

## Detection of Weapons and Alert System in ATM

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### Abstract

*In contemporary society, the prominence of security and safety has become a significant apprehension. Every day, both stores and banks fall victim to robberies, and the frequency of such incidents is progressively increasing. The assurance of public safety has emerged as a crucial matter in the present era, particularly considering the escalating global security concerns. Considering the advancements in computer vision technologies, the utilization of You Only Look Once (YOLO) algorithms for weapon detection stands out as a particularly auspicious approach. The YOLO family of real-time object identification algorithms, including YOLO v4 and YOLO v5, have gained attention for their speed and accuracy. YOLO v4 introduced improvements such as the CSPDarknet53 backbone and refined data augmentation techniques. A significant step toward enhancing public safety has been taken with the integration of YOLO with weapon detection and alarm systems. This essay will explain the basic concepts of YOLO, its application in weapon detection, current advancements, and possible future uses in applying this technology to address new security concerns. YOLO v5 further simplified the architecture while maintaining performance. In weapon detection, the system notifies the manager or user through a web portal and triggers an alarm. The manager can confirm the threat or dismiss it. If confirmed, the system uses the GSM module to contact local authorities. Response not received within 15 seconds; relevant authorities are alerted. A simulated heist scenario demonstrated the system's effectiveness.*

### Keywords:

### INTRODUCTION

Detecting firearms is important in sensitive locations, such as Automated Teller Machines (ATMs), to safeguard the public and stop criminal activity. Utilizing cutting-edge computer vision methods, especially the You Only Look Once (YOLO) algorithm, provides a reliable real-time weapon identification solution. By implementing

YOLO, ATMs can be outfitted with sophisticated fast detecting surveillance systems, including knives or firearms, allowing security staff to respond promptly or trigger automated warnings to police authorities. By proactively reducing possible threats and protecting both consumers and the environment, security measures are greatly improved [1].

Modern object identification algorithms like YOLO are renowned for their quickness and precision when performing real time detection jobs. Since its initial proposal by Joseph

Redmon et al. in 2016, YOLO has undergone different versions, with each iteration enhancing the efficiency of the preceding version. It is especially well-suited for circumstances involving security

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Received Date: April 27, 2024

Accepted Date: May 27, 2024

Published Date: June 04, 2024

**Citation:** Majusha P.K., Niveditha M. Hiremath, Vinod Desai, Sannidhi N. Reddy, Anagha Tholpady S., Sevanthi G. Meti. Detection of Weapons and Alert System in ATM. Journal of Electronic Design Technology. 2024; 15(1): 20–24p.

and surveillance, when prompt identification is essential, because of its exceptional speed and efficiency in object detection. Because of YOLO's quickness, detection capabilities can be added to current surveillance systems, improving their efficacy without adding a huge value of processing overhead [2].

The integration of YOLO with weapon detection and alert systems represents a major advancement in improving public safety. The fundamental ideas of YOLO, its use in weapon detection, recent developments, and potential future applications in utilizing this technology to tackle new security issues will all be covered in this article. By means of an extensive analysis of YOLO-based weapon detection systems, our objective is to offer discernments into the potential, constraints, and possibilities for additional investigation in this crucial field [3].

## LITERATURE REVIEW

An algorithm was developed that can automatically identify knives and firearms in CCTV footage and notify the operator or security officer. The main goals are to reduce false alarms and offer a real-time application using a knife detection algorithm that has a 94.93% specificity and an 81.18% sensitivity. Additionally, the fire alarm system's sensitivity is 35.98% and its specificity is 96.69% for the various items in the movie. The Histogram of Directed Tracklets, a video classifier that can identify irregular circumstances in complicated sequences, was developed by Mousavi et.al Long-range motion projections known as tracklets are the source of descriptors that have been developed in contrast to conventional methods that use optical [4].

flow and only measure edge features from two consecutive frames. Sequences of spatiotemporal cuboid imagery are collected statistically.

The passive millimeter wave photography, which uses the YOLO method on small-scale datasets, was obtained using metallic weapons mounted on human skeletons. The Single MultiBox Detector algorithm, YOLOv3-13, SSD-VGG16, and YOLOv3-53 are then compared using the PMMW dataset. Furthermore, the accuracy of weapon detection was calculated with a detection speed of 36 frames per second and a mean average precision of 95%.

