An Attendance System using face Recognition Through Mathematics

Pramod Joshi
Department of mathematics
P. N .G Government P. G College Ramnagar Nainital,244715

Abstract
Attendance is a vital aspect of learning in every educational institution. Attendance taking in every class is a routine activity in institutions and organizations. The traditional ways of taking attendance by signing papers or calling names in the class are very time-consuming and doubtful. The management of attendance also leads to an immense problem if administered manually. In this digital age, there must be a change from these traditional ways to accelerate and provide time efficiency.

This paper intends to develop an attendance system using Face Recognition AI that can be used to record attendance from everyone present in an organization. It will use the camera for capturing the faces of the students individually, recognize them, and update the database. The Face Geometry Algorithm attributes and machine learning-based methods will be applied. Extraction and pre-processing of the face region will be performed for advanced processing. With this algorithm, the system will recognize a person's face and record attendance for making it faster and more efficient. Several mathematical algorithms will also be used for the development of the system.

Key Words: Attendance, Face Recognition, Face Geometry, Artificial Intelligence, Machine Learning.

Introduction

Attendance is an essential aspect of the learning process in educational institutions. By attending classes, students are able to get beneficial information from the teacher and improve knowledge and understanding of a particular field.

The most common attendance records in most organizations are still manual. Currently, there are two common ways to record attendance: Teachers call students one by one and record attendance on paper, or Students sign attendance on their own. Using the traditional method of taking attendance in the classroom leads to time mismanagement, human error, data loss, a lot of paperwork, incorrect number of entries, and inconsistency in data entry. Moreover, it can be easily manipulated. An automatic attendance system by face recognition using machine learning will be embraced in this paper. This system will eliminate manual intake of attendance and will be more efficient.

From security to law enforcement, from airports to police stations, from social media to adhaar cards, facial recognition is a way of identifying an individual using their face. It uses biometrics to map facial features and can identify people in photos, videos, or real-time. It is one of the most intensively studied technologies in computer vision, with constant approaches and encouraging results.

Face recognition technology is more than 50 years old and was started by a research team in the 1960s. The team was led by Woodrow W Bledsoe to conduct experiments for checking whether 'programming computers' could recognize human faces.

The team used a fundamental scanner to map the hairline, eyes, and nose of a person. The task of the computer was to find matches but it wasn't successful. Then after years of research, finally there came a 3D face recognition system. In this type of machine learning model finds patterns in image data. The working procedure involves face detection, face

analysis, image conversion and finally matching the image with the database. Facial recognition is a logical and systematic verification system. It is faster, more convenient, and more reliable when compared to other biometric technologies like fingerprints, retina scans, voice recognition, and palm or finger vein patterns.

Keeping these features in mind, this paper intends to use face recognition technology to introduce an improved attendance system.

Review of related work

This review aims to analyze the results available through the distinguished authors associated with the area of this study. The introduction of a lecture attendance system using a novel technique named continuous monitoring and automatic student attendance marked using the camera, such that it captures the photo of each student in the class was conducted by [1]. The system architecture is simplified using a double camera properly attached to all the classes. One of the cameras captures the student's image while the other is a sensor camera used for students seated in the class [2]. It will capture the image of each student and compare the image, and faces in the database for the perfection of attendance. Real-time computing vision algorithms in AAMS were introduced by [3]. Face detection is an application that recognizes human faces in digital images. The digital image is self-possessed of picture elements in the form of pixel values. It is an application that is designed for computer vision technology. Automatic Attendance System which uses the Facial Recognition Method [4]. Deep face recognition is a type of face detection. Finally, this application will rectify all the problems. Class Attendance Auto-management based on Deep Learning", Improvements in Education, Humanities and Social Science Researches [5] Instance-based learning is a machine learning algorithm. This approach uses several applications like human-computer interaction, automatic gate control, and video monitoring system. Face recognition technology using a binary histogram pattern Haar cascade and distance-based approach which recorded the attendance of the individual students in the class and converts the attendance into a spreadsheet. Algorithm Mathematics and Computer Science provide an illustration of face images in facial recognition. The first method is to survey the existing algorithm which is used to reduce the storage capacity for the instance-based algorithm. And the second method is to propose six reducing algorithms. Counterpart Approach to Attendance and Feedback System using Machine Learning Technique [6]. Face recognition is used in the second research publication, "Face Recognition System Based Attendance Marking System" (SenthamilSelvi, Chitrakala, Antony Jenitha, 2014), to overcome prior system challenges [7]. According to a research journal "RFID-based Student Attendance System" (Hussain, Dugar, Deka, Hannan, 2014), the proposed solution is almost identical to the first research journal in which RFID technology was used to enhance the adult attendance program. During this process, the tag and the student are also used as a way to track the presence of students [8]. The difference between the original journals that is where the information for the participants will be available through the website. Provides very easy-to-retrieve information. Also, this method is not perfect as it is not portable, because the RFID reader can work only when it is connected to a PC. A real-time computing vision algorithm is a non-intrusive system installed with a camera that snaps any image present in the classroom and compares the extracted faces from the image of the camera in the system. Moreover, machine learning algorithms are used for computer vision, and Haar Classifier is used for training images captured by the camera. Finally, for subtraction consideration of the image, the captured faces will be converted into grayscale and transferred to the database on the server later for processing.

