Intra Student Surveillance System: Detection And Identifying Unauthorized Wandering

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Abstract. A student monitoring system is an advanced method of preserving security and discipline in educational institutions, particularly during class hours. Students are observed during intracultural and tech fest events hosted by the institutions. Unauthorized student roaming in restricted areas can disrupt learning and endanger security. The proposed system will develop an effective and trustworthy system for tracking student mobility on the college campus to address these challenges. Face recognition technology is integrated into the system using strategically positioned cameras to continuously monitor and identify student activity, ensuring their presence in permitted places during scheduled class periods. When students are found in unapproved locations, the technology instantly notifies authorized staff and campus security in real time. This system relies on the HOG method and dlib library, which effectively captures and analyses facial features using image processing techniques.

Keywords: Face Detection, Face Recognition, Machine Learning, Histogram of Oriented Gradients (HOG), Deep Learning

1 Introduction

Since student safety and security are educational institutions' top priorities, the quick development of deep learning and machine learning technologies has created new avenues for improving student safety. Students are wandering at the college mainly during the class hours that leads to indiscipline in the college. In response to these challenges, the introduced system is a cutting-edge solution, "Student Surveillance system", which leverages machine learning and deep learning algorithms, including HOG and specialized face recognition libraries. The monitoring system is designed to detect and accurately identify students who may be wandering in unauthorized areas, providing real time alerts to authorized persons. The system utilizes the power of facial detection and recognition technology. J. A. Mahajan et al. [3] in 2017 has suggested a face detection technique created especially for distorted picture data. Quality Histogram of Oriented Gradients (HOG) features are employed, suggesting an emphasis on high-quality descriptors to improve face identification accuracy under different distortions.

K. R. Madhavi et al. (eds.), *Proceedings of the International Conference on Computational Innovations and Emerging Trends (ICCIET 2024)*, Advances in Computer Science Research 112,
https://doi.org/10.2991/978-94-6463-471-6_115

At its core, this system employs state-of-the-art facial detection mechanisms, specifically HOG algorithm, to accurately locate and isolate human faces from images or video feeds captured by cameras positioned at the home's entrance. The capability of these algorithms to function effectively in various lighting conditions and environments ensures robust performance. Subsequently, the system employs deep learning-based face recognition models, trained on extensive datasets, to identify and authenticate individuals based on their facial features. This multi-step process ensures a high level of accuracy in recognizing authorized persons.

2 Literature Survey

Smrity Bhattarai et al. [1] in 2017 has proposed a system's design for instantly detecting faces in videos using Convolutional Neural Networks (CNNs). It emphasizes real time processing and the application of digital architecture for efficient face recognition have achieved 90% accuracy.

Patel Meghavi Kiritbhai et al. [2] in 2021 has proposed a system that employs deep learning techniques to automate the monitoring of university gate passes. It streamlines the process of verifying and managing entry permissions, enhancing security and efficiency at university gates have achieved 98.34% accuracy.

J. A. Mahajan et al. [3] in 2017 has proposed a face detection method specifically designed for distorted images. It utilizes Quality Histogram of Oriented Gradients (HOG) features, indicating a focus on high-quality descriptors to enhance accuracy in identifying faces under various distortions.

Ciya James et al. [4] in 2019 has proposed Student Monitoring System designed for school buses, incorporating facial recognition technology. The system seeks to improve safety and tracking on school buses by employing facial recognition for student identification and monitoring. This involves the implementation of technologies like Deep Learning and Haar-Cascades classifier to enhance the efficiency of the process.

Jack Febrian Rusdi et al. [5] in 2020 has a system for student attendance utilizing face recognition technology, incorporating Deep Learning and Machine Learning technologies. The approach aims to automate attendance tracking through the advanced capabilities of facial recognition, enhancing efficiency in the educational setting.

G. Sandhya Devi et al. [6] in 2017 has proposed a system that utilizes technologies such as face detection and object detection to enhance security and monitor potential irregularities. It aims to provide a proactive approach to maintaining the integrity of offline examinations through advanced surveillance techniques.

Amrutha C.V et al. [7] in 2020 has proposed a Deep Learning approach to detect suspicious activities in surveillance videos, achieving an accuracy rate of 87.15%. The implementation of Deep Learning technology underscores its effectiveness in recognizing and flagging potential security concerns within the surveillance footage.

Somasundaram R et al. [8] in 2021 has proposed Students Surveillance System in Mass Gathering using Deep Learning implemented technologies Computer Vision, Face recognition, Object detection.

