IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Real-Time Gun Detection

Mr. Chauhan Shani J [1], Asst.Prof. Nimesh Vaidya [2], DR.Vijaykumar B Gadhavi [3]

[1]PG Scholar – Faculty of Engineering, Computer Engineering Department Swaminarayan University, India

[2]Assistant Professor & HOD - Faculty of Engineering, Computer Engineering Department Swaminarayan University, India

[3]Associate Professor & Dean –Faculty of Engineering(I/C), Computer Engineering Department Swaminarayan University, India

ABSTRACT

Security is always a main concern in every domain, due to a rise in crime rate in a crowded event or suspicious lonely areas. Abnormal detection and monitoring have major applications of computer vision to tackle various problems. Due to the growing demand for the protection of safety, security, and personal properties, the needs and deployment of video surveillance systems can recognize and interpret the scene, and anomaly events play a vital role in intelligence monitoring. This paper implements an automatic gun detection using open cv. Gun violence has become a major cause of distress in the present society. The lack of proper mechanisms to detect and identify weapons in advance results in the increase of the impact caused by gun-related violence. This concept paper presents a study for concealed weapon detection in real time video using Image Processing and open CV and Hear cascade. The proposed system will perform the notification to the respective department followed by open cv detection models.

Keywords Gun Detection, Weapon Detection, Security

Introduction

Weapon detection plays a vital role in safety, security, and surveillance management. In this advanced time of observation and security the quantity of Closed-Circuit Television (CCTV) conveyed out in the open and private places, for example, Cinemas, Malls has expanded exponentially. As of now, there are a huge number of CCTV cameras in operation. In this way, the expanding density of investigation camera recording makes it a challenge for a human administrator to inspect, analyze whether a conceivably risky circumstance is going to occur. Gun detection with model and type recognition of the gun is displayed in this paper for both surveillance and control purposes, the method used is openCV. It uses the basic machine learning classifier which is modified to be used in photos and videos. The crime rate across the globe has increased mainly because of the frequent use of handheld weapons during violent activity. For a country to progress, the law-and order situation must be in control. Whether we want to attract investors for investment or to generate revenue with the tourism industry, all these needs is a peaceful and safe environment. The crime ratio because of guns is very critical in numerous parts of the world. It includes mainly those countries in which it is legal to keep a firearm. The world is a global village now and what we speak or write has an impact on the people. Even if the news they heard is crafted having no truth but as it gets viral in a few hours because of the media and especially social media, the damage will be done. People now have more depression and have less control over their anger, and hate speeches can get those people to lose their minds People can be brain washed and psychological studies show that if a person has a weapon in this situation,

he may lose his senses and commit a violent activity Gun detection in real-time is a very challenging task. As our desired object has a small size so, detecting it in an image is also very challenging in presence of other objects, especially those objects that can be confused with it. Deep learning models faced several below mentioned challenges for detection and classification task:

- The first and main problem is the data through which CNN learn its features to be used later for classification and detection.
- No standard dataset was available for weapons.
- For real-time scenarios, making a novel dataset manually was a very long and time-consuming process.
- Labeling the desired database is not an easy task, as all data needs to be labeled manually.
- Different detection algorithms were used, so a labeled dataset for one algorithm cannot be utilized for the other one.

Literature Review

This literature attempts to showcase several conventional weapon detection systems using machine learning and the most advanced deep learning techniques. The journey began with a manually operated system and progressed to completely automated and sophisticated technologies. In light of this, numerous conventional weapon detection techniques have already been developed, viz. HIPD, AAMs, SIFT, SURF, FREAK, and many more, wherein the AAMs have emerged to be the preeminent among these.

