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Unusual Behavior Detection: An Analysis of Abnormal Human Activity

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Abstract: In modern society, Many approaches, including the implementation of monitoring systems, have been undertaken to stop the abnormal human actions. If the monitoring systems can detect unusual human activity automatically and send out alarm or warning signals, that will be quite significant. The first step is for the algorithm to recognize whether there are any people in a frame of footage. Then, it's necessary to remove the frames that are likely to include abnormal human behavior. At this time, the useless frames should be removed. When a human exhibits abnormal behavior, the trained model identifies it and distinct photos of those frames are kept.

The ability to identify faces in these pictures has been improved. Here is the requirement to develop an automated security system that identifies the abnormal human activity in real-time so one can immediately take action on it. It is a very lengthy process to get abnormal human activity from lengthy surveillance videos so it will compress the video before passing it throw the activity recognition system so that system can first retain the objects of interest and then it can be passed throw the model. Utilizing just CNN (Convolutional Neural Network) is less accurate and consumes a lot of computing time. As a result, MobileNet, a pre-trained model, is used as the foundation for developing the complete model and offers improved accuracy. Telebot uses the Telegram app to send an alarm message to the relevant authorities.

Keywords: GSM, UPI ID,QR Code

I. INTRODUCTION

The- project is to design and implement a system that will detect and alert abnormal human activity that will avoid human violence. Finding abnormalities in security systems is in fact one method of detecting human behavior. An approach for tracking activities should be able to recognize the basic tasks that individuals perform each day. It is challenging to identify different activities with high-accuracy because of the complicated nature and diversity of human-activity. Since it has uses in a variety of fields, such as human-computer interface, security systems, criminal investigation, and video processing, machine learning groups that are interested to this research topic [1]. CCTV is a security camera that gives the appearance that there are constantly an extra set of eyes, giving users peace of mind. CCTVs are present in a variety of locations, both public and private.

The deployment and maintenance of the system face additional difficulties as its use for security is increasingly put to use. A big storage space used up by video content is one of the most frequent issues that CCTV systems encounter. Usually, the footage is kept on hard discs. Thus, several compression techniques are utilized to decrease the amount of storage space needed [2], [3]. The video data contains the information. The emphasis on analysis and processing is driven by the requirement for public safety. video information. Our objective is to streamline SS (security service) operations while concentrating on enhancing security in public locations. We run into a number of issues in the direction of anomalous incident classifications, including a lack of datasets with appropriate films for this issue [4].

The most well-known methods for recognizing human activity are Convolutional-Neural Networks (CNN), Long Short-Term-Memory (LSTM), and Support Vector Machines (SVM), according to the literature study [5], [6], [7]. Overcrowded cities are faced with a number of security challenges when they frequently host packed events like strikes, protests, parades, or other types of people gatherings. Security personnel are frequently used to monitor meetings and guarantee the safety of their attendees in order to reduce these problems [8], [9]. Using MIIs, a CNN is used to identify typical and atypical crowd behavior [10]. Machine learning methods are coupled with the magnetic induction device to detect a variety of human movements. Deep recurrent neural networks, laboratory measurements, and generated datasets are successfully used to assess this method [11]. Although the widespread usage of surveillance systems lessens security worries, it also generates a large volume of video data that cannot be seen in real time by humans [12].

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The objective of a project on abnormal human activity detection is to develop a system or algorithm that can automatically identify and flag unusual or abnormal behaviors or activities performed by humans. This could be achieved through the analysis of various data sources, such as video footage, sensor data, or biometric information, to identify deviations from expected patterns of behavior.