Research Methodology

In the Artificial Intelligence field, CV (Computer Vision) is one of the most impressive and demanding tasks. CV functions as a bridge between software and visualizations. It allows the software to understand and learn about the visualizations in the surroundings. Nowadays, various packages are available for machine learning and computer vision. OpenCV is an open-source library supported by several programming languages and runs on most of the available platforms. The face recognition technology in the attendance system proposed in this paper can be implemented by using OpenCV and Python. The process will start with the camera capturing the faces of the students. Then it will recognize each student and update the database. Algorithms for face detection will be used. Face geometry and machine learning-based methods are the proposed algorithms for face detection. Processes of extraction, resizing, and equalization will be conducted for advanced processing. The proposed system can be designed by using platforms like Google Colab, Jupyter, or Visual Studio Code for the front end and Microsoft SQL (Data Manipulating Language) for the back end. The libraries OpenCV, dlib, and Face_Recognition will be used for the execution. Several mathematical models of face recognition will also be used. They will be processed during data generation, face analysis, and image classification. If an image needs recognition, machine learning algorithms check the differences between the image and each of its components by representing them as a matrix. To improve the process it is much better if applied principal component analysis and the differences are calculated from the 'transformed' matrix. Most of the algorithms in face recognition are categorized into two major groups: feature-based and image-based algorithms. Geometric features of the face like the distance between the eyes or the size of the eyes are explored and represented by feature-based methods. The Pythagorean theorem is also used to calculate the distance of the human figure and represent the face in pixels. A Lens calculator tool can be used in determining the dimensions of the image captured by the camera.