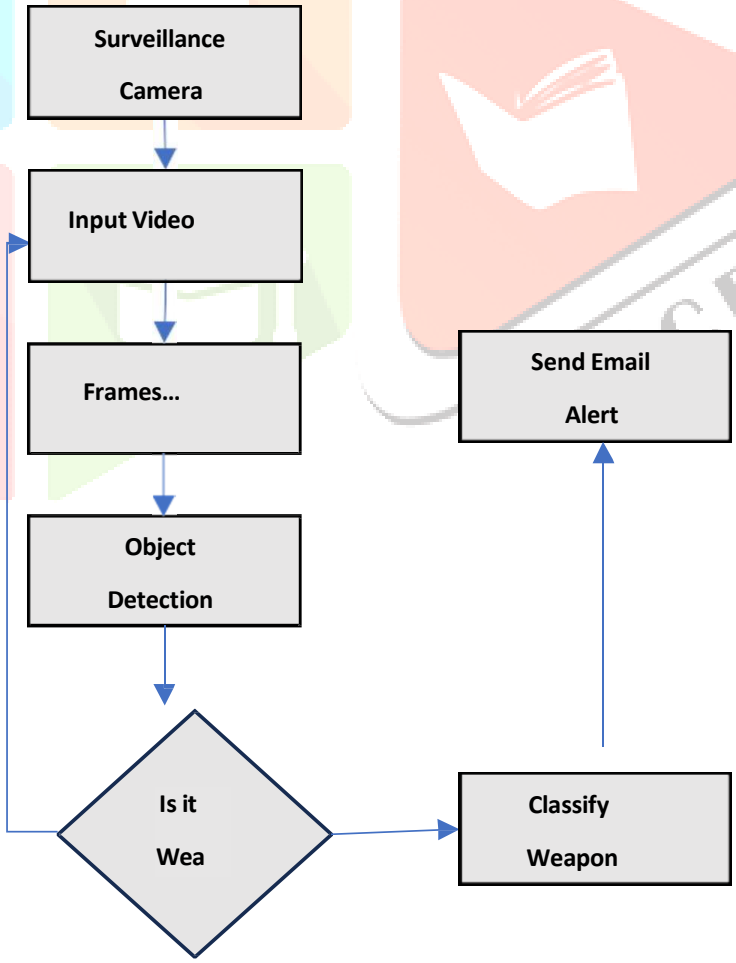
This Existing System uses a widely used deep learning architecture for object detection is Faster R-CNN. It consists of a convolutional neural network, a region proposal network and fully connected layers. This Existing System present an automatic gun detection system using Faster R- CNN. This also propose to test different CNN architectures, ResNet50, Inception-ResNetV2, VGG16 and MobileNetV2, as feature extractors in Faster R-CNN in order to select the most efficient one. The guns considered within the scope of this work are fire guns that can be carried by a person such as handguns, rifles and shotguns. The proposed system detects the presence of a gun without providing its type.

Although several past studies proposed to use Faster R-CNN for gun detection from either images or videos, but up to our knowledge, none of them have proposed to use ResNet50, Inception-ResNetV2, and MobileNetV2 as feature extractors with Faster R-CNN and none of them have trained and tested different architectures of Faster R-CNN on the same dataset and compared them to YOLOv2, also trained and tested on the same dataset and the same environment .Faster R-CNN is used to detect guns in images. A set of images of guns taken in different situations with different backgrounds are used to train Faster R-CNN. Then, the model is evaluated using another set of images. Faster R-CNN has been widely used for Object Detection with satisfying results. It consists of a pre trained feature extractor, a region proposal network, a ROI pooling layer and a set of fully connected layers. The next section briefly introduces Faster R-CNN .The authors in [1] tried to evaluate the detection problem by extracting the general pattern of the dataset to represent the fraud. In other words, the enhancement of the clustering method relies on the clusters used; this technique is called general enhancement. The authors proposed an approach that enables the application of local enhancement and general enhancement for fraud detection in financial transactions. In detail, the data are grouped based on abnormal features that refer to fraud[5]. These features are the used as the initial weights for the input layers of neural networks. The methods proposed to address such problems suffer from low accuracy and effectiveness. In addition, the methods used for detecting fraud may make some mistakes in identifying fraudulent transactions. The reason behind such shortcomings is that the proposed approaches focus on order analysis rather than anything else. Motivated by these facts, the authors proposed a method that focuses on the hackers themselves[5]. The key idea is to extract some recognized features, such as the address of delivery, customer name, and method of payment, and then, based on these features, the similarity among the attackers is calculated. Based on these similarities, the attackers are grouped in some clusters[6].

