International Journal for Modern Trends in Science and Technology
Volume 10, Issue 02, pages 479-483.
ISSN: 2455-3778 online
Available online at: http://www.ijmtst.com/vol10issue02.html
DOI: https://doi.org/10.46501/IJMTST1002065

AI Powered Automated Video Surveilance and Alarm System

Malaiappansrikanth.S | Ganeshan.M | Nithishkumar.G.R |Prof. Janani.S

Department of Computer Science and Engineering, Kamaraj College of Engineering and Technology, Virudhunagar, Tamil Nadu, India.

To Cite this Article
Malaiappansrikanth.S, Ganeshan.M, Nithishkumar.G.R, Prof. Janani.S, AI Powered Automated Video Surveilance and Alarm System, International Journal for Modern Trends in Science and Technology, 2024, 10(02), pages. 479-483.https://doi.org/10.46501/IJMTST1002065

Article Info
Received: 28 January 2024; Accepted: 19 February 2024; Published: 25 February 2024.

ABSTRACT

AI Powered Automated Video Surveillance and Alarm System project presents a comprehensive solution that leverages cutting-edge artificial intelligence technologies to enhance the efficiency and effectiveness of video surveillance in various contexts. Traditional video surveillance systems often suffer from limitations in real-time monitoring and incident detection. This system addresses these challenges by employing deep learning models for object detection, tracking and enabling the automatic identification of potential security threats and abnormal activities. When a potential security breach or anomaly is detected, the system triggers real-time alerts and notifications, allowing security personnel or relevant authorities to respond swiftly. This system not only aims to improve security but also offers scalability and flexibility, making it an invaluable tool for both private and public sectors.

Keywords: CCTV, CNN, image processing, alert, Cloud, accident, Fight, Anonmoly detection, Surveillance, area, Open CV

1. INTRODUCTION

Traditional video surveillance systems, while serving as essential tools for monitoring, have inherent limitations that hinder their effectiveness in detecting and responding to security threats in real time. These limitations include the inability to identify and track objects accurately, the potential for human error, and the overwhelming volume of data generated by surveillance cameras. In response to these challenges, the "AI Powered Automated Video Surveillance and Alarm System" emerges as a ground-breaking solution. The convergence of video surveillance technology can revolutionize how we ensure safety and security. This project is committed to harnessing the power of AI to create an advanced and automated video surveillance and alarm system that overcomes the shortcomings of traditional methods.By integrating cloud deployment, this system promises to be a game-changer in security and surveillance.

2. LITERATURE REVIEW

In Literature Review, we studied about existing project related to this topic and try to underst and about the existing system behavior.

The goal of such a review is to provide an understanding of the evolution of techniques and technologies used for detecting moving targets. Various researchers have made significant contributions to the field of moving target detection, each with distinct approaches and findings:

Sreedevi R Krishnan, et. al., [1] have proposedamethodinwhich an in-depth study of various automatic anomaly detection techniques helps to reduce the loss occurred of the anomalous situation.

YanjinlkhamMyagmar-Ochir, et. al.,[2] haveproposed a system VSS in smart city that is designed to monitor the based on the the urban environment using various devices such as public or private CCTVs. In contrast, moving monitoring devices are designed to move freely and monitor areas not directly visible.

Salvatore Carta, et. al.,[3] have worked on monitoring traffic and anomalies detection through scientific and industrial research that are very activein this direction, since it involves many topics, including, e.g., pattern recognition applications, cloud-based systems, cryptography and several others.

Xiongwei Wu, et. al.,[4] developed a system that works on Visual object detection aims to find objects of certain target classes with precise localization in a given image and assign each object instance a corresponding class label.

Weiming Hu, et. al.,[5] haveproposedasystema processing framework of visual surveillance in dynamic scenes includes the following stages: modeling of environments, detection of motion, and classification of moving objects, description of behaviors, human identification, from multiple cameras.

Hong-Bo Zhang, et. al.,[6] developed a system that provides an essential reference for those interested in further research on human action recognition and it presents a thorough review of human action recognition methods including progress in hand-designed action features in RGB and depth data, current deep learning-based action feature representation methods

AkmalazakiaFatan, et. al.,[7] have developed a system to provide a warning to the first responder accurately and as fast as possible while the system is running all the time. The faster the response of the first responder, the better chance of an anomaly to be resolved.

Maryam Qasim, et. al.,[8] have proposed a system that uses ResNet architecture which takes high-level feature representations from the video frames that come in, while the SRU collects temporal features.

