WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Real Time Weapon Detection and Notification Using Deep Learning for Security Application

[1]Mr. S. Barath, MCA., M.Phil., [2]S Kanagathara

[1]Asst. Prof. Department of MCA & Krishnasamy College of Engineering & Technology
[2]Department of MCA & Krishnasamy College of Engineering & Technology

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 openCV and Hear cascade. The proposed system will perform the notification to the respective department followed by opencv detection models.

Keywords: Weapon, Security.

1. 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.

2. LITERATURE SURVEY

Reducing the life-threatening acts and providing high security are challenging at every place. Therefore, a number of researchers have contributed to monitoring various activities and behaviors using object detection. In general, a framework of smart surveillance system is developed on three levels:

firstly, to extract low-level information like features engineering and object tracking; secondly, to identify unusual human activities, behavior, or detection of any weapon; and finally, the high level is about decision making like abnormal event detection or any anomaly. The latest anomaly detection techniques can be divided into two groups, which are object-centered techniques and integrated methods. The convolutional neural network (CNN) spatial-temporal system is only applied to spatial-temporal volumes of interest (SVOI), reducing the cost of processing. In surveillance videos of complex scenes, researchers in proposed a tool for detecting and finding anomalous activities.

By conducting spatial-temporal convolution layer, this architecture helps one to capture objects from both time domain and frequency domain, thereby extracting both the presence and motion data encoded in continuous frames. To do traditional functions to local noise and improve detection precision, spatial-temporal convolution layers are only implemented within spatial-temporal quantities of changing pixels. Researchers proposed anomaly-introduced learning method for detecting anomalous activities by developing multi-instance learning graph-based model with abnormal and normal bimodal data, highlighting the positive instances by training coarse filter using kernel-SVM classifier and generating improved dictionary learning known as anchor dictionary learning. Thus, abnormality is measure by selecting the sparse reconstruction cost which yields the comparison with other techniques including utilizing abnormal information and reducing time and cost for SRC.

Huetal have contributed in detecting various objects in traffic scenes by presenting a method which detects the objects in three steps. Initially, it detects the objects, recognizes the objects, and finally tracks the objects in motion by mainly targeting three classes of different objects including cars, cyclists, and traffic signs. Therefore, all the objects are detected using single learning-based detection framework consisting of dense feature extractor and trimodal class detection. Additionally, dense features are extracted and shared with the rest of detectors which heads to be faster in speed that further needs to be evaluated in testing phase. Therefore, intraclass variation of objects is proposed for object sub-categorization with competitive performance on several datasets.

Gregaetal presented an algorithm which automatically detects knives and firearms in CCTV image and alerts the security guard or operator. Majorly, focusing on limiting false alarms and providing a real-time application where specificity of the algorithm is 94.93% and sensitivity is 81.18% for knife detection. Moreover, specificity for fire alarm system is 96.69% and sensitivity is 35.98% for different objects in the video. Mousavi et al. in carried out video classifier also referred to as the Histogram of Directed Tracklets which identifies irregular conditions in complex scenes. In comparison to traditional approaches using optical flow which only measure edge features from two subsequent frames, descriptors have been developing over long-range motion projections called tracklets. Spatiotemporal cuboid footage sequences are statistically gathered on the tracklets that move through them.

Jietal developed a system for security footage which automatically identifies the human behavior using convolutional neural nets (CNNs) by forming deep learning model which operates directly on the raw inputs. Therefore, 3D CNN model for classification requires the regularization of outputs with high-level characteristics to increase efficiency and integrating the observations of a variety of various models.

In an image-fusion-based study, imbalance map calculation and selection of candidate regions from input frames were performed. A low-cost, symmetrical dual-camera system was installed to take advantage of this information. According to the results, the number of false positives decreased and the detection of objects in surveillance videos became more convenient. Brightness-guided pre-processing, known as darkening and contrasting at learning and test stages, was proposed to improve detection quality in surveillance videos and a cold steel weapon detection model was presented. In a hybrid weapon detection study using fuzzy logic, a system was developed to detect harmful objects such as guns and knives using additional parameters that improved correct results and reduced false alarm rates.

