



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 12, Issue 5, May 2023

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

ijrset@gmail.com

www.ijrset.com

Face Recognition Based Attendance Management System

Dr. K. Muthukannan¹, J. Daniel Durai², M. Mariya Prabaha³, P. Maharajan @ Essakiappan⁴

Professor & Head, Dept. of ECE, Thamirabharani Engineering College, Tirunelveli, India¹

UG Students, Dept. of ECE, Thamirabharani Engineering College, Tirunelveli, India²⁻⁴

ABSTRACT: Face recognition technology has become increasingly popular in recent years and has been applied in various domains, including security systems and attendance management. This project aims to develop an attendance management system using a combination of techniques such as Histogram of Oriented Gradients (HOG), Support Vector Machine (SVM) classifier and Anti-Spoofing algorithms. The system should be designed to capture images of individuals in a classroom or workplace and extract facial features using HOG descriptors. These features were then used to train an SVM classifier to recognize and identify individuals in real-time. Anti-Spoofing algorithms can be implemented to avoid spoofing and it makes the system more reliable. The system is accurate and efficient, as it eliminates the need for manual recording of attendance and reduces the likelihood of errors. Additionally, it provides a secure and convenient way to monitor attendance and ensure accountability. Overall, this paper demonstrates the potential of HOG and SVM algorithms in face recognition technology and their ability to streamline attendance management processes and enhance security.

KEYWORDS: face recognition, attendance management system, HOG, SVM, Anti-Spoofing algorithm.

I. INTRODUCTION

In recent years, face recognition technology has made remarkable progress and has become increasingly popular in various fields including security, law enforcement, and education. Smart attendance management system is now emerging as an innovative and effective solution to traditional attendance methods. The system uses a combination of hardware and software to capture and analyze an individual's face and compare them with the pre-stored facial data in the database. The system then records the attendance of the individual automatically in real-time, providing accurate and reliable attendance data for payroll and other purposes. Use of face recognition technology for attendance management offers several advantages, such as reducing time and effort spent on manual attendance tracking, eliminating human errors, and increasing security by ensuring that only authorized employees can check-in and check-out. This system is highly beneficial for organizations with large workforces, as it streamlines attendance management processes, leading to increased efficiency and productivity.

II. LITERATURE SURVEY

Various systems are currently in use to manage and assess student attendance at universities. Eventhough these systems are extremely usable, their practicality and constraints pose a problem in the process. The following are a few of the systems in place.

The system proposed by Shreyak Sawhney et.al. [1] is focused on making a face recognition model for attendance tracking using Convolutional Neural Network(CNN). The main disadvantage of this system is lot of training data is needed to train the CNN model. If any changes made in the student/employee database, the entire model should be trained again with the updated dataset. It is very space consuming and time consuming.

Ishan Ratn Pandey et.al. [2] proposed a face recognition system based on CNN. For face recognition softmax classifier is used. The performance of a softmax classifier can be sensitive to the quality and representativeness of the training data, and it may be necessary to collect large and diverse datasets to achieve high accuracy.

The system proposed by Vrushab Banajawad et. al. [3] is focused on making a face recognition attendance system. It uses Haar-cascade face classifier to recognize individual's faces SVM and KNN is used to build the face recognition model. Here the accuracy depends on the quality of data and it also requires large memory space to store all the training data.

The system proposed by Prachi et.al. [4] is also focused on making an accurate face recognition model for

border security control. Haar-cascade face classifier along with LBPH algorithm is used for face detection and recognition. Like other methods, if any modifications happened in face database. The entire model should be again built from the scratch. It is also a very time-consuming process.

Samridhi Dev and Tushar Patnaik [5] proposed a face recognition attendance system that uses Viola-Jones algorithm for face detection and KNN classifier for face recognition. But the Viola-Jones algorithm is not very effective when detecting tilted and turned faces.

The system proposed by Arjun Raj A et.al. [6] is focused on making a Smart Attendance System using LBPH face recognizer. This system is implemented using Raspberry Pi. Eventhough this system is standalone, it also has some hardware limitations. LBPH based face detection requires lot of computational power to handle large database effectively.