Proposed Approach

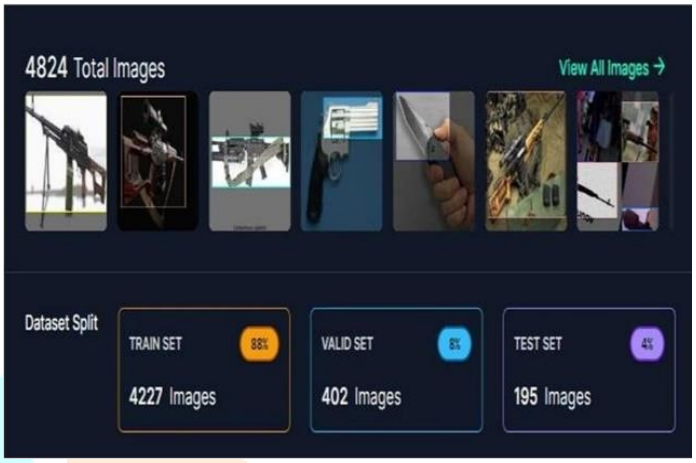
In this research, we propose a methodology for developing a real-time weapon detection system using machine learning and implementing an alert mechanism for timely notification of potential security threats. Initially, we collect a dataset comprising images and corresponding annotations specifically tailored for weapon detection. This dataset is pre-processed and augmented as necessary using platforms like Roboflow

We then proceed to train the YOLOv8 model, a state-of-the-art object detection architecture, on this dataset. Themodel is fine-tuned and validated using standard evaluation metrics such as precision, recall, and mean Average Precision (MAP). Next, we develop a user-friendly interface using Streamlit, allowing users to input images, videos, YouTube URLs, or live webcam feeds for real-time weapon detection. The trained YOLOv8 model is integrated into this application, enabling users to set a confidence scorethreshold for detection. Additionally, we implementan alert mechanism specifically for live webcam input. Upon detecting a weapon in the live webcamfeed, the system generates an alert and sends asecurity alert email to a specified email address using the smtplib library in Python. This emailincludes relevant information such as the timestampand location of the detection for further action by security personnel. Subsequently, we conduct extensive testing and evaluation of the application and model performance, ensuring functionality, usability, and effectiveness of the alert mechanism in timely detection and notification of security threats. Once validated, the system is deployed on a suitable platform, either cloud services or on- premise servers, ensuring scalability and reliability for real-world usage scenarios.



1) Data Collection and Preliminary Handling

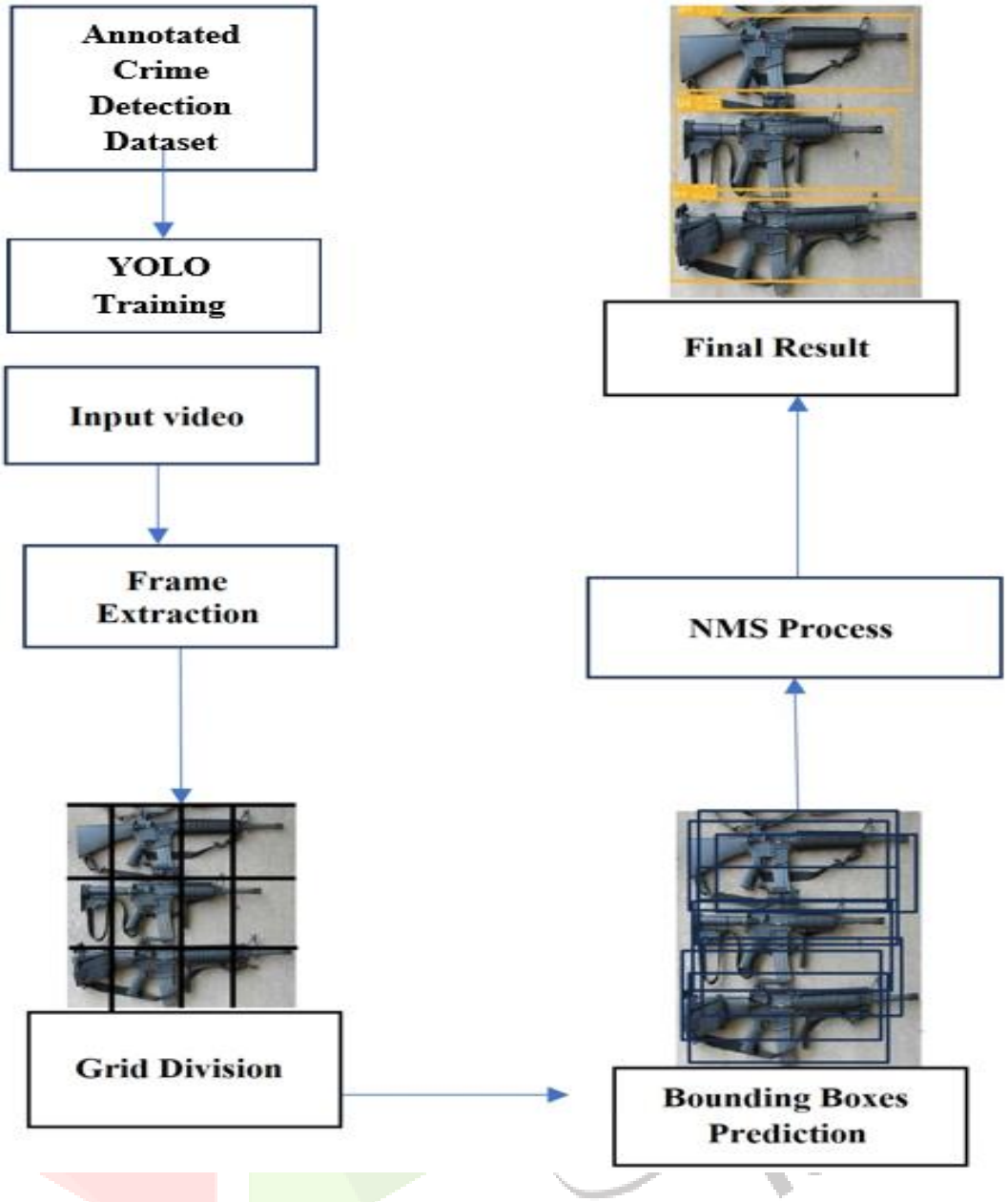
In this study, we begin by identifying a data set specially prepared for weapon identification. We use platforms like Roboflow to preprocess and enhance the dataset as needed, ensuring sufficient flexibility and quality for model training. Entries are carefully checked and adjusted to the requirements of the YOLOv8 model to ensure accuracy.