In a weapon classification study developed using a deep CNN, two new approaches were presented. In the proposed approach, the weights of the pre-trained VGG-16 model were taken. Using this model, the effects of changing the number of neurons in the fully connected layer on classification were investigated]. In a study aiming to detect firearms in surveillance videos, the focus was placed only on only areas where human beings were found and a weapon detection system was implemented using the separate components of the weapons.

A study on multilevel security management presented a system for the management of multimedia security in Internet of Things systems. This system automatically analyzed multimedia events and calculated security levels. In another real-time object detection study, the authors detected handheld weapons (pistols and rifles). In that study, a TensorFlow-based application of Overfeat, a CNN-based image classifier and feature extractor, was used to detect and classify weapons in the image. In another study on the automatic detection of firearms and knives, algorithms were proposed to warn human operators when guns or knives were detected in the closed-circuit television system. In the same study, in order to apply the system in real life, the number of false alarms was reduced and a system that was capable of real time warning when a dangerous situation was detected was developed.

Clustering algorithm and color-based segmentation were also previously used to eliminate irrelevant objects from an image for the purpose of automatic visual weapon detection. The Harris detector of interest points and the fast retina key point descriptor were used to detect the relevant object (weapon) in segmented images. By applying this system to the collected weapon sample images, the partial jamming, scaling, rotation and presence of multiple weapons were detected

3.PROPOSED SYSTEM

In this paper, the method used is open-cv libraries. OpenCV (Open-Source Computer Vision Library), the most used library for computer vision applications. It was primarily built to increase the use of computer vision and machine perception in commercial products. This library was built to accelerate the use of machine perception and take it into commercial products. The system will include multiple stages of image processing and object detection. For ease of understanding the methodology section will be divided into three subsections,

- Data gathering,
- Image Processing
- Object Detection

the high-level system architecture of the proposed system. The overall system consists of two phases the Image processing phase and the Object detection phase.

System Modules:

- RGB to Grayscale Conversion.
- Background Subtraction.
- Filtering Operation.
- Segmentation/Edge Detection.
- Sliding Window.
- Classification.

Module Description:

Dataset collection

- Collecting data heavy use of collections of images called datasets. A dataset in computer vision is a curated set of digital photographs that developers use to test, train and evaluate the performance of their algorithms.
- Data can be gathered by different means like scraping from the web, gathering from third-party sources or you could even buy datasets from re-sellers etc.
- Autoencoders work best for image data.
- Support file type filters.
- Support Bing.com filters.
- Download using multithreading and custom thread pool size.
- Support purely obtaining the image URLs.

OBJECT RECOGNITION

As the name suggests, it is the process of predicting the real class or category of an image to which it belongs by making probability high only for that particular class.

- Image Classification
- Object Localization
- Object Detection

1) Image Classification

The classification model takes an image and slide the kernel/filter over the whole image to get the feature maps. From Object Recognition to detection Hierarchy. The feature extracted, it then predicts the label based on the probability.

2) Object Localization

This method outputs the actual location of an object in an image by giving the associated height and width along with its coordinates.

3) Object Detection

This task uses the properties of the aforementioned algorithms. The detection algorithm tells us the bounding box having x and y coordinates with associated width and height along Box

Data Pre-Processing

The pre-processing process involves data cleaning, standardization, processing, extraction and choice of features, etc. The final training dataset is the result of pre-processing processes applied to the collected dataset. Pre-processing is necessary for better training of a model, so the first step is to make the same size or resolution of the dataset. The next step is to apply the mean normalization. The third step is making bounding boxes on these images,

which is also called annotation, localization, or labeling. In data, labeling a bounding box is made on each image. The value x, y coordinates, and width, height of the labeled object was stored in xml, csv or txt format. Following are the four main steps of data preprocessing:

RGB to Grayscale Conversion

The order of color is BGR (blue, green, red). The OpenCV function imwrite() that saves an image assumes that the order of colors is BGR, so it is saved as a correct image. ... Therefore, if the and array of the image read by OpenCV imread () is converted to a PIL.