Kajenthani Kanthaseelan et al. [9] in 2021 has proposed CCTV Intelligent Surveillance on Intruder Detection implemented technologies Image processing, Face Detection.

Htet Aung et al. [10] in 2021 has proposed a system for real-time face detection in live video using the YOLO (You Only Look Once) algorithm based on the VGG16 Convolutional Neural Network. The implementation integrates technologies such as Face Detection, VGG16 convolutional neural network, and YOLO Object detection, emphasizing efficiency and accuracy in identifying faces in dynamic video streams.

Deng-Yuan Huang et al. [11] in 2018 has proposed a system for real-time face detection with a moving camera, leveraging technologies such as Face Detection, Histogram of Oriented Gradient, and Support Vector Machine. The inclusion of Histogram of Oriented Gradient and

Support Vector Machine enhances the system's capability to handle variations in facial features and movement.

3 Related Work

Smrity Bhattarai et al. [1] in 2017 has proposed a system that uses convolutional neural networks (CNNs) to quickly identify faces in videos. It places a strong emphasis on real-time processing and the effective use of digital architecture to achieve 90% accuracy in face recognition. In this model, author has used Convolutional neural network which is not suitable for detecting the multiple faces accurately. And even the objects are being recognized along with faces. This system may not perform more accurately. Following are the algorithms used

3.1 Convolutional Neural Network

A Convolutional Neural Network (CNN) is a smart computer program used to understand and make sense of visual things like pictures and videos. It's really good at tasks like recognizing faces, figuring out what's in a picture, and spotting objects in images. It's like a type of tool that can separate things into three categories. CNNs work especially well when you have lots of pictures to teach them from, and they're good at using the same information over and over to save space in their memory.

Convolutional Neural Network (CNN) is made up of various components. Some parts help it pick out important details in pictures, like finding edges and shapes. Other parts help it shrink the picture to make it easier to handle. Additionally, there are components within the system that contribute to determining the contents of an image, such as assessing whether an individual is in good health or has a medical condition. So, in simple terms, CNNs are like detective tools that take pictures, pick out the important stuff, and decide whether it's a healthy situation or something that needs attention. Smrity Bhattarai et al. [1] in 2017 has proposed a system that utilizes the convolutional neural networks (CNNs) for rapid face identification in videos, prioritizing real-time processing and optimizing digital architecture to attain a 90% accuracy rate in face recognition.

3.2 Histogram of Oriented G+47radients

The Histogram of Oriented Gradients (HOG) serves as a feature extraction method in computer vision, describing the local shape and texture of an image. The process involves partitioning the image into small cells, computing pixel gradients within each cell to determine intensity changes, and generating histograms of gradient orientations for each cell. These orientation histograms are subsequently combined to create a feature vector, applicable for tasks such as object detection and image classification. HOG is particularly effective in capturing edge and shape information in images and is widely used in applications like pedestrian detection and face recognition. J. A. Mahajan et al. [3] in 2017 has proposed a system introduces a face detection technique tailored for distorted images, employing high-quality descriptors like Quality Histogram of Oriented Gradients (HOG) features. The emphasis on precision suggests a dedicated effort to improve accuracy in identifying faces amid different distortions.

3.3 You Only Look Once (YOLO)

YOLO, short for "You Only Look Once," is a clever computer vision system for quickly spotting objects in images or videos. Instead of scanning the same image multiple times, YOLO looks at it just once and splits it into a grid. Then, for each grid cell, it predicts if there's an object, where it is, and what type of object it might be. YOLO is known for being super-fast, making it perfect for things like self-driving cars or security cameras that need to identify objects in real time.

YOLO, which is really fast at spotting things in pictures, can also be used to find faces. It's good at finding many faces at once, even if they're close together or overlap. YOLO draws boxes around the faces it finds and can tell you that what's inside those boxes are, indeed, faces. It works quickly, so it's used in things like security cameras and video chats. Htet Aung et al. [10] in 2021 has proposed a real time face detection system in live video employing the YOLO (You Only Look Once) algorithm and based on the VGG16 Convolutional Neural Network. The implementation combines Face Detection, VGG16 convolutional neural network, and YOLO Object detection technologies, highlighting a focus on efficient and accurate identification of faces in dynamic video streams.