YOLO V3 algorithm uses Faster Region-Based CNN (RCNN) to detect handguns in visual surveillance by separating the number of false positives and false negatives. Real-time photos are then taken, integrated with ImageNet dataset, and trained using YOLO V3 algorithm. They used four separate films to compare YOLO V3 and Faster RCNN. The results showed that YOLO V3 imparted faster speed in a real-time context [5].

In today's pool of AI, there are many different object detection algorithms available. YOLO, R-CNN, HOG, Fast R- CNN, R-FCN, Faster R-CNN, SSD, SPP-net, and R-CNN are some of the most well-liked and effective algorithms among researchers worldwide. Nevertheless, a comparison examination reveals that YOLO's most recent versions have comparatively higher mAP (mean average precision) and FPS (frames per second) in object identification [6].

While the smaller network variant, Fast YOLO, processes 155 frames per second (fps) and doubles the mean average precision (MAP) of other real-time detectors, the basic model processes real-time images at 45 fps (frames per second). This algorithm outperforms other identification techniques, such as R-CNN and DPM, because it generates results from natural images in different domains, like artwork. In the past, people have employed methods like R-CNN, Fast-RCNN, Faster R-CNN, and sliding window object detection. Because of its speed and precision, YOLO was invented in 2015 and has since become widely used in industries for object detection [7].

YOLO operates by using CNN. After receiving an input image, CNN creates a feature map output in the form of a vector with dimensions that match the grid size and parameters, like number of classes,

bounding box width/height, class number, coordinates for the bounding box's center, likelihood that an object will be detected, and likelihoods of other potential classes. The feature map's depth is determined by these factors. Multiplying the grid by the number of parameters yields the feature vector's volume.

A thorough examination of applying object identification algorithms for medical image analysis was published, as was a survey of object detection for medical pictures using deep learning techniques. In this The Yolo architecture, its development, and its usage for three important medical applications—medical pictures, PPE detection, and surgical procedures—were the main topics of this article.

While YOLO designs have been reviewed in a number of studies, these reviews frequently have restrictions, such as concentrating on particular YOLO variants [8] or concentrating on particular application domains [9]. But this evaluation stands out for being the first to offer a thorough examination of popular YOLO variations, ranging from YOLO v1 to YOLOv8.

The analysis provides a comparative assessment across over 20 areas by exploring the innovations driving the success of each version. Moreover, this thorough analysis clarifies the ongoing difficulties that the YOLO series has in addition to analyzing the advantages of YOLO designs. The study seeks to provide a nuanced picture of the ongoing challenges by highlighting existing limitations and areas for improvement.

## **SELECTION OF RESEARCH PROBLEM**

An increased awareness of public safety and security has highlighted the necessity of sophisticated monitoring and danger detection systems. Automated Teller Machines (ATMs) are crucial hubs for financial transactions in this regard, necessitating strict security protocols. The growing number of gun-related crimes committed close to ATMs exposes a serious weakness. The inadequacy of conventional security systems to rapidly identify and notify authorities of potential threats often forces the development of novel solutions. This issue is addressed by the Weapon Detection and Alert System with YOLO (You Only Look Once), which uses real-time object detection capabilities to quickly identify weapons and triggers instant notifications to reduce potential threats in and around ATM locations.

It's important to assess the viability and efficacy of using YOLO for weapon detection in ATMs. This entails considering elements including the accuracy of detection, real-time processing capabilities, and computational requirements. It's also critical to consider any potential privacy issues, ethical and legal ramifications, and other factors related to the use of such surveillance systems. For the research problem to be viable and accepted and make sure that these factors must be addressed responsibly.