RGB stands for Red Green Blue. Most often, an RGB color is stored in a structure or unsigned integer with Blue occupying the least significant "area" (a byte in 32-bit and 24-bit formats), Green the second least, and Red the third least. BGR is the same, except the order of areas is reversed

RGB to Grayscale Conversion is performed in order to simplify the complexity of each frame and speed up the operation of the subsequent Background subtraction and segmentation stages. Grayscale images are computed much faster compared to RGB images when performing segmentation operations such Canny

Background Subtraction

Background subtraction is a widely used approach to detect moving objects in a sequence of frames from static cameras.

The base in this approach is that of detecting moving objects from the difference between the current frame and reference frame, which is often called 'Background Image' or 'Background Model'.

Background subtraction is a mainstream algorithm for moving object detection in video surveillance systems.

It segments moving objects by using the difference between the background and input images. The key to background subtraction is to establish a reliable initial background

Filtering Operation

Due to varying lighting conditions and other interferences, the extracted foreground object is highly noisy. This affects the performance of consequent operations that will take later on and demand high computational requirements by creating false regions of interest which carry minimal information.

Dilation and Erosion operations were performed on the extracted foreground object in order to remove small white noises that occur due to lighting changes and joining disparate elements in an image.

Segmentation/Edge Detection

In order for the next stages of the algorithm to perform as desired, edges must be detected. For this purpose, the famous Canny edge detection algorithm is used.

The Canny algorithm takes the filtered foreground object as input and returns the edges as output.

Sliding Window

As the dangerous object can be at any location in the foreground frame a sliding window technique is used. A sliding window is a rectangular region of fixed width and height that slides across an image. The sliding window technique significantly minimizes the area to be inspected by the learning algorithm selected after numerous experiments and is subject to change in the future shows a frame with multiple windows on the foreground object.

Classification

OpenCV comes with a trainer as well as a detector. If you want to train your own classifier for any object like car, planes, etc. you can use OpenCV to create one. Here we deal with the detection of Gun. First we need to load the required XML classifiers. Then load our input image (or video) in grayscale mode. Now we find the guns in the image. If guns are found, it returns the positions of detected guns as Rect (x, y, w,h). Once we get these locations, we can create a ROI (Region of Interest) for the gun.

Mail sending

Python provides smtplib module, which defines an SMTP client session object that can be used to send mail to any Internet machine with an SMTP or ESMTP listener daemon. Here is a simple syntax to create one SMTP object, which can later be used to send an e-mail − import smtplib smtpObj = smtplib.

Once an object detected and generates an alert message. It then sends the email along with the location to the server ...When the server receives an alert email.

How to send emails using Python

Set up the SMTP server and log into your account.

Create the MIME Multipart message object and load it with appropriate headers for From, To, and Subject fields.

Add your message body.

Send the message using the SMTP server object.

Open cv

OpenCV is an open-source computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products.

OpenCV is a library of programming functions mainly aimed at real-time computer vision. Originally developed by Intel, it was later supported by Willow Garage then Itseez (which was later acquired by Intel).

OpenCV is a great tool for image processing and performing computer vision tasks. It is an open-source library that can be used to perform tasks like face detection, objection tracking, landmark detection, and much more.

Some of these functions are really common and are used in almost every computer vision task.

Haar cascade

It is a machine learning approach where a cascade function is trained from a lot of positive and negative images. Positive images are those images that consist of faces, and negative images are without faces. In face detection, image features are treated as numerical information extracted from the pictures that can distinguish one image from another.