Kolipaka Preethi and swathy vodithala [7] proposed a face recognition attendance system using LBPH algorithm. This method uses 200 images for a single person to train the model. So, the space required for storing the images is very high.

III. RESEARCH POSSIBILITIES

There are a variety of research possibilities for developing a face recognition attendance system. Here are some potential areas of investigation.

Face recognition algorithms: Research can be done to develop more accurate and efficient face recognition algorithms that can handle variations in lighting, poses, expressions, and occlusions.

Data collection and preprocessing: Collecting and preprocessing high-quality facial data is a critical aspect of building an accurate face recognition system. Research can be done to develop new techniques for data collection and processing, such as using 3D face models or dealing with imbalanced datasets.

Machine learning models: Face recognition systems typically rely on machine learning models to recognize faces. Research can be done to develop new machine learning models such as deep learning neural networks, ensemble models etc.

System integration: A face recognition attendance system must be integrated with other technologies, such as cameras, databases, and access control systems. Research can be done to optimize the integration of these technologies and improve the overall performance of the system.

Usability and user experience: A face recognition attendance system must be user-friendly and easy to use for both administrators and employees. Research can be done to improve the usability and user experience of the system, such as through the use of intuitive interfaces or feedback mechanisms.

Security: Face recognition attendance systems must be secure and resistant to attacks, such as spoofing or hacking. Research can be done to develop security mechanisms that can protect the system against these threats.

IV. METHODOLOGY

4.1 HOG Face Detection

The first step is to detect the faces in the images. In this paper, HOG face detection technique is used to detect faces. To find faces in the image, first the image is converted to black and white because the color data is not required for finding faces. The color conversion is shown in figure 4.1.1.



Figure 4.1.1 Color Conversion

Then for every pixel in the image gradient direction and gradient magnitude needs to be calculated. This can be calculated by focusing on a particular pixel of the image and corresponding pixels around it. The goal is to figure out



how dark the current pixel is compared to the pixels directly surrounding it. Then an arrow needs to be drawn in the direction in which the image is getting darker.

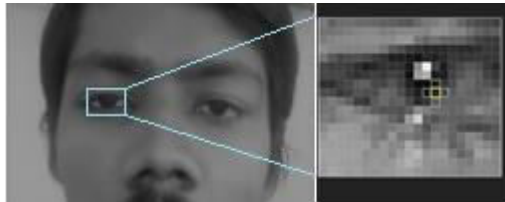


Figure 4.1.2 Gradient Magnitude & Gradient Direction

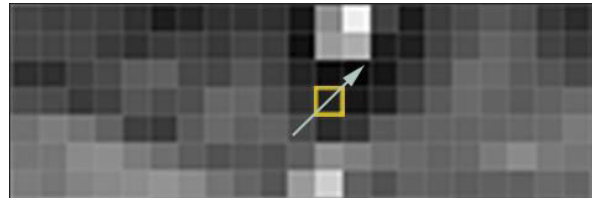


Figure 4.1.3 Gradient direction

represented by arrow

Looking at just this one pixel and the pixels touching it, the image is getting darker towards the upper right. If this process is repeated for every single pixel in the image, it will end up with every pixel being replaced by an arrow. These arrows are called gradients and they show the flow from light to dark across the entire image. If the pixels are analyzed directly, really dark images and really light images of the same person will have totally different pixel values. But by only considering the direction that brightness changes, both really dark images and really light images will end up with the same exact representation. That makes the problem a lot easier to solve.

But saving the gradient for every single pixel gives us way too much detail. That much amount of detail is not required for detecting the faces. It would be better if the basic flow of lightness/darkness at a higher level are only analyzed. So, the basic pattern of the image can be seen in the end. To do this, the image is broken into small squares of 16x16 pixels each. In each square, the gradient point in each major direction is calculated. Then the square in the image is replaced by arrow directions that were strongest. The end result is the original image is converted into a very simple representation that captures the basic structure of a face in a simple way as shown in figure 4.1.4.

