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Video Analysis for Weapon Detection and Alerting

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ABSTRACT

Modern society places a premium on safety and security. The prosperity of a nation depends on its ability to attract both tourists and investors. While Closed Circuit Television (CCTV) cameras are utilized for monitoring and surveillance purposes, human oversight and intervention are still necessary. There must be a system that can quickly and easily identify any instances of illegal behavior. Cutting-edge deep learning algorithms, lightning-fast processing power, and cutting-edge CCTV cameras still can't solve the problem of real-time weapon identification. The difficulty of the endeavor is amplified by the need to account for varying viewing angles and occlusions caused by the gun's carriage and bystanders. The goal of this effort is to create a safe environment by using state-of-the-art open-source deep learning algorithms applied to CCTV data to identify potentially lethal weapons. Binary classification has been developed using the pistol class as the reference class, and the concept of including relevant confusion objects has been introduced to cut down on false positives and negatives. Since there was no pre-existing dataset for such a real-world scenario, we created one using photos we took of weapons with our own camera, images we manually collected from the internet, data extracted from YouTube CCTV videos using GitHub repositories, data provided by the University of Granada, and the Internet Movies Firearms Database (IMFDB) imfdb.org. Sliding-window classification and region-proposal-based item detection are the two methods employed. The algorithms employed range from VGG16 to Inception-V3 to SSDMobileNetV1 to YOLOv3 and YOLOv4. Object detection methods were evaluated based on their precision and recall rather than their accuracy. The F1-score and mean average precision that Yolov4 provided were both significant improvements above previous algorithms' performance.

Keywords:FRCNN,deelearning, VIDEO ANALYSIS, WEAPON DETECTION

I. INTRODUCTION

The detection of weapons or anamolies is the process of looking for occurrences or objects that do not fit the mold of what is expected, or that are otherwise anomalous in comparison to the rest of the data in a dataset. An anomaly is a pattern that deviates from a typical distribution. As a result, anomalies are phenomenon-specific. Object detection is the process of identifying specific items based on their category, using feature extraction and learning techniques or models. The proposed implementation focuses on properly identifying and categorizing guns. Concerned about precision as well, since a false warning could have unintended consequences. It is important to strike

a balance between speed and precision when deciding which method to use. The procedure for detecting firearms with deep learning is depicted in Figure 1. The input video is sliced into individual frames. Before an object is detected, a bounding box is generated using a frame-difference method. Fig.1.Methodology Figure 2: Tracking and Detection Figure 2 depicts the process flow for object recognition and tracking. The object detection algorithm is fed a newly constructed, trained dataset. Gun detection algorithms (SSD or fast RCNN) are selected based on their ability to perform optimally in the target applications. The method uses multiple machine learning models, such as a Region Convolutional Neural Network (RCNN), Single Shot Detection, and others, to solve a detection problem.

Problem definition

The widespread availability of handguns has contributed to an uptick in crime rates around the world. For a nation to advance, its criminal justice system must be stable. A tranquil and secure atmosphere is essential if we are to attract investors for investment or produce income from the tourism business. In many places of the world, the crime rate is extremely high due of the availability of weaponry. It consists primarily of nations where private gun ownership is permitted. Now that the globe is truly a global village, every word we say or write has an effect on people everywhere. The damage will be done even if the news they heard was fabricated and based on nothing at all, as it would become viral in a matter of hours thanks to the media and, in particular, social media. People today suffer from greater sadness and less self-control, making them especially vulnerable to the radicalizing effects of hate speeches. Brainwashing is possible, and psychological research suggests that a person armed with a weapon is more likely to lose control in such a setting.

II. MOTIVATION

An anomaly is a pattern that deviates from a typical distribution. As a result, anomalies are phenomenon-specific. To recognize instances of different classes of items, object detection employs feature extraction and learning techniques or models [6]. The proposed implementation focuses on properly identifying and categorizing guns. Concerned about precision as well, since a faulty alert could have unintended consequences

Methodology:

Major advancements in CCTV technology, processing hardware, and deep learning models prompted the emergence of the problem of object identification and classification in real time. Very little has been done in this area previously, and what little there was to accomplish involved the detection of concealed weapons (CWD).

Modules:

The modules incorporated in this project are:

1. Dataset upload
2. Pre-processing data
3. Extracting dataset
4. Splitting dataset into training and testing
5. image processing
6. Applying model

III. FUNCTIONAL REQUIRMENTS:

A functional requirement specifies the features and/or functions that must be included into a system in order for it to meet the needs of the business and be accepted by its customers. The following are some of the essential features that the system must have:

The system needs to be able to read the supplied video or photos.