3. VIDEO SURVEILLANCE ALARM SYSTEM

A typical security guard spends most of his time watching surveillance monitors throughout the night and periodically patrols the compound of the area he is guarding. In larger buildings, he might find that there are too many monitors to watch, hence unwanted activity might slip past him. When the guard patrols the compound, he leaves the monitors unwatched.During these occasions, the guard would find it very useful to be automatically alerted via his cell phone of any undesired activity caught on the surveillance cameras.It helps prevent crimes such as theft, vandalism, and acts of violence, creating a safer environment for communities. It features a user-friendly interface that empowers usersto easily configure and customize surveillance parameters, view live feeds, and access alert logs.

3.1 Modular Architecture

Modular architecture is a design approach that structures a system into independently replaceable and upgradeable modules, each serving a specific function.The key principle is to enhance flexibility and maintainability by isolating functionalities, enabling developers to modify individual modules without affecting the entire system.

3.1.1 Preprocessing

Before feeding the video frames into the AI model, a preprocessing module handles tasks such as resizing, normalization, and filtering. This module is flexible enough to accommodate different preprocessing techniquesbased on the specific requirements of the AI model.

3.1.2 Person Detection

This module is designed as a standalone component responsible for identifying and classifying

individuals within each video frame. It utilizes a modular machinelearning model, facilitating upgrades to the AI algorithm without disrupting other system components.

3.1.3 Event Detection

This module, implemented in the cloud, employs convolutional neural networks (CNN) and deep learning techniques to identify accidents, fights, and anomalies within video streams. Its modular architecture facilitates upgrades to theAI algorithm without disrupting other system components, ensuring real-time analysis and scalability.

3.1.4 Notification

Once an event is detected, the notification module generates alerts. This module is modular, allowing users to customize notification preferences and easily integrate with variouscommunication channels, such as email, SMS, or push notifications.

4. SYSTEM ARCHITECTURE

Figure –1 below represents the System Architecture of our system that basically shows each component of the system, flow of the system and so on. Images that are taken from the CCTV camera go under pre- processing stages to detect the undesired activities of image frames extracted.

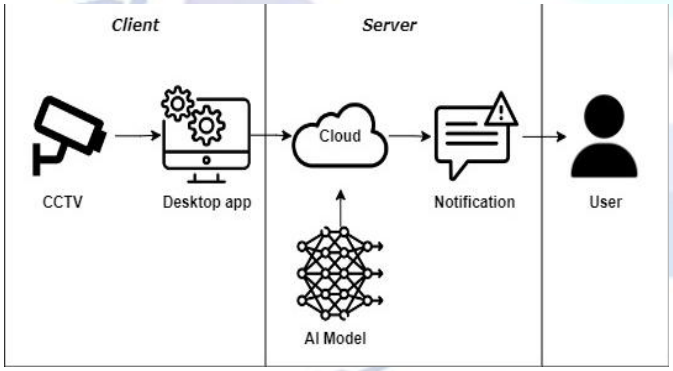

Figure -1: System Architecture

It defines the process flow of the image frames which detected by using CNN deep learning model from the database of datasets collected. Then, the trained CNN model compares the normal and accident scenes using the image frame extracted using computer vision.

After that it detects the objects of interest like fight, fire, car crashes, guns, knives and other accidents. As soon as the activity is detected as abnormal, it automatically sends an alert message to the intended recipient or the rescue team for responding appropriateactions through e-mail and other sources.

5. IMPLEMENTATION OF THE SYSTEM

Here we will discuss how we implemented our system.

5.1 Training of the System

The CNN deep learning model underwent rigorous training with 16,000 images for each class of event, namely fights and accidents. Following this extensive training regimen, the model demonstrated exceptional performance metrics: achieving a training accuracy of 100%, a validation accuracy of 97.52%, and a testing accuracy of 95.64%. This meticulous training process equipped the CNN model with the capability to swiftly and accuratelydetect objects and events within video frames.

5.1.1 Model Architecture

The model architecture comprises a Sequential convolutional neural network (CNN). It consists of three convolutional layers, each followed by a max-pooling layer, gradually reducing spatial dimensions. The convolutional layers have 32, 64, and 128 filters respectively, with ReLU activation and 'same' padding. Subsequently, a flattening layer prepares for fully connected layers, with two dense layers of 32 units each and a sigmoid activation function in the final layer for binary classification.