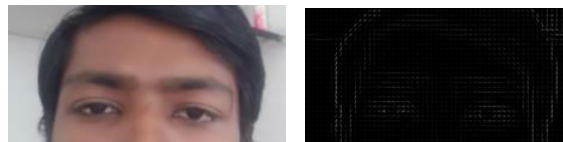


Figure 4.1.4 HOG Representation of an image

Figure 4.1.5 shows HOG face pattern and the original image is converted into a HOG image. The next step is to find the part of the image that looks similar to a known HOG pattern that was extracted from a bunch of other training faces.

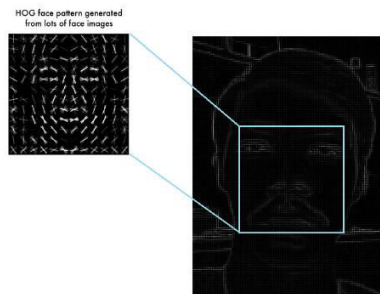


Figure 4.1.5 HOG Face Pattern

4.2 Face Landmark Estimation

Face landmark estimation is a computer vision technique that involves detecting and locating specific points on a human face, such as the corners of the eyes, the tip of the nose, and the corners of the mouth. These points, also known as facial landmarks, can be used to identify unique features of a face and track facial expressions. Facial landmark estimation can be accomplished using machine learning algorithms, such as Convolutional Neural Networks



(CNNs), which are trained on large datasets of annotated facial images. Once trained, the algorithm can accurately detect and locate facial landmarks in new images or videos. 68 different landmarks on the face is shown in figure 4.2.1.

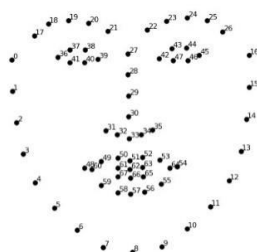


Figure 4.2.1 Face landmarks

Now the location of eyes and mouth are found, so by simply rotating, scaling, and shearing the image the eyes and mouth are always centred as best as possible. Any 3D fancy warps are not required because that would introduce distortions into the image. This process only going to use basic image transformations like rotation and scale that preserve parallel lines. No matter how the face is turned, this method can able to centre the eyes and mouth are in roughly the same position in the image. This will make the next steps lot more accurate.

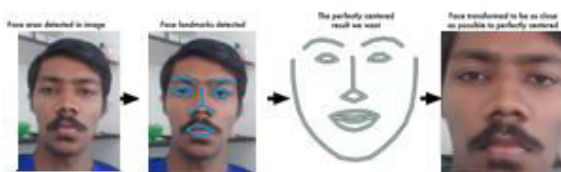


Figure 4.2.2 Process of centering the face

4.3 Face Encoding Generation

This is the core part of the problem. The simplest approach to face recognition is to directly compare the unknown faces with all the known pictures. When a known image looks similar to the unknown face, it must be the same person. This is the idea behind face recognition. There is actually a huge problem with this approach. If the number of persons is huge then it is nearly impossible to loop through each and every image. That would take way too long. This approach should be able recognize faces in milliseconds, not hours. A method is needed to extract few basic measurements of face. Then the same way can be used to measure the unknown faces. For example, measurements like size of each ear, the spacing between the eyes, the length of the nose, etc can be made. It turns out that measurements that seem obvious to humans don't really make any sense to a computer looking at individual pixels in the image.

Researchers have discovered that the more accurate approach is to let the computer figure out the measurements to collect itself. Deep learning does a better job than humans at figuring out which parts of a face are important to measure. The solution is to train a deep Convolutional Neural Network. But instead of training the network to recognize faces, 128 measurements need to be made for each face.

The training process works by looking at three face images at a time:

1. Load a training face image of a known person.
2. Load another picture of the same known person.
3. Load a picture of a totally different person.

