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"Automatic Attendance System, Using Face Detection and Machine Learning"

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Abstract:

The manual process of recording attendance in educational institutions and workplaces is laborious, prone to errors, and often ineffective. In response, automatic attendance systems have gained favor due to their capacity to streamline the procedure, heighten precision, and reinforce security. This study introduces an inventive Automatic Attendance System that takes advantage of Convolutional Neural Networks (CNN) and facial recognition technology to automate attendance administration. The proposed system commences by capturing images of individuals as they enter a classroom or place of work via a network of surveillance cameras or webcams. These images are subjected to preprocessing, where facial characteristics are recognized and extracted using CNN-powered deep learning methodologies. The extracted facial features are subsequently matched against a pre-established repository of registered individuals' facial data for identification. This identification process is resistant to fluctuations in lighting conditions, facial expressions, and minor variations in pose, ensuring elevated precision in attendance tracking.

Key Words:- Automatic Attendance , CNN, Face Recognition ,Deep Learning ,Efficiency, Real-Time Attendance, Security.

Introduction:

In recent years, the fields of computer vision and artificial intelligence have seen significant advancements, and one of the standout applications of these technologies is face recognition. Face recognition technology has made remarkable contributions to various sectors, including security, personal identification, and, significantly, attendance management. One particularly promising application of face recognition is its role in streamlining attendance tracking. Traditional methods for attendance recording, such as manual sign-in sheets or proximity card systems, have their drawbacks, including potential inaccuracies, time-consuming processes, and susceptibility to errors. The need for a more reliable and efficient solution has driven the exploration of biometric authentication techniques, with face recognition emerging as a frontrunner due to its non-invasive, unobtrusive nature and exceptional accuracy.

This research paper aims to explore the concept, development, and implementation of a Face Recognition-based Attendance Management System (FRAMS). The primary objectives of this study are to explain the technology behind face recognition, discuss the advantages and limitations of FRAMS, evaluate its impact on attendance management in various contexts, and propose best practices for its deployment. In summary, this research paper provides a comprehensive exploration of the use of face recognition technology in attendance management.

Literature Survey:

Description of "Automatic Attendance System based on Face recognition using machine learning", Sk. Sharmila , G. Kavya Nagasai , M. Sowmya , A. Sai Prasanna , S. Navya Sri, N. Meghana , Issue 04 April 2023 [1]

In this paper we compared the results of multiple machine learning methods for Automatic attendance system This research work presents the working of a cascade classifier built with machine learning to improve the face detection results. This has been done by comparing the face images in the current image to a database of previously trained faces. The acquired image contributions are searched for a previously registered face, and once found, the person's attendance is recorded automatically. A face detection and recognition- based attendance monitoring system might very well rapidly and accurately locate and identify people in photographs or video footage. In addition to being laborious to maintain, the time-honored practice of physically ticking off attendees is inefficient.

Description of "Deep Learning based Facial Recognition System for Attendance Maintenance ", K.G. Saravanan , Jayamabel Rani , D.C. Jullie Josephine , M. Parameshwari , Hridya Venugopal , Janaki Ramal , Issue 08 November 2022 [2]

This paper proposes an approach of Automatic recognition of face for tracking attendance. The Haar-cascade classifier and the LBPH (Local Binary Pattern Histogram) algorithm, both of which are implemented in Python and the OpenCV library, are used in our proposed model to identify the positive and negative features of the face. Numerous algorithms and techniques have been developed to enhance face recognition performance. In order to assess the effectiveness of any organisation, attendance records must be maintained and evaluated. Automating the conventional method of recording attendance is the aim of building an attendance monitoring system. Therefore, it can be utilized for identification and authentication.

Introduction to "Face Detection and its Features Extraction using Convolution Neural Network Model" , Yenumaladoddi Jayasimha , Venkatesha M , R. Venkata Siva Reddy , Issue 27-29,May 2022 [3]

This paper analyses the structural features, and uses four machine learning algorithms for training .The whale optimization algorithm , Conventional neural network , etc are used . In this work a CNN based prototype is presented to estimate the age and to classify the gender of detected faces along with its emotions. The proposed model is implemented in three stages namely a hybrid feature extraction technique to identify the facial expressions by using SVM classifier. A combination of SIFT and Deep learning-based model is presented for identifying facial emotions. Whale optimization algorithm is applied to optimize the performance of face emotion recognition. This model gives a convolution neural network and introduces a novel technique for classification of facial emotions, age prediction and male-female identification.

Description of "Facial recognition system for Automatic Attendance Tracking using an Ensemble of Deep Learning Techniques " , Venugopal A ; Rahul R Krishna ; Rahul Varma U , Issue 06-08, July 2021 [4]

In this perspective, the proposed research work has developed a model to recognize face . The proposed system captures the face of students attending the lecture by first detecting a face from the video input and with the help of an ensemble of deep learning models recognize the student and mark his/her attendance in the database . This system uses an ensemble of facial recognition models such as VGG-FACE, Facenet, Openface, DeepFace so that it may be able to yield a much higher accuracy while identifying the subject.