Approaches

The leading methods for face recognition are Geometric (feature-based) and photometric (view based).
Recognition algorithms are categorized into two main
modes:
1. Geometrics:
This is an approach to geometrical relationships and facial landmarks, the spatial outline of facial structures. The face is categorized based on several geometrical angles and distances among features by locating the core geometrical structures of the face as the nose, mouth, and eyes.
2. Photometric stereos:
Several images are captured under different lighting circumstances to recover the form of any object. The shape of the recovered object is defined by a gradient map with an array of the surface normal.
 Some Common recognition algorithms include:
1. Linear Discriminate Analysis;
2. Elastic Bunch Graph Matching;
3. Fisher-face algorithm;
4. Principal Component Analysis via Eigen-faces (PCA).
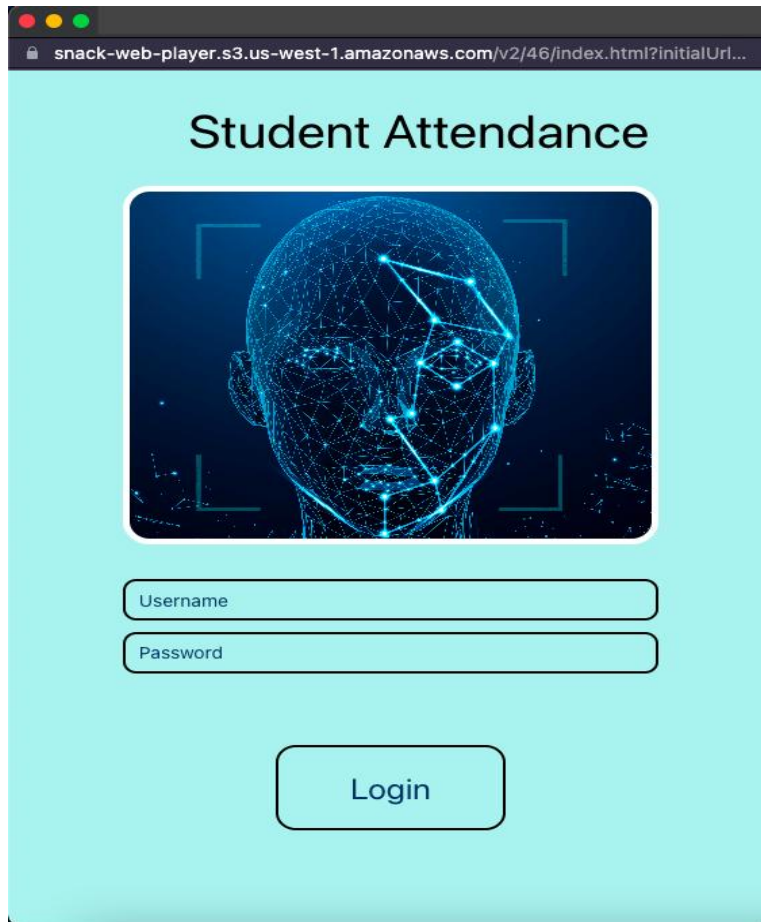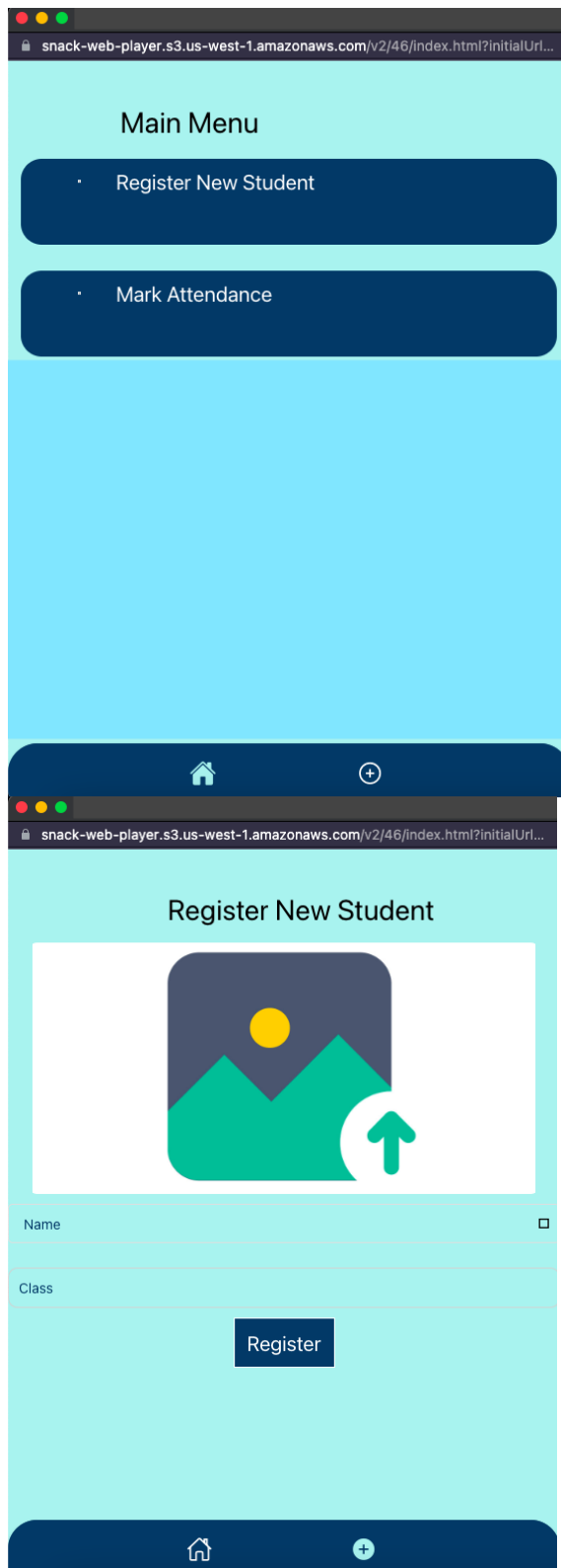
Why facial recognition over other biometrics?