That format necessitates a system that can analyze, detect, and recognize wepanes.

IV. OBJECTIVES

Multiple techniques exist for concealing the bulk of a weapon while holding it in either one or two hands.

Time is a factor while creating a new data set.

• Real-time alarm triggered by the identification of automatic weapons.

• Exact pinpoint of weapon at crime scene to set off alarm.

Scope of the project:

Major difficulties, such as a high rate of false negatives and positives, stem from obstacles such the similarity in form and handling of non-weapon objects that are often held in the hand. A further difficult task is guaranteeing that the model has a very low false negatives rate and never misses the weapon. The model should also be able to filter out false positives caused by the image or video's context. False negatives in videos are extremely common with the currently available models. Imagine ten armed persons trying to enter a building; if only one of them makes it inside, the results might be disastrous. Therefore, it is necessary to broaden the spectrum of detectable

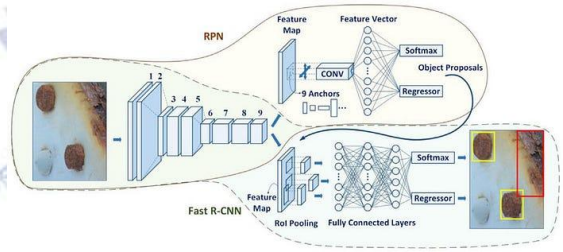
weapons to include rifles, while decreasing the number of false negatives and false positives by implementing the strategies proposed in [8,9].

1) *Fast R-CNN Object Detector*

The R-CNN The image classifier categorized each boundary separately. The image classifier created a feature map for each of the 2000 proposed regions. This was a costly procedure.Ross Girshick developed a new method for speeding up object detection in his follow-up study dubbed Fast R-CNN.Instead of computing 2000 separate feature maps for each of the 2000 proposed regions, the plan was to instead create a single global feature map for the entire image. Each proposed zone has a fixed-length feature vector from the feature map retrieved using a region of interest (RoI) pooling layer. Then, every feature vector was put to double duty:

Place the area under the appropriate category (dog, cat, background, etc.).

Use a bounding box repressor to refine the precision of the initial bounding box.



Results analysis:

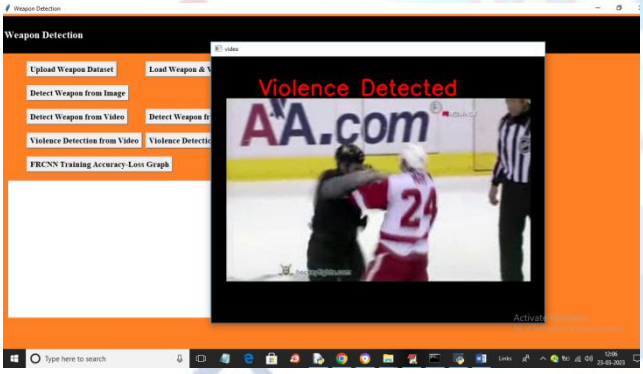


Figure 2:Wepan detected

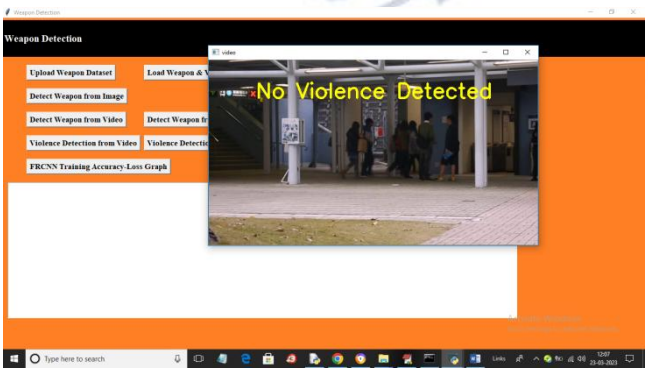


Figure 2:Wepan not detected

V. CONCLUSION

For the purpose of weapon (gun) detection, both pre-labeled and custom-created image datasets are simulated using SSD and faster RCNN algorithms. Both algorithms are cost-effective and produce usable outcomes, but using them in real time requires compromising one for the other. With a speed of 0.736 seconds per frame, the SSD algorithmic program is significantly faster. When compared to SSD's performance, even the faster RCNN's one.606s/frame isn't very good. Faster RCNN achieves 84.6% accuracy in terms of relevance. SSD's accuracy of 73.8 percent is low when compared to that of the faster RCNN.SSD's faster speed allowed for real-time detection, whereas RCNN's faster speed resulted in better accuracy.

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