2) Model Training

The YOLOv8 model architecture was selected due toits efficiency and effectiveness in real-time object recognition tasks. Using deep learning algorithms such as TensorFlow or PyTorch, we implement and optimize the YOLOv8 model on custom datasets and trained a model using 50 Epochs. Transfer learning techniques are used, including applying pre-trained loads to large datasets such as COCO, to speed up convergence and improve performance Training a the best is repetitive, with ongoing checks and adjustments to improve accuracy and reduce false positives.

Training the YOLOv8 model on a custom dataset isan important step in this research approach. During their training, models learn how to recognize and accurately place weapons in photos or videos. Fine-tuning in custom datasets enables the model to customize its feature renderings with the specific characteristics of the target area, enhancing the ability to detect weapons with greater accuracy and enhance recall and improving the robustness of the model to changes in the world personal circumstances.



3) Strea mlit Application Development

The focus of this research is to develop a user- friendly interface using the Python library Streamlit to build interactive web applications. The application allows users to easily insert live photos, videos, YouTube URLs, or webcam feeds to see real- time weapons. Adding the trained YOLOv8 model toan application allows users to set confidence score constraints, allowing them to customize and modify according to their specific requirements

4) Alert Mechanism

To improve the efficiency of the system, we use an alert system designed for live webcam input. By detecting a weapon in the live feed, the systemtriggers an alarm system designed to immediately alert security personnel. Using the smtplib library in Python, the system sends a security alert email to a custom email address, containing important information such as timestamp and required location This method provides they are able to act quickly and effectively reduce potential security risks.

5) Testing and Evaluation

The Streamlit process and the YOLOv8 model are subjected to rigorous testing and evaluation to evaluate performance and reliability. Different input scenarios are considered, including images, video, and live webcam feeds. Standard evaluation metrics such as precision, recall, and average accuracy (MAP) are used to quantitatively assess the performance of a model. Additionally, the use casesare analysed to see how the application can be used and improved in real-world situations.

Results

The results of the detected weapon from the video frame for each of the 3 classes of weapons – Handguns, Knives, and heavy guns with the accuracy and type of detected weapon is formulated in a table. Using this we can infer that our weapon detection system is fairly accurate to detect weapons in real- time surveillance videos.

TRAINING SET	TESTING SET	ACCURACY	RESULT
		Handgun 95%	DETECTED
		Handgun 88%	DETECTED
		Handgun 87%	DETECTED

Result of detection of Handguns

TRAINING SET	TESTING SET	ACCURACY	RESULT
		Knife 75%	DETECTED
		Knife 87%	DETECTED
		Knife 85%	DETECTED

Result of detection of Knife

TRAINING SET	TESTING SET	ACCURACY	RESULT
   		Heavy Gun 84%	DETECTED
		Heavy Gun 80%	DETECTED
		Heavy Gun 82%	DETECTED

Result of detection of Heavy guns

Conclusion and Future Work

The weapon detection in surveillance system using yolov3 algorithm is faster than the previous CNN, R-CNN and faster CNN algorithms. In this era where things are automated, object detection becomes one of the most interesting field. When it comes to object detection in surveillance systems, speed plays an important role for locating an object quickly and alerting the authority. This work tried to achieve the same and its able to produce a faster result compared to the previously existing systems.