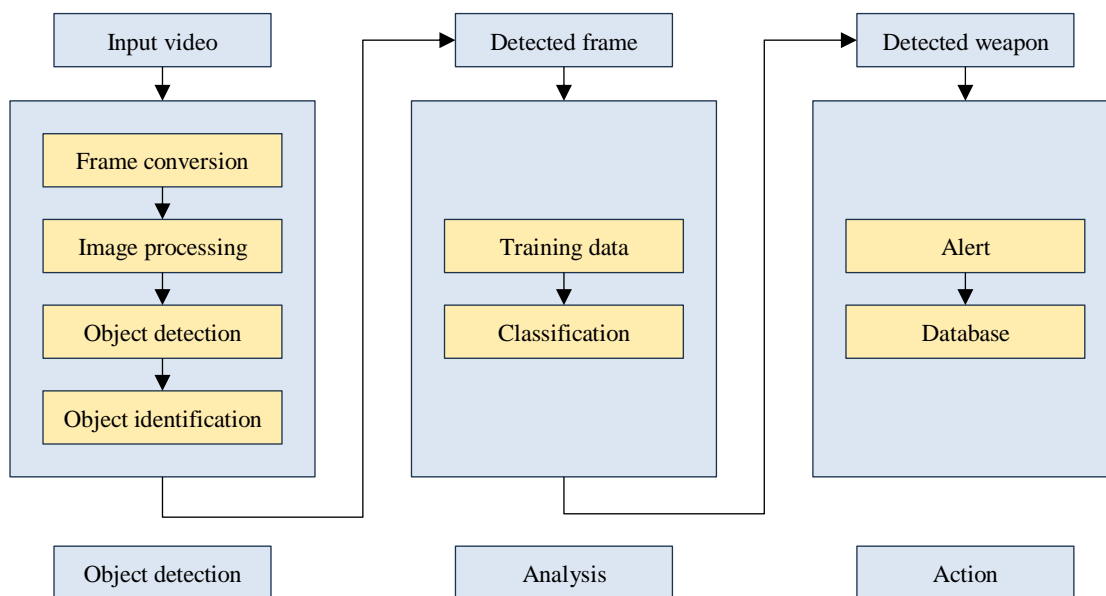
All things considered, the chosen study question should try to solve an urgent security need, make good use of cutting-edge technology like YOLO, and abide by moral and legal requirements while guaranteeing practical viability and efficacy.

## **DATASETS**

There were two kinds of guns in the dataset: handguns and rifles, totaling 7801 photos. The training set consisted of 6240 photos containing 7347 instances of both classified weapon classes, of which 2963 belonged to handguns and 4384 to rifles. An 80-20 division was created for the validation set. 1561 photos with 1904 instances of both identified weapon classes— 1128 for rifles and 776 for handguns— were included in the validation set. Various sources, including CCTV photos, movies, and Google Images, were used to collect the dataset [10-13]. Using the YOLOv5 GitHub repository, the model was developed on Google Collab.

## **METHODOLOGIES**

The proposed method makes use of CNN to recognize human behavior in a crowd and classify it as typical or atypical. We will create a deep learning algorithm to classify exertion from the dataset. An



**Figure 1.** Architecture of weapon detection.

image is entered by the system. There are two types for this input: typical and strange. Neural networks (NNs) that fuse the image with the properties of each CNN, picture preparation techniques, and a collection of CNNs make up the system. The aggregate combines the outputs of the NNs using unweighted averaging to produce a collection of class-specific prediction probabilities. The data will be categorized according to the highest probability, producing the output. The architecture of the proposed system is shown in Figure 1.

### SYSTEM ARCHITECTURE

The process of transforming data from one form to another, so that it can be used more effectively and is more informative, is known as data processing. This entire process can be automated with the use of machine learning algorithms, mathematical modeling, and statistical expertise. Graphs, movies, charts, tables, photos, and many more formats can be produced as an output of this entire process, contingent on the work at hand and the machine's specifications.

The prepared data may now be in a format that is not machine-readable; therefore, conversion methods are required to change this data into a readable format. This work requires a high level of computation and accuracy to be completed. At this point, the machine produces findings that are meaningful and simple for the user to interpret. Reports, graphs, movies, and other formats are examples of output.

### SUMMARY

In interpersonal connections and human-to-human interaction, the ability to recognize unusual activities is essential. Because it includes details about a person's identity, personality, and psychological condition, it is challenging to remove. The ability of humans to recognize the actions of another is one of the key areas of research in the scientific domains of computer vision and machine learning. Because of this, many applications, including robotics for the characterisation of human behavior and human-computer interaction as well as video surveillance systems, need a multimodal activity recognition system. Behaving suspiciously in public is risky and can have dire repercussions. Various solutions rely on the capture of video frames when motion or pedestrian detection happens, but real-time computer intelligence is insufficient to identify questionable activities.

### CONCLUSION

The addition of a weapon detection and alarm system that utilizes YOLO (You Only Look Once) to Automated Teller Machines (ATMs) is a significant invention in the fields of security and technology.

The investigation of innovative ways to reduce possible risks has been spurred by the critical concern for public safety in delicate settings like banks. This system uses the effective real-time object detection algorithm YOLO to detect and notify authorities if a weapon is found in close proximity to an ATM. Such a system is required because to the rise in criminal activity and security breaches that are occurring globally. Due to their importance as financial hubs, ATMs are frequently the target of criminal activity.

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