Then the algorithm looks at the measurements it is currently generating for each of those three images. It then tweaks the neural network slightly so that it makes sure the measurements for 1st and 2nd images are slightly closer while making sure the measurements for 2nd and 3rd images are slightly further apart. After repeating this step millions of times for millions of images of thousands of different people, the neural network learns to reliably generate 128 measurements for each person. Any ten different pictures of the same person should give roughly the same measurements.

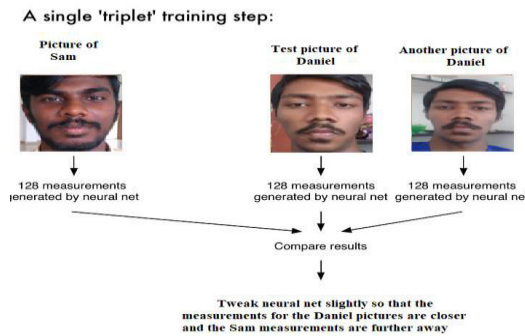


Figure 4.3.1 Training a neural network for generating face encodings

4.4 Finding the person’s name from the encoding

This last step is actually the easiest step in the whole process. The system needs to find the person in the database of known people who has the closest measurements to the test image. This can be done by using any basic machine learning classification algorithm. No fancy deep learning tricks are needed. This research uses simple linear SVM classifier, but lots of classification algorithms could work. The classifier needs to be trained to take in the measurements from a new test image and tells which known person is the closest match. Running this classifier takes milliseconds. The result of the classifier is the name of the person.

4.5 Anti-Spoofing Algorithm

Face anti-spoofing algorithms are used to distinguish between real and fake faces in biometric authentication systems. These algorithms use various techniques to detect and prevent spoofing attacks that involve presenting a fake face to the authentication system.

The methodology used in the Face-anti-spoof library involves several steps to detect and prevent spoofing attacks on facial recognition systems. Here is a high-level overview of the methodology:

Face Detection: The first step is to detect faces in the input image or video frame. This can be done using deep learning-based face detection algorithms such as Haar cascades or Convolutional Neural Networks (CNN).

Face Alignment: Once the faces are detected, they need to be aligned to a standardized position for further processing. This involves identifying the facial landmarks such as eyes, nose, and mouth, and warping the image to align them to a reference template.

Feature Extraction: Next, a set of features is extracted from the aligned face. These features can be extracted using techniques such as Local Binary Patterns (LBP) or Histogram of Oriented Gradients (HOG).

Spoof Detection: With the extracted features, a classifier is trained to distinguish between genuine faces and spoofed faces. This involves training a machine learning algorithm such as Support Vector Machines (SVM) or Random Forests (RF) using a dataset of both genuine and spoofed faces.

Anti-spoofing: If a spoofing attack is detected, the system takes appropriate action to prevent it. This can involve displaying a warning message or denying access to the system.

Overall, the methodology used in the Face-anti-spoof library involves a combination of computer vision and machine learning techniques to detect and prevent spoofing attacks on facial recognition systems.

4.6 Attendance Generation

The faces will be recognized using the HOG and SVM techniques. The recognized faces will be stored using the CSV file or real-time database. For example, Firebase can be used. It is one of the widely used databases today. The CSV file can be used for further reference of the attendance data. The entry will be directly stored in a database. So, only authorized person can access the attendance data. Others cannot modify the attendance data. This method adds an additional layer of security to the attendance data. If a new student needs to be added, then the data can be fetched by using an admin panel. Here the new student details will be added and directly dumped into a json file. Then, these data inside the json file will be uploaded to the database. So, no need to directly access the database for new addition of members.



V. EXPERIMENTAL RESULTS AND DISCUSSION

The user interface of the Smart Attendance Management System is shown in figure 5.1.