We apply every feature of the algorithm on all the training images. Every image is given equal weight at the starting. It founds the best threshold which will categorize the faces to positive and negative. There may be errors and misclassifications. We select the features with a minimum error rate, which means these are the features that best classifies the face and non-face images.

HAAR-Cascade Detection in OpenCV

OpenCV provides the trainer as well as the detector. We can train the classifier for any object like cars, planes, and buildings by using the OpenCV. There are two primary states of the cascade image classifier first one is training and the other is detection.

OpenCV provides two applications to train cascade classifier opencv_haartraining and opencv_traincascade. These two applications store the classifier in the different file format.

For training, we need a set of samples. There are two types of samples:

Negative sample: It is related to non-object images.

Positive samples: It is a related image with detect objects.

4. SYSTEM ARCHITECTURE

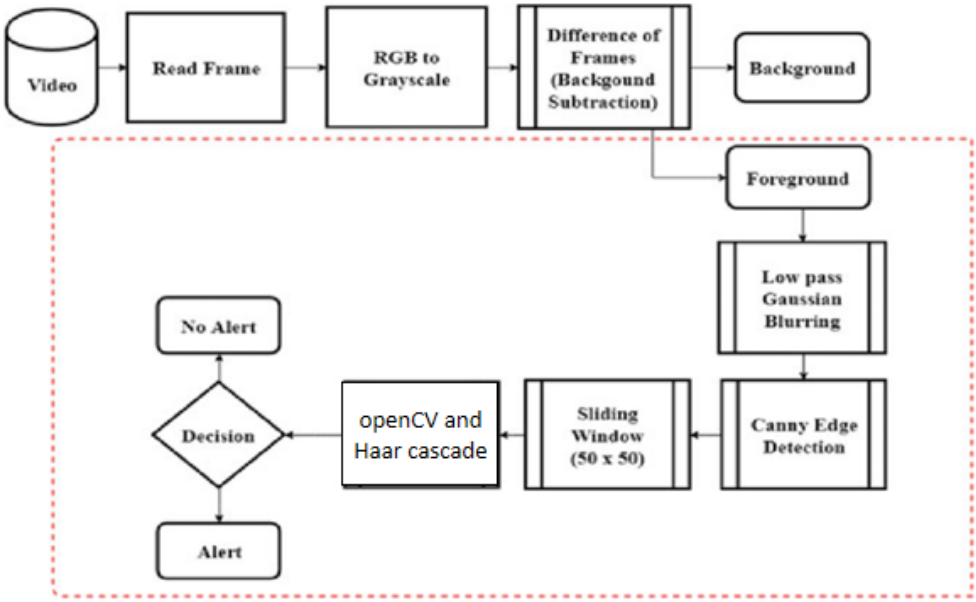
Software Requirements

- Operating system: Windows 7.
- Coding Language: python
- Tool: pycharm

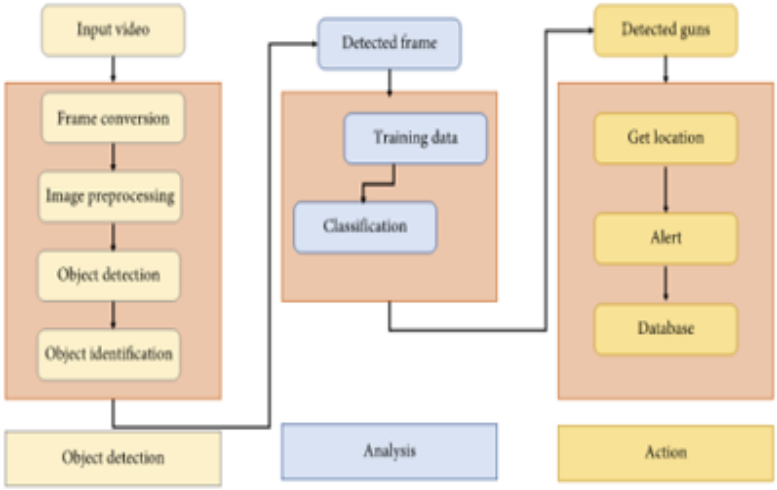
Hardware Requirements

- System: Pentium i3 Processor
- Hard Disk: 300 GB (min)
- Monitor: 15’’ LED
- Input Devices: Keyboard, Mouse
- Ram: 2 GB