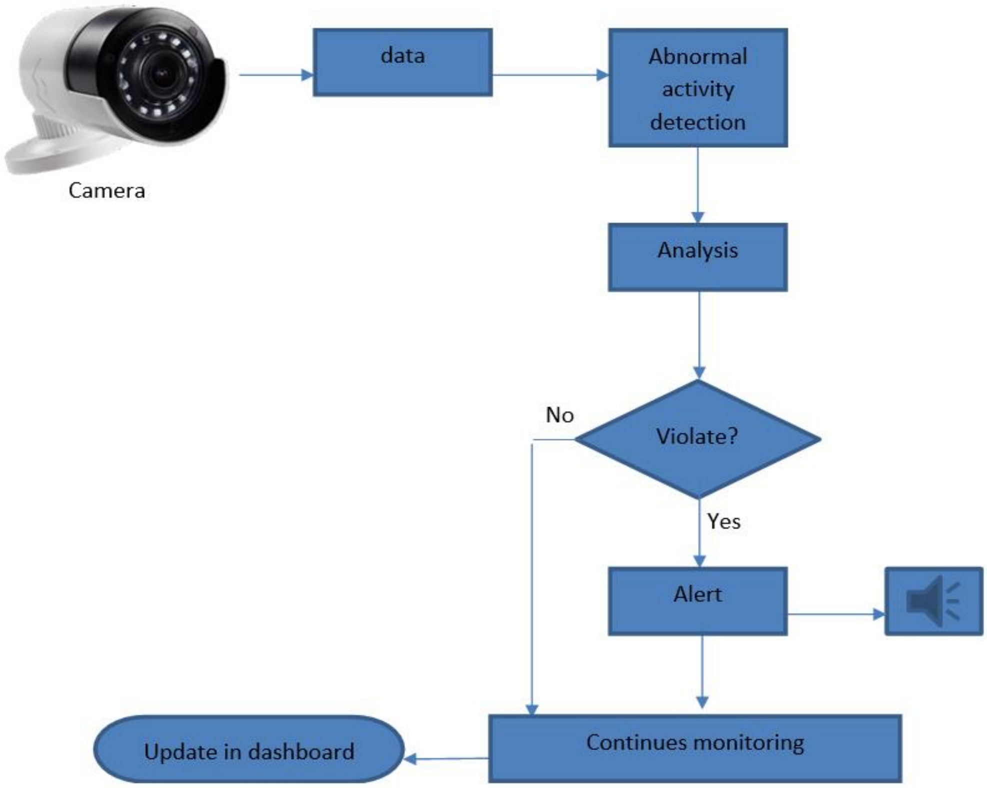

Fig 1: Block Diagram

Anomaly Detection: Developing algorithms or models that can identify anomalies or outliers in human activity data. These anomalies could include activities that are outside the norm or patterns that deviate significantly from typical behavior.

Early Warning Systems: Creating systems that can provide early warnings or alerts when abnormal human activities are detected. This could be particularly useful in security or surveillance applications where prompt detection of unusual behaviors can help prevent incidents or crimes. Pattern Recognition: Analyzing human activity data to identify patterns and trends that can be used to establish baselines for normal behavior. Deviations from these baselines can then be flagged as abnormal activities.

II. LITERATURE REVIEW

A. Abhiram. at el., [1] In this paper the project primarily addresses the issue, which necessitates the development of an automated system that detects unusual behaviors in the environment and alerts the end user. They combined adaptive video compression with the identification of items of interest prior to activity recognition to improve recognition performance and make our proposed system more efficient.

A. Papaleonidas. at el., [2] The experiments were performed using Matlab R2019a. Due to the vast data and the big number of classifiers, a private distributed-parallelized environment of 10 virtual instances of Matlab was employed. Each instance had access to eight i9-9900k threads and 32GB of memory, while it was equipped with two Matlab workers, which means that a total 20 workers were available. The accuracy threshold was set to 0, which means that each classification was accepted only if all instances created by VSM had been classified to the same class. The zero threshold could be also called zero error tolerance and it was selected to check the model's performance under the strictest configuration. The 10-fold cross validation was also applied to tests.

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A. P. v Andrew Joemon. at el., [3] The implemented system with CNN and LSTM method, it can automate the process of detecting abnormal events from CCTV camera feeds. CNN and LSTM technologies are used to detect anomalies in both supervised and unsupervised manner. Alert messages can be sent to authorities on detection of events. The design of this system consists of various modules or parts that have to be integrated together to complete the system. This involves the creation of Video Compressor, Anomaly Detector, Storage Management and Alert Management modules.