3.4 Support Vector Machine

A Support Vector Machine (SVM) functions as an intelligent tool in machine learning, proficient in categorizing data. Its operation involves identifying an optimal line, plane, or boundary to effectively separate distinct data groups, essentially locating a significant gap between the entities to be distinguished. The SVM is equipped to handle complex and non-linear data through a technique known as the "kernel trick.".

Support Vector Machines (SVMs) play a role in face detection by helping computers figure out where faces are in pictures. They do this by looking at specific parts of the face, like the eyes or nose, and deciding whether those parts are part of a face or not. In 2018, Deng-Yuan Huang and colleagues [11] presented a system that uses support vector machines, histogram of oriented gradients, face detection, and other technologies to detect faces in real time from a moving camera. The integration of Support Vector Machine and Histogram of Oriented Gradient improves the system's ability to manage changes in movement and facial features.

4. Existing System

The existing system, which aims to identify unauthorized wandering using advanced deep learning techniques like CNN, HOG, SVM, and Random Forest, primarily relies on the CNN algorithm. CNN is specifically engineered to process and make sense of visual data, such as images and videos. However, it's important to note that CNN may exhibit lower accuracy in its initial stages since it requires training to improve its performance. This system's architecture is notably complex, given the integration of multiple algorithms and technologies. Smrity Bhattarai et al. [1] in 2017 has proposed system design aims to promptly detect faces in videos through Convolutional Neural Networks (CNNs), underscoring a commitment to real time processing and the utilization of digital architecture for efficient face recognition.

Disadvantages:

- It has High Complexity.
- It consumes more time.
- It has less accuracy.

5 Proposed System

To address the issue of students wandering on campus, especially during class hours, which has been causing disruptions and indiscipline, the system introducing an innovative solution called the "Student Surveillance System." This system uses deep learning and machine learning techniques to their full potential., Dlib which is a library. The library provides a robust implementation of the Histogram of Oriented Gradients (HOG) feature descriptor combined with a linear SVM for face detection. The proposed system is to keep track of where students are on a college campus. The system is going to use face recognition technology with cameras in specific spots to watch what students are doing. It will make sure students are in the right places during their classes. If it catches students in places are not supported to be, it will immediately alert campus security and authorized people. It provides a comprehensive and effective response to the problem.

