IJARSCT

ISSN (Online) 2581-9429

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

Impact Factor: 7.301

Volume 3, Issue4, May 2023

Suspicious Object Detection Using Machine Learning

Puttu Bharath Kumar, Abdul Rehman, Munnam Prasanna Kumar, Dasari Jayanth

Students, Dept, of ECE, Dhanalakshmi Engineering College, Chennai, Tamil Nadu, India

Abstract: *Identification of suspicious objects in real-time scenarios is crucial for security systems. Traditional surveillance systems, such as CCTV, are limited to passive monitoring and are unable to provide real-time early warning systems, making it difficult to anticipate security threats or violations of regulations. There is a growing need for a system that can identify suspicious objects using video surveillance systems, particularly in public areas. The integration of artificial intelligence, machine learning, image processing, and computer vision is the latest innovation in surveillance system development. The proposed system is an effective solution for real-time suspicious object detection using a web camera and machine learning algorithms.*

This system can significantly improve security systems' accuracy and efficiency, thereby enhancing public safety. The use of machine learning algorithms can enhance the surveillance system's ability to detect suspicious objects, providing an efficient way to anticipate security threats or violations of regulations in real-time This system's deployment can be used in various security applications, such as airports, public places, and government buildings, where real-time detection of suspicious objects is critical. Additionally, the system's application can also be extended to other fields, such as healthcare and manufacturing, where real-time detection of abnormal or suspicious objects can improve quality control and ensure safety.

Keywords: CCTV, Object Detection, Alarm, Suspicious Object.

I. INTRODUCTION

Closed-circuit television (CCTV) systems have been used for many years as an effective tool for monitoring and enhancing security. In recent years, advances in technology have led to the development of more sophisticated video security and surveillance systems. These automatic surveillance systems are designed to improve the efficiency and effectiveness of CCTV cameras, but their success depends on several factors, including technological advancements and the quality and positioning of the cameras. Additionally, CCTV systems can be integrated with other security technologies such as facial recognition and motion detection, which can further enhance their capabilities. Automated surveillance systems are increasingly being used to reduce the workload on human operators in complex situations, improving productivity and performance. The design of these systems is crucial to their reliability and effectiveness. With the rise in crime and terrorist activities, there is a growing need for a large number of CCTV cameras to monitor surroundings, but it is difficult for human operators to monitor each camera screen continuously.

While CCTV footage can help solve robbery and assault cases through forensic analysis, immediate responses are required in some cases, such as those involving public transport systems like railway stations that are vulnerable to severe events like terrorist attacks. Automated surveillance systems can assist operators in monitoring video footage continuously to detect and respond to potential threats.

II. EXISTING SYSTEM

Conventional surveillance systems, such as Closed-Circuit Television (CCTV), have been widely used to monitor and secure public places, such as airports, train stations, shopping malls, and government buildings. However, these systems have several limitations in detecting suspicious objects in real time. The existing systems rely on manual intervention and human monitoring, which can lead to errors and delays in identifying suspicious objects. For instance, a security officer may not be able to monitor all the CCTV cameras at once, leading to missed objects.

IJARSCT

ISSN (Online) 2581-9429

International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)