R. Vrskova, R. at el., [4] On one of review paper, they created dataset called the Abnormal Activities Dataset. they proposed a neural network architecture for classifying human activities from video using Conv LSTM architecture. they used their created dataset for training and testing. Classification was carried out for 11 classes: Begging, Drunkenness, Fight, Harassment, Hijack, Knife Hazard, Normal Videos, Pollution, Property Damage, Robbery, and Terrorism. Videos were cropped to an input size of 50 × 50 × 3 RGB. also tested other architectures on our designed dataset. they tested Conv LSTM from, as well as 3D Resnet50, 3D Resnet101, and 3D Resnet152. The mentioned 3D Resnet architectures were not pre-trained. We only used the architectures to train new model. We compared the results of all architectures on the dataset we created. We compared the evaluation metrics of accuracy, and precision. We also compared interim results during testing. cases, they evaluated that the neural network we designed achieved the best results on the dataset they created. For the overall results using the Abnormal Activities Dataset, the evaluation metrics (accuracy, precision, recall, and F1 score) were obtained. The overall accuracy was 96.16%. Precision reached a value of 96.50% and recall reached 96.85%. The F1 score was 96.42%. The results clearly confirm that the proposed neural network architecture is suited for the classification of human activities.

M. H. Arshad at el., [5] Another review paper aims to categorize existing state-of-the-art literature based on application areas, data sources, techniques, and open research challenges. A total of ninety-five articles related to HAR published since 2018 are selected from different research repositories. It is seen that the majority of existing research (42%) focuses on daily living activities. Furthermore, in daily living activities, dynamic activities such as walking, cooking, washing, reading, etc. are explored much more than static activities such as sitting and standing. User-based (34%) HAR is the second most prominent category explored in the existing literature. It is categorized based on group activities such as crowd behavior and individual user activities such as punching, kicking, and pushing. The real-time activities (24%) explored by existing studies include surveillance, suspicious activities, and healthcare. It is seen that suspicious activities such as theft, shooting, aggressive driving and hiding are explored much more than others.

A. Krishna at el., [6] This paper, their algorithms are proposed by Sum of Absolute Difference for recording videos only when motion is detected. The major advantage of this algorithm is that less storage is required as the system records only for frames with a particular threshold. Even the amount of processing required is reduced. The system efficiency is calculated to be around 72%.

Y. Zhou et al., [7] The research on multi-person abnormal behavior recognition is comprehensively reviewed, and the research methods of action recognition in recent years are summarized, including the methods based on spacetime, sparse representation and deep learning. Although the research on human behavior detection has been developed, there are still some problems: 1. The shape and size of objects vary with different frames. 2. Occlusion. 3. Noise and Blur. 4. Brightness and intensity changes. 5. Object's abrupt motion. 6. Projection of 3D world into 2D space. 7.

Real time scenario analysis requirements. In the current research, accurate depth information and bone data can effectively study the human motion features. However, in most real scenes, the data collection platform can only provide RGB data. In the monitoring scene, the depth sensor is not suitable for accuracy and cost. Therefore, on the basis of RGB data, depth data and skeleton data, the integration of multimodal data is a key issue in the research of behavior recognition.

M. Bendali-Braham at el., [8] Deployment of intelligent surveillance systems is linked with the development of smart cities. The use of these systems requires the development of a framework capable of scanning adequately video-surveillance scenes. Throughout this paper, we explored previous reviews on crowd analysis. We saw recent studies pertaining to pedestrian and group detection, as well as on the branches and several sub-branches of crowd analysis. We enumerated the sources of video/image data we came across, and due to the paucity of datasets.

S. Habib et al., [9] Hajj and Umrah. When a violent activity occurs, the system can sound an alarm and notify law enforcement agencies to take the appropriate safety actions required. In order to identify violent activity, we have assessed the performance of our proposed model by using publicly available Hockey Fight and Surveillance Fight datasets. After running multiple experiments, we have achieved 96% accuracy on Hockey Fight and 81.05% on Surveillance Fight datasets, the highest accuracy achieved in comparison with state-of-the-art methods.

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C. Direkoglu at el., [10] Motion Information Image presented an approach for abnormal crowd behavior detection. The proposed approach is based on a new Motion Information Image (MII) model that is formulated using optical flow. The MII depends on the angle difference calculated between the optical flow vectors in consecutive frames. There are also some optical flow measurements that are small, and their angle difference may affect the observation. To overcome this problem, the angle difference is multiplied with the optical flow magnitude in the current frame to generate the MIIs. A convolutional neural network (CNN) is used to learn normal and abnormal events, and when a test sample is input to the CNN, it is assigned to one of the two classes (Normal or Abnormal).