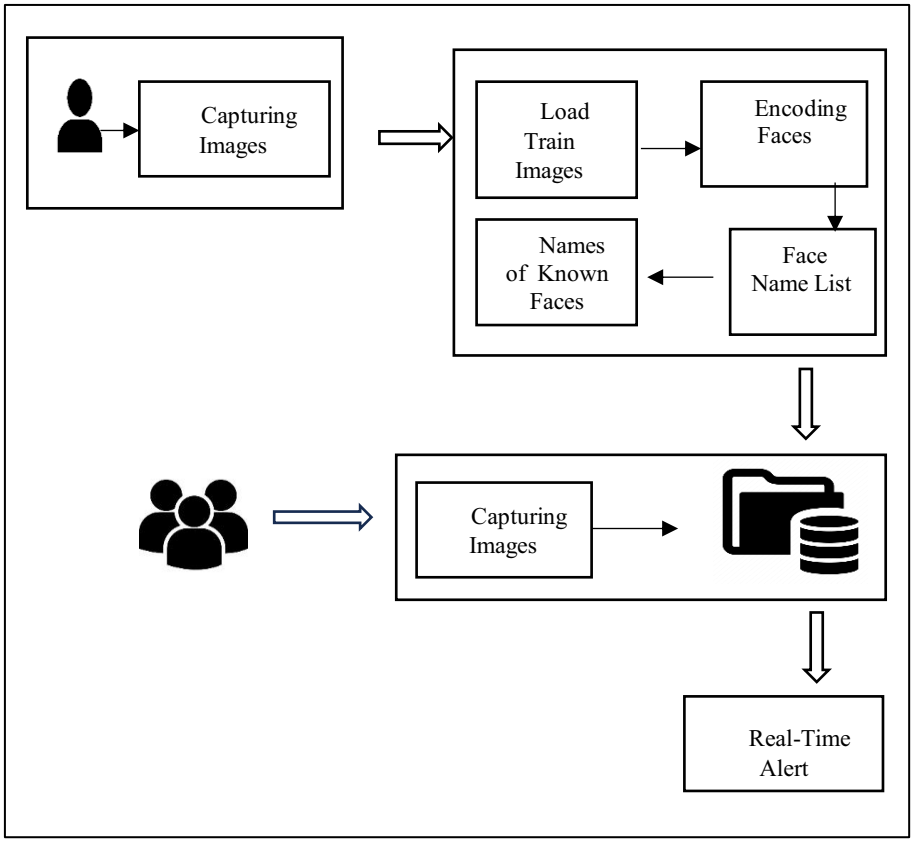


Fig. 1. Block diagram of detection and identifying students

6 RESULTS AND DISCUSSIONS

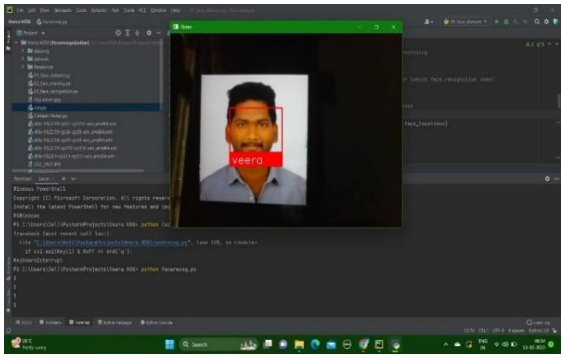


Fig. 2. Detecting single face

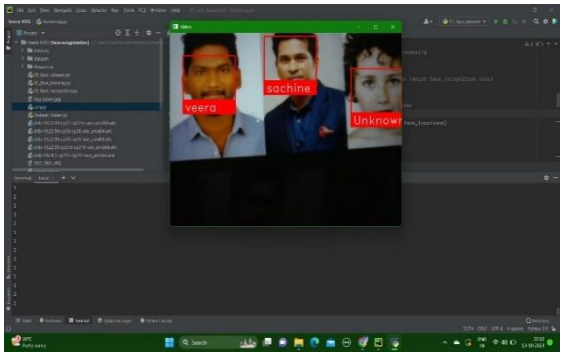
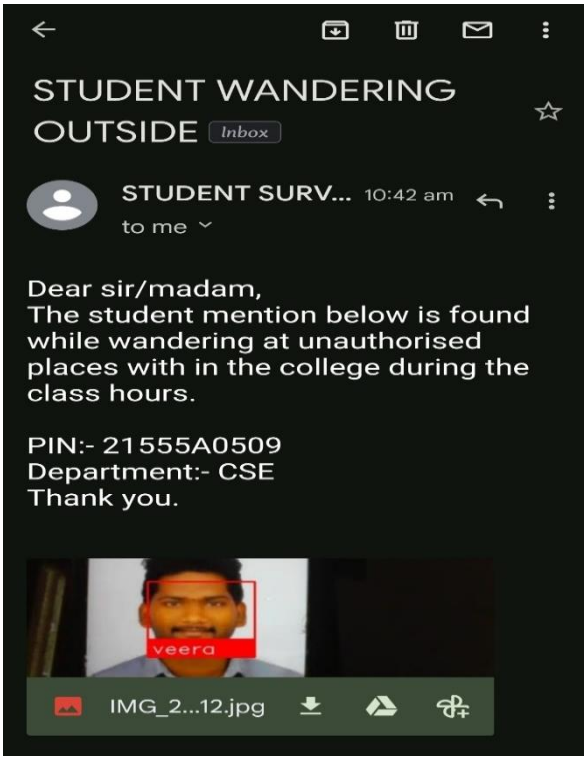


Fig. 3. Detecting multiple faces



Fig, 4. Mail generation

This model has done through the Deep Learning models. Smrity Bhattarai et al. [1] in 2017 has proposed system design aims to swiftly detect faces in videos using Convolutional Neural Networks (CNNs), emphasizing a dedication to real-time processing and leveraging digital architecture for effective face recognition.

In the existing system, the CNN model was used to implement the project which gives less accuracy. However, the suggested system uses a Residual Neural Network, a Linear SVM classifier, and a HOG to create a more accurate system that can take multiple pictures in a single shot.

7 Conclusion and Future Work

The introduction of a Student Surveillance system represents a significant step towards maintaining security and discipline in educational institutions, especially during important events. By incorporating Face Recognition Technology and strategically placing cameras, the system guarantees that students stay within authorized areas throughout scheduled class hours. In addition to detecting unauthorized wandering, this proactive approach notifies authorized staff and campus security in real time when students are discovered in restricted areas. By relying on using the HOG, Linear SVM classifier, Residual Neural Network methods for facial feature analysis, this system offers an effective and trustworthy solution for enhancing safety and discipline on the college campus.

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