IJARSCT International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal

Impact Factor: 7.301

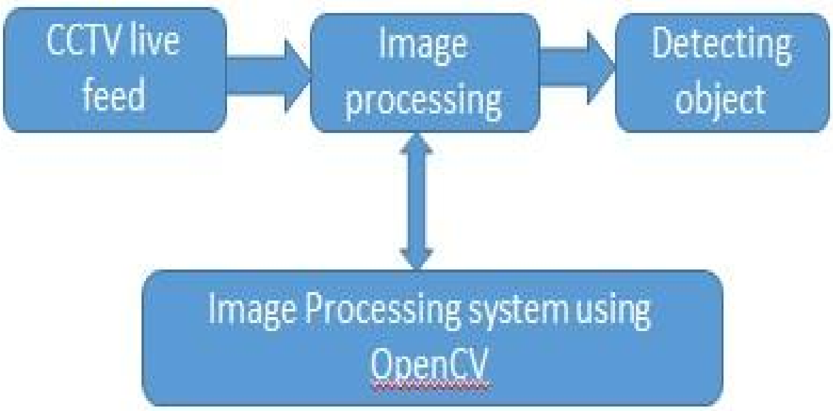
Volume 3, Issue4, May 2023

Moreover, humans can experience fatigue and inattention, further increasing the risk of errors and missing objects. The existing system of conventional surveillance systems has limitations in real-time object detection due to reliance on manual intervention and human monitoring. Furthermore, the high installation and maintenance costs limit their adoption in smaller organizations or public places. These limitations demonstrate the need for a more automated and cost-effective solution for suspicious object detection, which the proposed system aims to address using machine learning algorithms and web camera integration.

III. PROPOSED SYSTEM

The proposed system is an advanced solution for real-time suspicious object detection using machine learning algorithms and web camera integration. The system is designed to detect suspicious objects in public places, such as airports, train stations, shopping malls, and government buildings.

The proposed system uses a combination of artificial intelligence, machine learning, image processing, and computer vision technologies to achieve its objectives. The system is based on advanced machine learning algorithms, which are trained on large datasets of images to detect suspicious objects accurately and efficiently.



These algorithms are capable of learning from patterns and features in images, allowing them to identify and classify objects accurately. Furthermore, the proposed system is designed to continually learn and adapt to new objects, making it more effective over time. The system works by capturing live video feeds from web cameras. The video feeds are then processed in real-time by the machine learning algorithms to detect a few suspicious objects

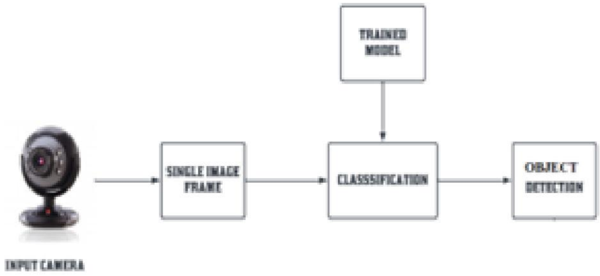
IV. CONCEPT AND TECHNOLOGIES

OpenCV, or Open-Source Computer Vision Library, is a computer vision and machine learning software library that is open-source. Its primary goal is to provide a standard framework for computer vision applications and accelerate the use of machine vision in commercial products. OpenCV is licensed under the BSD license, making it easy for companies to use and modify the code.

The library contains over 2500 advanced algorithms, including a wide range of both classic and cutting-edge computer vision and machine learning algorithms. These algorithms can be used for face detection and recognition, object identification, human action recognition in videos, camera calibration, object tracking, 3D object modeling, 3D point cloud generation from stereo cameras, image stitching to create a high-resolution panoramic image, image retrieval from an image database, red-eye removal from images taken with flash, eye tracking, scene recognition, and feature detection for augmented reality, among others.

OpenCV has a vast user community of over 47 thousand people and an estimated download count of over 7 million. The library is widely used by companies, research groups, and government organizations.

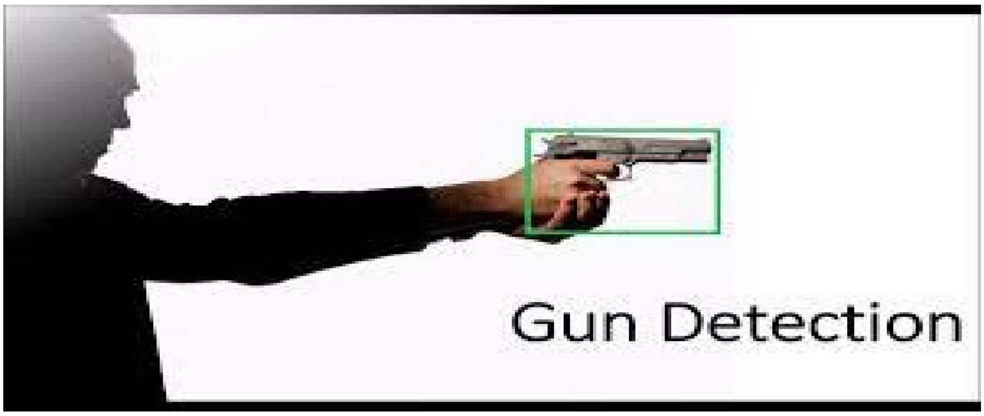
IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue4, May 2023