N. Golestani at el., [11] Recognizing human physical activities using wireless sensor networks has attracted significant research interest due to its broad range of applications, such as healthcare, rehabilitation, athletics, and senior monitoring. There are critical challenges inherent in designing a sensor-based activity recognition system operating in and around a lossy medium such as the human body to gain a trade-off among power consumption, cost, computational complexity, and accuracy. We introduce an innovative wireless system based on magnetic induction for human activity recognition to tackle these challenges and constraints. The magnetic induction system is integrated with machine learning techniques to detect a wide range of human motions. This approach is successfully evaluated using synthesized datasets, laboratory measurements, and deep recurrent neural networks.

Thittaporn Ganokratanaa at el., [12] Current works typically struggle with object detection and localization problems due to crowded and complex scenes. Hence, we propose a Deep Spatiotemporal Translation Network (DSTN), novel unsupervised anomaly detection and localization method based on Generative Adversarial Network (GAN) and Edge Wrapping (EW). In training, we use only the frames of normal events in order to generate their corresponding dense optical flow as temporal features. During testing, since all the video sequences are input into the system, unknown events are considered as anomalous events due to the fact that the model knows only the normal patterns. To benefit from the information provided by both appearance and motion features, we introduce (i) a novel fusion of background removal and real optical flow frames with (ii) a concatenation of the original and background removal frames. We improve the performance of anomaly localization in the pixel- level evaluation by proposing (iii) the Edge Wrapping to reduce the noise and suppress non-related edges of abnormal objects. Our DSTN has been tested on publicly available anomaly datasets, including UCSD pedestrian, UMN, and CUHK Avenue.

Wu at el., [13] The detection framework used in this paper is easy to implement and has low time complexity. Through the experimental results obtained on public and manually created data sets, it can be demonstrated that the performance of the detection framework used in this paper is similar to those of the compared methods in outdoor detection scenarios. It has a strong advantage in terms of indoor detection. In summary, the proposed detection framework has a good practical application value. Compared with other detection methods, the detection framework used in this paper has a better detection effect for abnormal human behavior indoors, and the detection performance is greatly improved.

E. Duman at el., [14] A convolutional autoencoder method is employed to learn the pattern of normal activities in videos. The main idea of the framework is that the frames, which contain any abnormal event, give significantly different motion pattern than the normal frames. As an input to the encoder, dense optical flow maps are used. Then the network is trained with videos in which no abnormal event is included. After the training stage is properly done, the autoencoder can model the complex distribution of the pattern of normal motion changes. If an input video has an abnormal event, the model is expected to give a higher reconstruction error. Besides, the model was able to reconstruct optic flow maps for corresponding normal video volumes. Our framework consists of three main stages. The first stage of the framework, called pre-processing, aims at extracting dense optical flow map of each frame. In the second stage, the convolutional autoencoder is used in order to obtain the spatial structure of each dense optical flow map volume. The last stage includes a convolutional long short-term memory network to learn the temporal patterns of encoded optical flow maps.

III. METHODOLOGY

Footage from the surveillance camera is broken down into frames. The frames are given as input to MobileNet v2 classifier for detecting Abnormal activities in the given sequence of input frames. If no Abnormal activity is recognized the respective frames are discarded.

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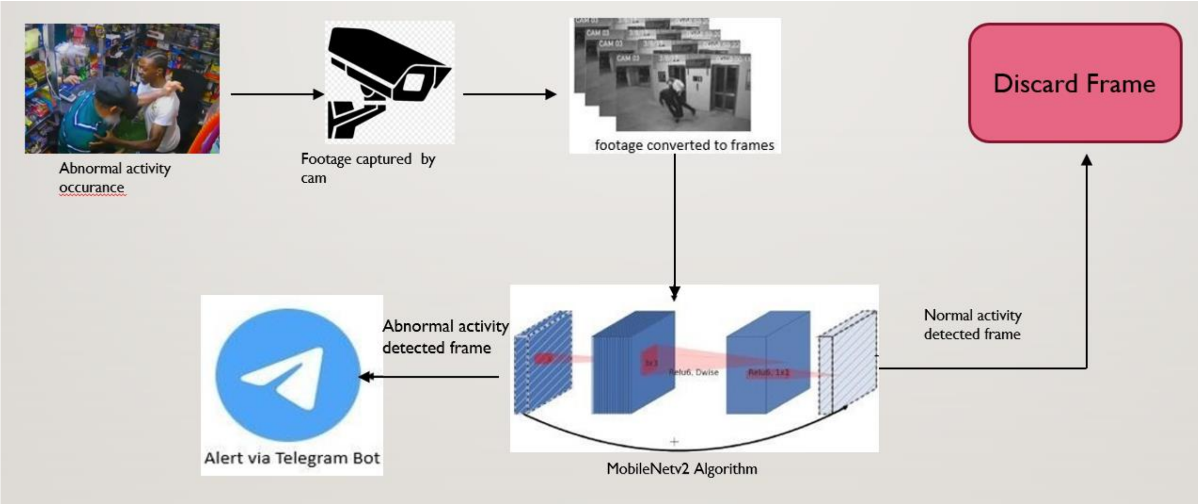