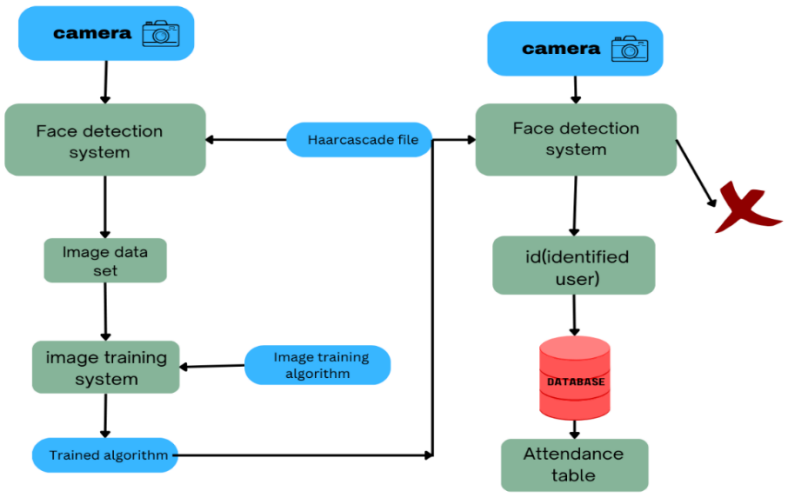
Description of "Face Detection and Recognition System using Digital Image Processing" , Gurlove Singh, Amit Kumar Goel , Issue 23 April 2020 [5]

The whole procedure for authenticating any face data is sub-divided into two phases, in the first phase, the face detection is done quickly except for those cases in which the object is placed quite far, followed by this the second phase is initiated in which the face is recognized as an individual. Then the whole process is repeated thereby helping in developing a face recognition model which is considered to be one of the most extremely deliberated biometric technology.The Eigenface method basically make use of the PCA (Principal Component Analysis) to minimize the face dimensional space of the facial features. The area of concern of this paper is using the digital image processing to develop a face recognition system.

Proposed System:

To use the face recognition system, every student in the class needs to register first by providing necessary details. During the registration process, their images will be captured and stored in the system's dataset. In each class session, the system will detect faces from the live streaming video of the classroom. These detected faces will then be compared with the images stored in the dataset. If a match is found between the detected face and the stored images, the attendance will be marked for the respective student.

The system architecture of the proposed system is given below,

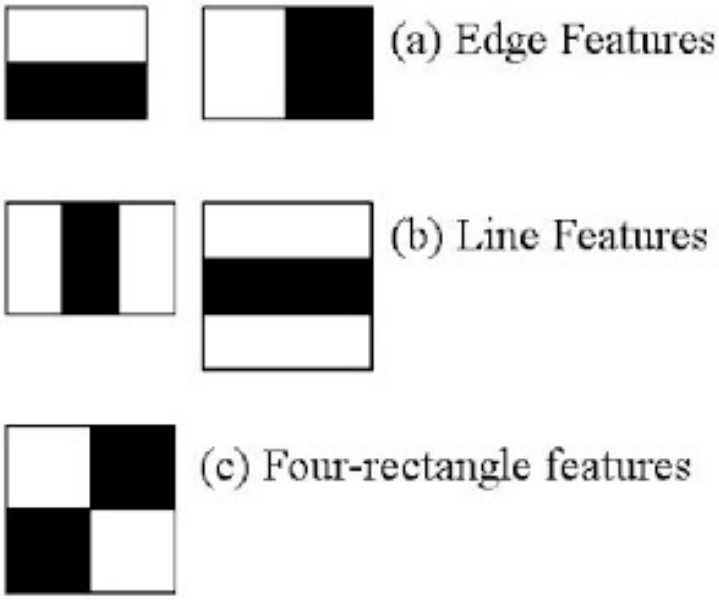


1.Dataset Generation:

To build the dataset, we begin by capturing images of the students using a webcam. Multiple images of each student are taken, capturing different facial expressions and angles. These images go through a preprocessing stage. The first step involves cropping the images to isolate the Region of Interest (ROI), which will play a crucial role in the recognition process. Subsequently, the cropped images are resized to specific pixel dimensions. Afterward, these images are converted from RGB to grayscale. Finally, these processed images are saved with the corresponding student's names in a dedicated folder.

2. Face Detection

In this system, face detection is accomplished using the Haar-Cascade Classifier in conjunction with OpenCV. It's important to note that prior to using Haar Cascade for face detection, the algorithm must undergo a training process to recognize human faces. This training step is referred to as feature extraction.



In this system, we utilize the detectMultiScale module from OpenCV to identify faces within an image. This module is essential for drawing rectangles around the detected faces. It operates with three important parameters: scaleFactor, minNeighbors, and minSize.scale Factor determines how much the image should be reduced in each image scale.minNeighbors specifies the minimum number of neighboring rectangles a candidate rectangle must have. Higher values for this parameter generally lead to the detection of fewer faces but with higher confidence in the image.

3. Face Recognition:

The face recognition process is typically divided into three key steps: preparing training data, training the face recognizer, and making predictions.In the first step, the training data comprises the images from the dataset. Each of these images is associated with an integer label indicating the student it belongs to. These labeled images are then utilized for face recognition.In this system, the face recognizer used is the Local Binary Pattern Histogram. Initially, the system obtains a list of local binary patterns (LBPs) for the entire face. These LBPs are converted into decimal numbers, and histograms are created based on these decimal values. As a result, a histogram is generated for each image in the training data.

4. Attendance Update:

Following the face recognition process, the system will mark the recognized faces as present in an Excel sheet, while the unidentified faces will be marked as absent. Additionally, a list of absent students will be generated and sent via email to the respective faculty members. At the end of each month, the faculty will receive an updated monthly attendance sheet.

Conclusion:

The goal of the proposed system is to create an efficient class attendance system by leveraging face recognition methods. The intended system will have the capability to record attendance through face recognition. It will employ a webcam to detect faces and subsequently identify them. Following the successful recognition process, it will record the attendance of the identified student and update the attendance records accordingly. This system is very useful for the schools and colleges to mark the attendance of students ,teachers and other staff members .

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