5.1.2 Training Results

The training process, as described, corresponds to the results depicted in Figure -2. Throughout 32 epochs of training, the model steadily improved its performance. It began with a loss of 0.3945 and an accuracy of 81.64% in the first epoch, gradually reducing the loss to nearly zero by the final epoch, while achieving a perfect accuracy of100% from the third epoch onward. This consistent improvement demonstrates the model's abilityto accurately classify input data, highlighting its effectiveness in learning and adapting to the training data.

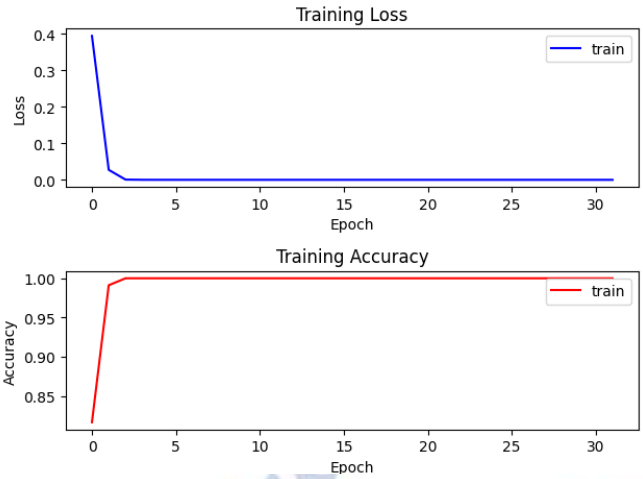

Figure-2: Training results

Following are thesteps that represents the process of the operation that are carried out after the image frames are extracted:

- CCTV camera captures video footage of the area being monitored.
- Video footage is sent to to the cloud AI server for real-time detection and classification.
- Cloud AI Server uses a pre-trained CNN model to identify objects/events of interest, such as fire, guns, knives, accidents, fights, undesired actions performed by humans and other weapons.
- If the cloud AI application detects an object/event of interest, it sends an alarm notification to the intended person through e-mail.
- The user can then view live video footage from the CCTV camera to assess the situation and take appropriate action.

After applying all the above steps, we get the exact prediction of detected activity with an appropriate alert message to the rescue team.

6. RESULTS

The below are the obtained results on implementing the system:

6.1 User Interface

Figure -3 represents the graphical user interface (GUI) of the Video Surveillance System. It includes the tkinter module that allows users to view live capturing of video.

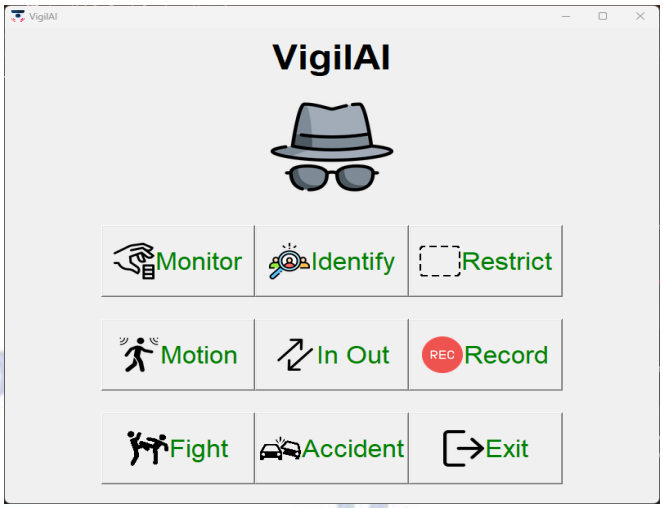

Fig -3: User Interface

It displays the dashboard of the application, where various operations can be performed by our sentinel guard system.

6.2Motion Detection

Figure – 4 represents the activity detected in the rectangular restricted area where the motion detection module analyzes and determines whether the motion occurs in the specified area.

Fig -4: Motion Detected

Sentinel guard detects or captures the movement of unauthorized persons or objects when entering the area under surveillance.

6.3 Scenario Detection

Figure – 5 represents the anomaly event noticed and detected where the event detection module analyses the output and determines whether specific events, such as fights, accidents, fire, guns, or knives, are occurring.