Fig 2: Architecture diagram

The Abnormal activity detected frame is obtained. That frame, along with the location are sent to the nearest authorities using Telegram bot. The alert module sends alert message to the specified authority.

Figure 6.5 describes the architecture of the implemented alert system. When a frame is detected true for violence, the system initializes a counter variable to one. Then it checks the subsequent 30 frames, whether if they too have violence detected true. The counter is incremented at each consecutive frame that is true for abnormal activity. If a frame is false for normal activity, the counter variable is set to 0 and starts checking the consecutive frame respectively checking whether abnormal activity is recognized. On the other hand, if the violence is detected true for the 30 consecutive frames, the current time is obtained using an inbuilt python function and an alert is sent to a Telegram group that consists officials of higher authorities.

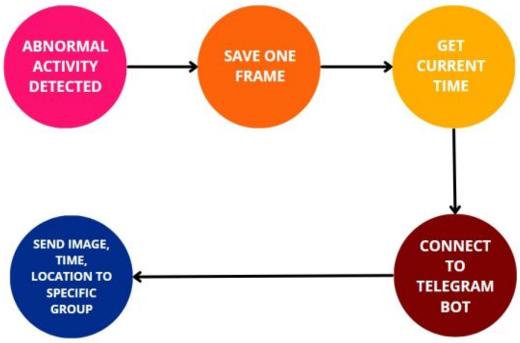

Fig 3: Alert system

III. RESULTS AND OBSERVATION

In summary, an Unusual Behavior Detection using Mobilenet v2 project aims to develop a system that can automatically detect abnormal activities in live CCTV data and alert relevant individuals when such activities are identified. This could have applications in various areas such as security monitoring, surveillance, and anomaly detection.

The experimental results showed promising performance in detecting abnormal human activities using the developed system. After the running the testing part of program we got the following result,

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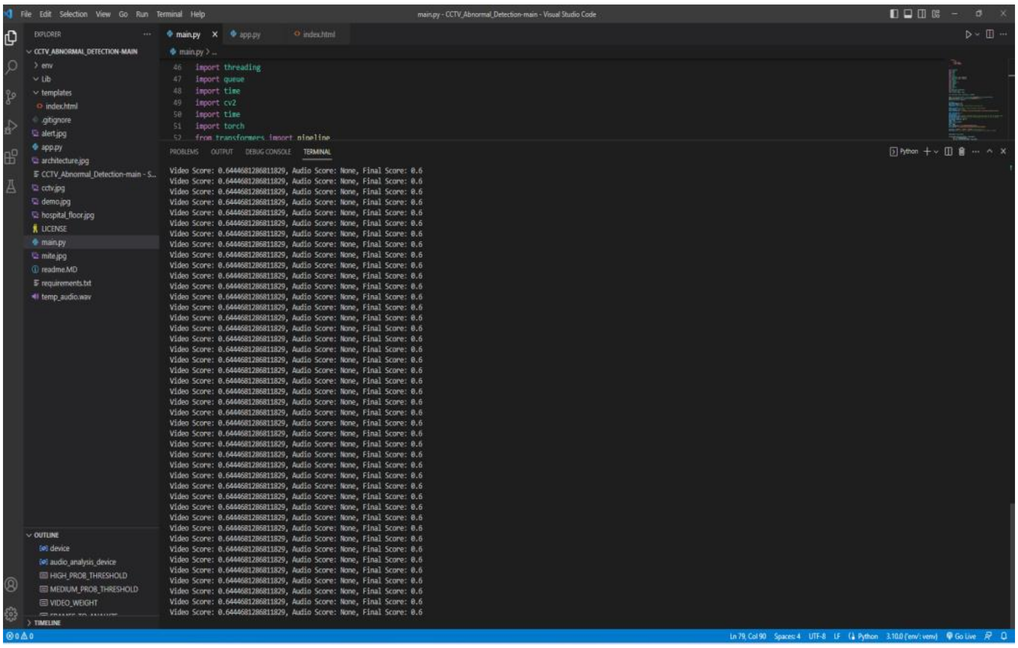