The longer-term work of the proposed system is to extend a greater number of types of weapons and classifying them. The accuracy of the weapon detected can be improved by using different types of algorithms. A possible way to improve this work is to detect a concealed weapon which cannot be detected using the normal camera. Also, analyzing the behavior of the people to find any suspicious activities like hiding the weapon can be done to improve this surveillance system. The alert system can also be improved to notify multiple users if the weapon is detected. A surveillance system with these features can be helpful to prevent violent crimes and provide security to the public

REFERENCE

[1] Systems, Vol: 2 No: 2, 2012, Gowsikhaa D, Manjunath, Abirami S, Department of information science and technology,

[2] JIANYU XIAO SHANCANG L, (Member, IEEE), QINGLIANG

[3] XU11 School of Computer Science and Engineering at Central South University, China"Video-based Evidence Analysis and Extraction in Digital Forensic Investigation", IEEE Access (2020).

[4] JEONGIN SEO AND HYEYOUNG PARK School of Computer Science and Engineering, Kyungpook National University, "Object Recognition in Very Low Resolution Images Using Deep Collaborative Learning",IEEE Access (2020).

[5] Harsh Jain, Aditya Vikram, Mohana, Ankit Kashyap, Ayush Jain Telecommunication Engineering, "Weapon detection using AI and deep learning for security application", IEEE (2019).

[6] Shenghao Xu School of Science and Technology, The Open University of Hong Kong, Hong Kong, China, "Developement of AI based system for automatic detection and recognition of weapons in surveillance video", IEEE (2020).

[7] Dongdong Zeng, Xiang Chen, Ming Zhu, Michael Goesele and Arjan Kuijper, "Background Subtraction with Real-time Semantic Segmentation", IEEE (2019).

[8] Edge detection based boundary box construction algorithm for improving the precision of object detection in YOLOv3 Shaji Thorn Blue, M. Brindha Department of Computer Science and Engineering National Institute of Technology Tiruchirappalli, India, IEEE 2019

[9] Efficient Object Detection Method Based on Improved YOLOv3 Network for Remote Sensing Images Jintao Wang, Wen Xiao Key Laboratory of Unmanned Aerial Vehicle Development & Data Application of Anhui Higher Education Institutes 2Maanshan Wireless Sensor Network and Intelligent Perception Engineering Technology Research Center 3Wanjiang University of Technology Maanshan, China, 2020

[10] An Improved YOLOv3-based Neural Network for De-identification Technology Ji-hun, Dong-hyun Lee, Kyung-min Lee, Chi-ho Lin Won School of Computer Semyung University Chungcheongbuk-do,

[11] Korea,IEEE 2018

[12] Amrutha C.V, C. Jyotsna, Amudha J. Dept. of Computer Science & Engineering, "Deep Learning Approach for Suspicious Activity Detection from Surveillance Video", IEEE Xplore (2019).

[13] HYESEUNG PARK , SEUNGCHUL PARK, AND YOUNGBOK

[14] JOO, "Detection of Abandoned and Stolen Objects Based on Dual Background Model and Mask R-CNN", IEEE Access (2020).

[15] Maddula J N V Sai Krishna Asrith, K Prudhvi Reddy,Mrs. Sujihelen, " Face Recognition and Weapon Detection from Very Low Resolution Image", ICETITER (2018).

[16] Jose L. Salazar González a, Carlos Zaccaro a, Juan A. Álvarez- García a,∗,Luis M. Soria Morillo a, Fernando Sancho Caparrini, "Real-time gun detection in CCTV: An open problem", ELSEVIER (2020).

[17] Collins Ineneji, Mehmet Kusaf, "Hybrid weapon detection algorithm, using material test and fuzzy logic system",ELSEVIER (2019).

[18] Francisco Luque Sanchez, Isabella Hupont, Siham Tabik,Francisco HerreraF, "Revisiting crowd behavior analysis through deep learning: Taxonomy anomaly detection, crowd emotions, datasets, oppurtunities and prospects.", ELSEVIER (2019).

[19] Zhong-Qiu Zhao, "Object Detection With Deep Learning: A Review", IEEE (2018)