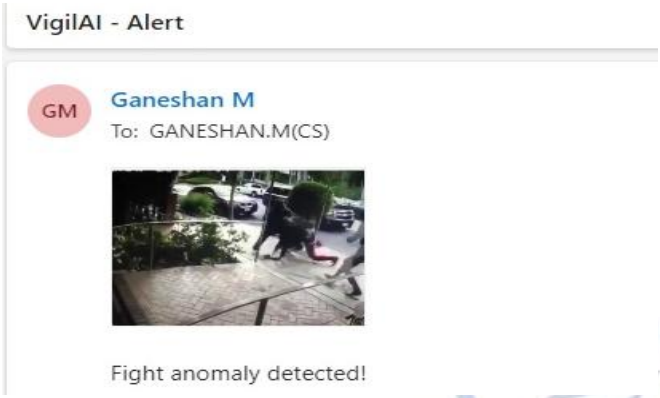

Fig -5: Scenario Detected

The system swiftly detects and captures instances of fights within CCTV footage. Upon identifying a fight event, it generates alerts for immediate action, ensuring timely intervention to address the situation.

6.4 Notification

Figure –7 represents the notifications that users receive when thereis abnormal activity on live detection through their mails.

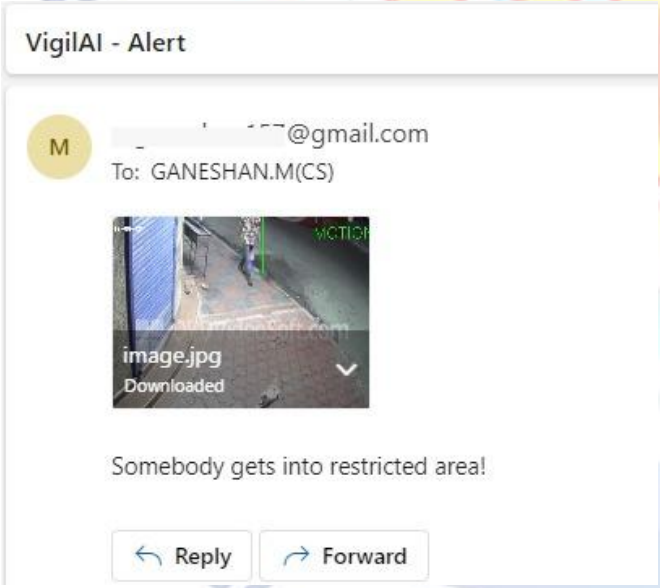

Fig -7: Alert Notification

Finally, our guard sends an alert message to the respective user when any undesired activity occurs in the area.

7. CONCLUSION

In conclusion, the implementation of our AI-powered Video Surveillance System utilizing the CNN deep learning model marks a significant advancement in enhancing security and situational awareness.The real-time object/event detection and tracking capabilities, provide a robust solution for proactive monitoring. We look forward to continued collaboration and refinement to ensure the ongoing effectiveness and reliabilityof our system in safeguarding diverse environments.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

REFERENCES

[1] K. Doshi and Y.Yilmaz , 'Continual Learning for Anomaly Detection in Surveillance Videos' IEEE/CVF Conference on, Computer Vision and Pattern Recognition Workshops (CVPRW), 10, pp.1025-34, June 2021.

[2] Y.Zahid, M.A.Tahir and M.N.Durrani , 'Ensemble Learning Using Bagging And Inception-V3 For Anomaly Detection In Surveillance Videos' IEEE International Conference onImage Processing, pp. 588-92, Oct 2022.

[3] W. Heng, T.Jiang, and W.Gao , 'How to Assess the Quality of Compressed Surveillance Videos Using Face Recognition', IEEE Transactions on Circuits and Systems for Video Technology, 29, pp.2229-43,Aug 2020.

[4] V.Jadhav, R.Deshmukh, P.Gupta, S.Ghogale, 'Weapon Detection from Surveillance Footage in Real-Time Using Deep Learning', 7th International Conference On Computing, Communication, Control And Automation, 21, pp, 843-848, Aug 2023.

[5] K.J. Oguine, O.C. Oguine, H. Bisallah, 'YOLO v3: Visual and Real-Time Object Detection Model for Smart Surveillance Systems', Creative Commons Attribution-ShareAlike 4.0 International Conference, 8,pp.367-82, sept 2022.

[6] A. Castillo, S. Tabik, F. Pérez, R. Olmos, F. Herrera, 'Brightness guided preprocessing for automatic cold steel weapon detection in surveillance videos with deep learning, Neurocomputing, 17, pp, 478-84, Nov 2022.

[7] S.Narejo, B.Pandey, D.E.Vargas, C. Rodriguez, and M. Anjum,"Weapon Detection Using YOLO V3 for Smart Surveillance System",Mathematical Problems in Engineering, pp. 1-9, May 2022.