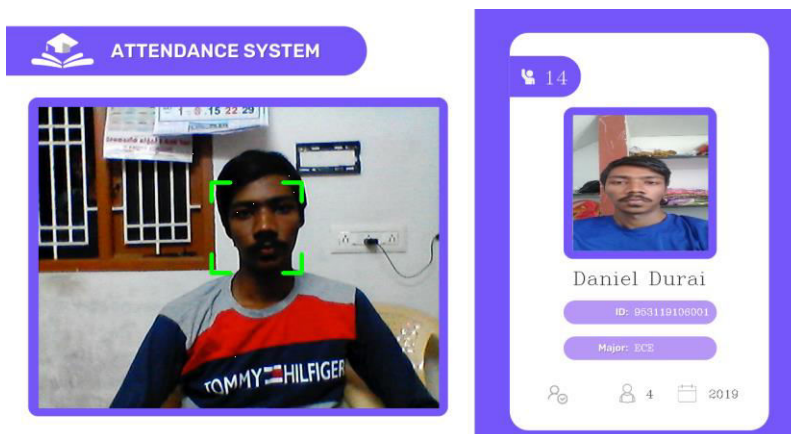


Figure 5.1 User Interface

Figure 5.1 shows the exact image took from the UI of the attendance management system. While recording the attendance it provides number of information to indicate the individuals about their attendance status. It displays name, department of the student, register number, year, starting year and the total attendance. From this information, peoples can immediately know about their attendance status. Providing this information is very helpful for the students/employees to keep track of their attendance.

Attendance record stored in the real-time database is shown in figure 5.2.

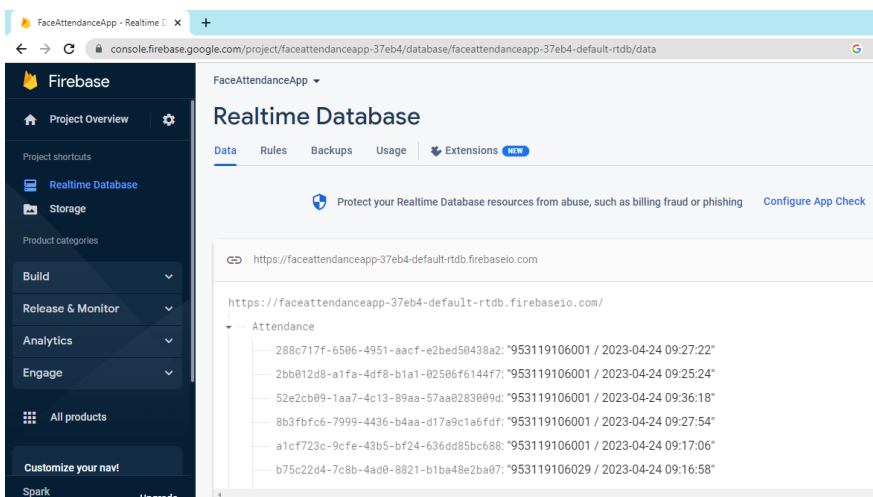


Figure 5.2 Attendance data stored in database

In this research, firebase is used as real time database. Here the students attendance is recorded by storing their register number along with the exact time and date of their entry. For each entry, an unique identifier will be generated to avoid collision in database. This entries can be downloaded as json file for further reference.

VI. CONCLUSION

This method of face recognition requires only one image for a single person. It saves lot of space. So, no need to store multiple images of a single person inside the database. Face anti spoofing is very helpful to avoid spoofing attacks. This face attendance system was built using HOG and SVM. This face recognition technique has the accuracy of 99.38%. This system also linked with real-time database for attendance storing. This attendance



tracking system can be used in schools, colleges and other large organizations. This system is a cost-effective solution for organizations to manage their attendance data. The system proposed in this paper is suitable for attendance tracking applications. This system can be enhanced to make access control system based on face recognition. For access control applications high accuracy is required. This face recognition model can be further optimized to make it suitable for access control. Research can be done to integrate the attendance tracking and access control system to make a single system that can perform these two functions.