Fig 4: Converting input video into frames

The input video input is converted as frames. Then each frame is compared, whether the frame contains abnormal behavior or normal behavior. After pressing start button in webpage, the model starts to load. Real time detection of Human Abnormal Activity Detection.

Fig 5: Webpage

Abnormal behavior detected in frame and the alert system generates alert message in telegram app.

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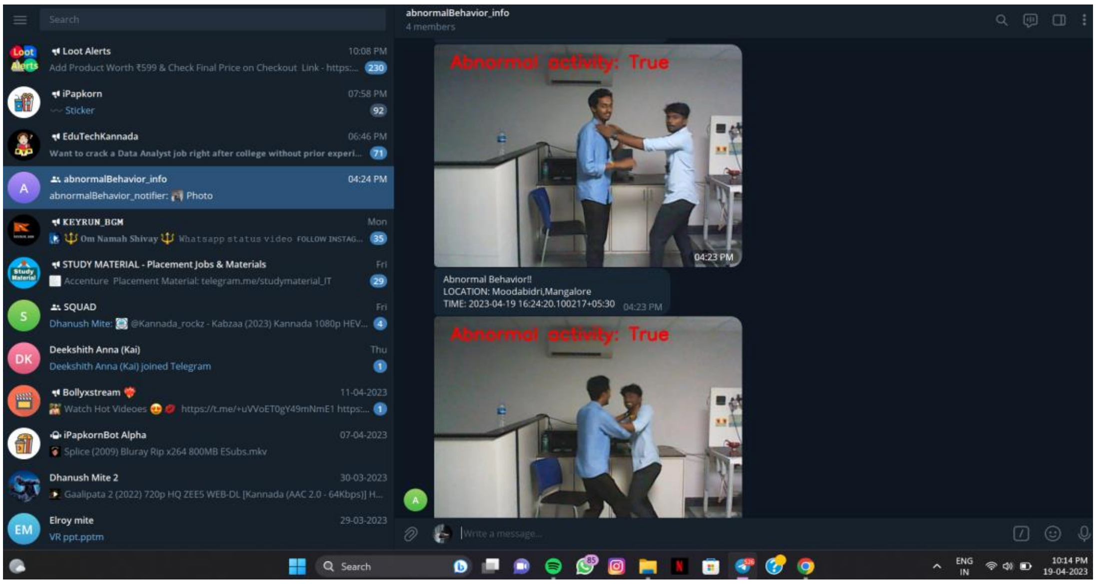

Fig 6: Alert generated by telegram bot

IV. CONCLUSION

our abnormal human activity detection project has achieved significant progress in detecting and identifying abnormal behaviours using advanced technologies and techniques. Through the utilization of computer vision, machine learning, and sensor data, we have developed a robust system capable of accurately identifying activities that deviate from normal patterns.The project has undergone rigorous testing and evaluation, utilizing diverse datasets and real-world scenarios, to validate its effectiveness. Our results have shown promising performance in detecting various abnormal activities, including falls, intrusions, and unusual movements, with a high level of accuracy and reliability. The implications of this project are far-reaching, with potential applications in various fields such as surveillance, security, healthcare, and smart environments. Early detection of abnormal activities can significantly enhance safety measures, prevent accidents, and improve situational awareness in critical settings. However, there are still some limitations that need to be addressed. Challenges such as occlusions, lighting variations, and complex scenes may affect the system's performance, requiring further refinement and optimization. Additionally, privacy and ethical concerns must be carefully considered when deploying such technologies to protect individuals' rights and ensure responsible use.Overall, our abnormal human activity detection project represents a significant advancement in the field of computer vision and machine learning. With continued research and development, it holds the potential to make a positive impact on various domains, contributing to the advancement of safety and security technologies in real-world applications.

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