5.ARCHITECTURE DIAGRAM



6.WORK FLOW DIAGRAM



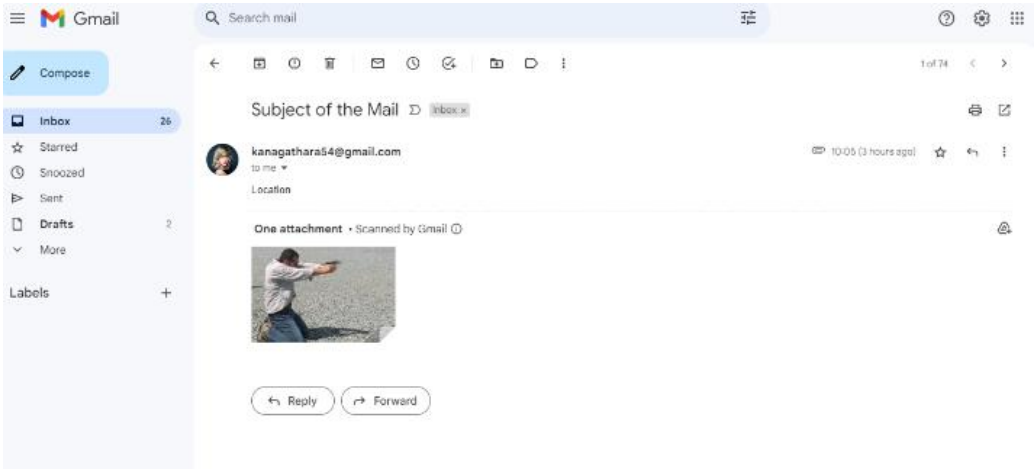
7. RESULT

In this section, analyze the results of the proposed system. The screenshots are the results of the system.

Figure 7.1: Image Detection

Figure 7.2: Video Detection

Figure 7.3: Mail Notification



8. CONCLUSION

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, have expanded exponentially and this has led to a challenge to humans to spot weapon in so many cameras.

This paper presents a real-time framework and method that is mainly designed for security and safety management purposes for both monitoring and control purposes, this work has presented a novel automatic weapon detection system in real-time. This work will indeed help in improving the security, law and order situation for the betterment and safety of humanity, especially for the countries who had suffered a lot with these kinds of violent activities. This will bring a positive impact on the economy by attracting investors and tourists, as security and safety are their primary needs. We have focused on detecting the weapon in live CCTV streams and at the same time reduced the false negatives and positives

REFERENCE

- Iqbal, Javed, et al. "Orientation Aware Object Detection with Application to Firearms." arXiv preprint arXiv:1904.10032 (2019).
- Weapon Detection Using Image Processing." International Journal of Electronics, Communication and Soft Computing Science & Engineering (IJECSCSE) (2018): 31-34
- Elsner, Jens, et al. "Automatic Weapon Detection in Social Media Image Data using a Two-Pass Convolutional Neural Network." European Law Enforcement Research Bulletin 4 SCE (2019): 61-65.
- de Azevedo Kanehisa, Rodrigo Fumihiro, and Areolino de Almeida Neto. "Firearm Detection using Convolutional Neural Networks." ICAART (2). 2019.
- Chen, Hua-Mei, et al. "Imaging for concealed weapon detection: a tutorial overview of development in imaging sensors and processing." IEEE signal processing Magazine 22.2 (2005): 52-61.
- Redmon, Joseph, and Ali Farhadi. "Yolov3: An incremental improvement." arXiv preprint arXiv:1804.02767 (2018).