This paper prefers the use of facial recognition over other biometrics due to the following reasons:

1. No physical interaction by the user is required.
2. It is accurate

3. It permits high enrolment and
verification rates.
4. Expert is not demanded to interpret the comparison
result.
5. No requirement for additional devices, existing hardware can be used.
6. It allows you to perform passive identification in many environments.

Components of Face Recognition Systems
The components used in the development of the proposed system will be Artificial intelligence, Computer vision, Object recognition, Machine learning, Learning paradigms, Supervised learning, and learning by classification. These components will help recognize the key features of the face. The main facial recognition methods will be feature analysis, neural networks, eigenfaces, and automatic face processing.

Algorithm for Facial Recognition

Algorithm 1
1. Student's Picture configuration;
2. Algorithm Application of Face recognition;
3. Extraction of the face recognition based;
4. Resizing image and converting it for normalizing;
5. Correction of above normalization;
6. Post-processing.

Algorithm 2
1. Student's Picture configuration;
2. Application of face recognition Algorithm;
3. Extraction from 2 above;
4. Conversion to 100x100 i.e. Apply pre-processing;
5. Correction of the above;
6. Post-processing.

Conclusion
Human face recognition is a way of authentication used in several areas. This paper proposes a facial recognition attendance system to reduce and gradually end the issues faced while taking and managing manual attendance. This system will be a procedure of recognizing students by their face biostatistics. It will be based on several computer technologies like AI, CV, HD monitoring, Machine learning, etc. Several mathematical algorithms will also be used for the development of the system.

References

[1] Surekha, B., Nazare, K. J., Raju, S. V., & Dey, N. (2017). Attendance recording system using partial face recognition algorithm. In Intelligent techniques in signal processing for multimedia security (pp. 293-319). Springer, Cham.

[2] Sawhney, S., Kacker, K., Jain, S., Singh, S. N., & Garg, R. (2019, January). Real-time smart attendance system using face recognition techniques. In 2019 9th International Conference on Cloud Computing, Data Science & Engineering (Confluence) (pp. 522-525). IEEE.

[3] Fowers, J., Ovtcharov, K., Papamichael, M., Massengill, T., Liu, M., Lo, D.,... & Burger, D. (2018, June). A configurable cloud-scale DNN processor for real-time AI. In 2018 ACM/IEEE 45th Annual International Symposium on Computer Architecture (ISCA) (pp. 1-14). IEEE.

[4] Rathod, H., Ware, Y., Sane, S., Raulo, S., Pakhare, V., & Rizvi, I. A. (2017, January). Automated attendance system using machine learning approach. In 2017 International Conference on Nascent Technologies in Engineering (ICNTE) (pp. 1-5). IEEE.

[5] Wang, D., Fu, R., & Luo, Z. (2017). Classroom attendance auto-management based on deep learning. Advances in Social Science, Education and Humanities Research, 123.

[6] Fernández, A., García, S., Galar, M., Prati, R. C., Krawczyk, B., & Herrera, F. (2018). Learning from imbalanced data sets (Vol. 10, pp. 978-3). Berlin: Springer.

[7] K.Senthamil Selvi, P.Chitrakala, A.Antony Jenitha, "Face recognition based Attendance marking system" IJCSMC, Vol. 3, Issue. 2, February 2014, pg.337 – 342.

[8] Elima Hussain, Priyanka Dugar, Vaskar Deka, Abdul Hannan, (2014), "RFID based Student Attendance System" in International Journal of Computer Applications® (IJCA) (0975 – 8887) National Conference cum Workshop on Bioinformatics and Computational Biology, NCWBCB- 2014.