REFERENCES

- [1] Shreyak Sawhney, Karan Kacker, Samyak Jain, Shailendra Narayan Singh, Rakesh Garg, “Real-Time Smart Attendance System Using Face Recognition Techniques” *9th International Conference on Cloud Computing, Data Science & Engineering (Confluence)*, pp.522-525, 2019.
- [2] Ishan Ratn Pandey, Mayank Raj, Kundan Kumar Sah, Tojo Mathew, M. S. Padmini, “Face Recognition Using Machine Learning”, *International Research Journal of Engineering and Technology (IRJET)*, Vol. 06, Issue 04, Apr 2019.
- [3] Vrushab Banajawad, Nithin Shetty, Pratham Shekar, Mr. Ajith Kumar B P , “Face Recognition Attendance System”, *International Research Journal of Engineering and Technology (IRJET)*, Vol. 09, Issue 06, pp. 1394-1397, June 2022.
- [4] Prachi, Ashish Mishra, Ujjwal Sahu, Akash Kumar Gupta, Arpit Sharma, “On Border Security Based Face Detection System”, *International Research Journal of Engineering and Technology (IRJET)*, Vol. 07, Issue 05, pp. 6816-6824, May 2020.
- [5] Samridhi Dev, Tushar Patnaik, “Student Attendance System Using Face Recognition”, *International Conference on Smart Electronics and Communication (ICOSEC 2020)*, pp. 90-96, 2020.
- [6] Arjun Raj A, MahammedShoheb, Arvind K, Chetan K S, “Face Recognition Based Smart Attendance System” *International Conference on Intelligent Engineering and Management (ICIEM)*, pp. 354-357, 2020.
- [7] Kolipaka Preethi, Swathy vodithala, “Automated Smart Attendance System Using Face Recognition”, *Fifth International Conference on Intelligent Computing and Control Systems (ICICCS 2021)*, pp. 1552-1555, 2021.
- [8] Shantanu Shahi, Balveer Singh, “Face Recognition System and its Applications”, *International Research Journal of Engineering and Technology (IRJET)*, Vol. 09, Issue 02, pp. 455-458, Feb 2022.
- [9] Rohit Sharma, Sanvida Badhe, Achal Patil, Akshata Prabhu “Facial Recognition Attendance System”, *International Research Journal of Engineering and Technology (IRJET)*, Vol. 08, Issue 05, pp. 1408-1413, May 2021.
- [10] Muhammad Sharil, Farah Naz, Mussarat Yasmin, Muhammad Alyas Shahid and Amjad Rehman, “Face Recognition: A Survey”, *Journal of Engineering Science and Technology Review*, March 2017.
- [11] Shailaja A Patil, Dr. P. J. Deore, “Face Recognition: A Survey”, *Information Engineering, an International Journal (IEIJ)* , Vol. 01, pp. 31-41, Dec 2013.
- [12] Aryan Verma, Samkit Saraf, Varun Vasani, “Review Paper on Attendance Capturing System using Face Recognition” *International Research Journal of Engineering and Technology (IRJET)*, Vol. 09, Issue 01, Jan 2022.
- [13] Anubhav Kumar Singh, Manish Gupta, Akshay Kumar Singh, Mayank Kumar Singh, Mehul Gupta, “Analysis and Study of Face Recognition and Detection” *International Research Journal of Engineering and Technology (IRJET)*, Vol. 07, Issue 04, Apr 2020.
- [14] Yongzhong Lu, Jingli Zhou, Shengsheng Yu, “A Survey of Face Detection, Extraction and Recognition”, *Computing and Informatics*, Vol. 22, 2003.
- [15] Kavita, Ms. Manjeet Kaur, “A Survey paper for Face Recognition Technologies”, *International Journal of Scientific and Research Publications*, Vol. 06, Issue 07, July 2016.
- [16] Muthukannan K, Latha P and Manimaran C, “Implementation of Artificial Neural Network for Face Recognition Using Gabor Feature Extraction”, *ICTACT Journal on Image and Video Processing*”, Vol. 04, Issue 02, Nov 2013.



INNO SPACE
SJIF Scientific Journal Impact Factor
Impact Factor: 8.423



ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

9940 572 462 **6381 907 438** **ijirset@gmail.com**



www.ijirset.com

Scan to save the contact details