In the fields of machine learning, pattern recognition, and image processing, feature extraction involves taking an initial set of measured data and creating new, derived values (features) that are both informative and non-redundant. This process is intended to facilitate subsequent learning and generalization steps, as well as provide better human interpretations of the data.

Feature extraction is an important technique used in machine learning and data analysis to reduce the dimensionality of input data by selecting a relevant subset of features or variables.

This process is also known as feature selection, and it is closely related to dimensionality reduction. The purpose of feature selection is to improve the efficiency of algorithms by reducing computational complexity and memory requirements, while retaining the relevant information needed for the desired task. Finally, if new data is introduced, it can be stored in the database and processed accordingly.



V. CNN USING YOLO V3 ARCHITECTURE

YOLOV3:

YOLOv3 (You Only Look Once version 3) is a state-of-the-art object detection algorithm developed by Joseph Redmon and Ali Farhadi. It is known for its speed and accuracy and has been widely used in various computer vision applications

ARCHITECTURE:

The architecture of YOLOv3 is based on a convolutional neural network (CNN) that is divided into three main parts: a backbone network, a detection head, and a post-processing module.

1. Backbone Network:

The backbone network is responsible for extracting high-level features from the input image. YOLOv3 uses a variant of the Dark Net architecture, which consists of 53 convolutional layers. This backbone network is pre-trained on the ImageNet dataset, which allows it to learn a wide range of features that are useful for object detection.

2. Detection Head:

The detection head is responsible for predicting the bounding boxes, class probabilities, and confidence scores for each object in the input image. It consists of a set of convolutional layers and two fully connected layers. The output of the detection head is a tensor of shape (N, G, G, 3*(C+5)), where N is the batch size, G is the grid size, C is the number of classes, and 5 is the number of parameters for each bounding box (x, y, w, h, confidence score).

3. Post-Processing Module:

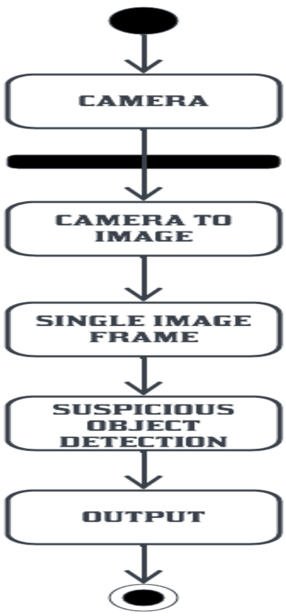
The post-processing module is responsible for filtering out low-confidence detections and applying non-max suppression to remove overlapping bounding boxes. It consists of a set of Python functions that operate on the output tensor from the detection head. These functions perform operations such as thresholding, intersection over union (IoU) computation, and non-max suppression.

In addition to these main components, YOLOv3 also uses a number of techniques to improve its performance, including:

- Multi-scale training: YOLOv3 is trained on images of different sizes, which allows it to detect objects of different scales.
- Feature pyramid network: YOLOv3 uses a feature pyramid network (FPN) to improve the accuracy of small object detection. The FPN combines features from multiple layers of the backbone network to create a pyramid of features with different spatial resolutions.
- Anchor boxes: YOLOv3 uses anchor boxes to improve the accuracy of bounding box prediction. Anchor boxes are pre-defined bounding boxes of different shapes and sizes that are used to encode the location of objects in the input image.
- Dynamic convolution: YOLOv3 uses dynamic convolution to reduce the number of parameters in the model. Dynamic convolution allows the network to adjust the size of the convolutional filters based on the input data, which can lead to significant savings in memory and computation.

