methodology: face detection and face recognition. In the first phase, the system quickly finds and extracts human faces from pictures. However, its performance may drop when the subject is farther away. The next step is to identify the people by matching the detected faces with stored data. This process is done over and over again to make the system work better and more accurately.

The suggested method uses the Eigenface method, which is based on Principal Component Analysis (PCA), to lower the number of dimensions in facial data while keeping important features. This reduction in dimensionality makes computations faster and more accurate. The study shows how useful digital image processing is for making reliable face recognition systems and stresses how important it is as a widely used biometric identification technology.

[4] Smart Attendance System using Deep Learning and Facial Recognition

This paper suggests an automated attendance system that uses deep learning and facial recognition methods. The system uses a Convolutional Neural Network (CNN) model to find and identify students' faces in a classroom in real time. To improve accuracy and performance, the model is trained on a set of student images. The system can automatically mark attendance without any human involvement, which makes it more efficient and reliable. The authors say that the accuracy is about 93.7%, which shows that it works well. The study shows that systems based on deep learning can offer a scalable and accurate way to manage attendance in the modern world.

[5] Automatic Attendance System, Using Face Detection and Machine Learning

This paper presents an automated attendance system that employs machine learning and facial recognition

technologies to enhance the efficiency of conventional attendance methods. The system uses Convolutional Neural Networks (CNN) and face detection algorithms to find and identify people in images taken by webcams or security cameras. The captured images are pre-processed, which includes extracting features, and then they are compared to a database of registered users to identify them.

The system uses Haar-Cascade to find faces and LBPH (Local Binary Pattern Histogram) to recognize them. This makes sure that it works well even when the lighting and facial expressions change. Once a match is found, attendance is automatically recorded in an Excel sheet. This makes it easy to make and share reports like absentee lists. The study shows that the system cuts down on manual work, mistakes, and security risks, making it a useful and effective way for schools to keep track of attendance.

[6] Management of Attendance with OpenCV

This paper suggests an automated attendance system that uses OpenCV and computer vision techniques to replace old-fashioned ways of taking attendance. To make detection more accurate, the system uses image pre-processing techniques like resizing, noise reduction, and contrast enhancement. Haar Cascade is used for face detection, and the LBPH (Local Binary Patterns Histogram) algorithm is used for recognition. The LBPH algorithm is known for being strong in different lighting conditions.

A dataset of facial images is constructed and trained utilizing grayscale images, from which features are extracted via histogram methodologies. The system uses similarity measures like Euclidean distance to compare input images with stored data to find people. Once someone is recognized, their attendance is automatically logged in an Excel sheet. The study shows that LBPH is more accurate and has less noise interference, which makes the system reliable, efficient, and good for real-time attendance management. It also cuts down on manual work and stops people from attending on behalf of others.

[7] Deep Learning based Multi-face Recognition System for Automatic Attendance Registering in Classrooms

This paper talks about an automated attendance system that uses deep learning to recognize multiple faces in classrooms. The system uses MTCNN (Multi Task Cascaded Convolutional Networks) to find faces and FaceNet to recognize them by making unique facial embeddings. A custom dataset with pictures of different students is made, and methods like changing the brightness and rotating the images are used to make them more accurate.

The system takes pictures of the classroom in real time, finds multiple faces, and compares them to stored data using similarity measures. Students who are recognized automatically have their attendance recorded. The model has a high detection accuracy of about 91.9% and works well in different lighting, pose, and occlusion situations.

In general, the system makes things more efficient, cuts down on the work that needs to be done by hand, and cuts down on proxy attendance.

METHODOLOGY:

The Automated Attendance System works by integrating multiple algorithms at different stages to ensure accurate face detection and recognition. Each stage of the system uses a specific algorithm to perform a defined task efficiently. As per the studies made, the following are the findings regarding the algorithm used for different stages of face recognition system.

Stages in Face-Recognition	Algorithm	Purpose
Input Images	Image acquisition algorithms	To acquire a high-quality image with less noise.
Pre-processing	Image Enhancement and filtering, geometric transformations, image restoration, colour space conversion, intensity normalisation and edge detection algorithms	Pre-processing algorithms tries to improve the image quality.
Feature Extraction	Spatial domain feature, transform domain feature, local feature descriptors and learned feature descriptors and learned features algorithms	The process of transformation raw image data into a compact numerical representation that highlights distinctive structures.
Classifier	**Machine Learning Algorithms:** SVM, KNN, Random Forest, Naïve Bayes etc **Deep Learning Algorithms:** LeNet-5, AlexNet, VGGNet, ResNet, ViT, mobileNet and EfficientNeT etc	Classifier algorithms are of two types traditional machine learning and modern deep learning algorithms which identifies the object and has decision making capability.

Table 1: Face Recognition Stages, Algorithms used and the purpose

The Steps in **Image Acquisition** pipeline includes illumination, sensing and digitization which includes sampling and quantization. In the digitization process, the Analog signal of the real world get converted to discrete numerical pixels in the digital devices.

The **Image Preprocessing** involves Resizing, Grayscaling, Noise Reduction, Normalization, Binarization, Contrast Enhancement etc.

The **Feature Extraction** in image processing enables computer vision algorithms to perform tasks like classification, object detection and tracking faster. The feature extraction algorithms detect edges, corners/key points, texture description, shape description etc. The algorithms include SIFT (Scale Invariant Feature Transform), HOG (Histogram of Oriented Gradients), PCA (Principal Component Analysis), CNN (Convolutional Neural Networks).

The **Classifier** algorithms include SVM (Support Vector Machine), KNN (K Nearest Neighbour), VGGNet (Visual Geometry Group) which was developed at University of Oxford, ResNet (Residual Network), ViT(Vision Transformer) etc.

CONCLUSION

The Multiple face recognition system's goal is to use face recognition technology to make a more efficient way for students to take attendance. The system that is planned will be able to keep track of attendance by recognizing faces. It will use a webcam to find faces and then name them. After the recognition process is successful, it will record the attendance of the student who was identified and update the attendance records. This system is very helpful for schools and colleges to keep track of who is there and who is not in the class.

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