Overall, the YOLOv3 architecture is a powerful and flexible object detection algorithm that is suitable for a wide range of computer vision applications. Its combination of speed and accuracy makes it particularly useful for real-time object detection in video streams or other applications with high computational requirements.

ACTIVITY DIAGRAM



VI. CONCLUSION

The project on suspicious object detection using machine learning offers a promising solution to improve security and safety in public places. The proposed system integrates advanced technologies and machine learning algorithms to enable real-time detection of suspicious objects, enhancing the accuracy and efficiency of surveillance systems. The project has several future directions for research, and its successful implementation has the potential to make public places safer and more secure. The project has several advantages over the existing systems, including cost-effectiveness, reduced errors and delays, and the ability to improve security and safety in public places. In conclusion, the project on suspicious object detection using machine learning is a significant contribution to the field of video surveillance systems and offers a promising solution for enhancing security and safety in public place.

ACKNOWLEDGMENT

The authors express their gratitude to the Department of Electronics and Communication Engineering at DCE for their support. We would like to thank our guide and co-guide for their invaluable guidance, without which this paper would not have been possible. Their valuable advice and insight helped us accomplish the objectives of this paper. We would also like to extend our appreciation to the Head of the Department of Electronics and Communication Engineering for her constant encouragement and support.

We would also like to acknowledge the support and encouragement of our colleagues, who assisted us in correcting errors and ensuring that the paper met the necessary standards. Their contributions were instrumental in the success of this paper, and we are grateful for their assistance

REFERENCES

[1] K. Yu et al., "Design and Performance Evaluation of an AI-Based W-Band Suspicious Object Detection System for Moving Persons in the IoT Paradigm", IEEE Access, vol. 8, pp. 81378-81393, 2020.

[2] Z. Q. Zhao, P. Zheng, S. T. Xu and X. Wu, "Object Detection with Deep Learning: A Review", IEEE Trans. Neural Networks Learn. Syst., vol. 30, no. 11, pp. 3212-3232, 2019.

[3] O. Ye, J. Deng, Z. Yu, T. Liu, and L. Dong, "Abnormal event detection via feature expectation subgraph calibrating classification in video surveillance scenes", IEEE Access, vol. 8, pp. 97564-97575, 2020.

[4] Q. Zhang, N. Huang, L. Yao, D. Zhang, C. Shan, and J. Han, "RGB-T Salient Object Detection via Fusing Multi-Level CNN Features", IEEE Trans. Image Process., vol. 29, pp. 3321-3335, 2020.

[5] R. Zhang and S. Cao, "Real-Time Human Motion Behavior Detection via CNN Using mmWave Radar", IEEE Sensors Lett., vol. 3, no. 2, pp. 2018-2021, 2019.

[6] C. Cao et al., "An Improved Faster R-CNN for Small Object Detection", IEEE Access, vol. 7, pp. 106838-106846, 2019.

[7] M. Kang, L. Xia and H. Chen, "Research on the Crowd Abnormal Behavior Recognition in Surveillance Video Based on Modified Social Force Model", 2019 3rd Int. Conf. Imaging Signal Process. Commun. ICISPC 2019, pp. 101-106, 2019.

[8] W. Guangli, L. Liping, Z. Chen and T. Dengtai, "Video abnormal event detection based on ELM", 2019 IEEE 4th Int. Conf. Signal Image Process. ICSIP 2019, pp. 367-371, 2019.

[9] A. Mohan, M. Choksi and M. A. Zaveri, "Anomaly and Activity Recognition Using Machine Learning Approach for Video Based Surveillance", 2019 10th Int. Conf. Comput. Commun. Netw. Technol. ICCCNT 2019, pp. 6-11, 2019.