iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 **Issue:** III **Month of publication:** March 2026

DOI: https://doi.org/10.22214/ijraset.2026.78517

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue III Mar 2026- Available at www.ijraset.com

Real-Time Detection of Armed Individuals in Video Surveillance Using Machine Learning Techniques

P. Srinivasulu[1], Leela Harshini T[2]
[1]*Assistant Professor, CSE Department, PBR Visvodaya Institute of Technology and Science, Kavali-A.P*
[2]*M. Tech, Computer Science and Engineering, PBR Visvodaya Institute of Technology and Science, Kavali-A.P*

Abstract: ***By using various methods on object detection models, a lot of research attempts to improve weapon detection. However, there is a dearth of study on using real-time surveillance cameras to identify armed individuals. The creation of algorithms to recognize individuals carrying weapons (pistols and revolvers) is the suggested remedy. The YOLOv4 model is the one we have selected to identify faces, firearms, and individuals. Then, in order to identify the armed individuals in each video frame, we extract information from YOLO pertaining to real-time movies, including bounding box coordinates, distances, and intersection regions between firearms and the individuals. Some obstacles must be overcome, such as occlusion, concealed firearms, and persons in close proximity to one another. It enables us to create and contrast various kinds of solutions. We suggested seven machine-learning models and three heuristics. The three heuristics are the principle of distances, the principle of intersections, and the principle of centers. The Random Forest Classifier, Multilayer Perceptron, k-Nearest-Neighbors, Support Vector Machine, Logistic Regression, Naive Bayes, and Gradient Boosting Classifier are other machine learning models.***

Index Terms: Detection of armed individuals, computer vision, heuristics, and machine learning.

I. INTRODUCTION

The goal of this study is to improve video security camera systems' ability to identify armed individuals. To identify faces, handguns, and persons in video, we use a widely used object detection technique in deep learning and computer vision. The goal of the study challenge is to recognize and differentiate the faces of those who carry weapons. Therefore, in order to speed up response times to crimes and increase the effectiveness of security personnel's supervision, we suggest automating the detection of armed individuals. In order to secure areas like residences, workplaces, and streets, surveillance cameras are now necessary. Most cameras do not have people supervising them and are used to try to recognize those responsible after crime. These types of systems represent a useless method to prevent different crimes. Conversely, some of these systems count on security personnel supervising them, relying on someone efficiently monitoring the system to warn security personnel when necessary, increasing reaction time. People who supervise these systems are exposed to fatigue and different distractions. In this research, we focus on identifying people carrying weapons through the video surveillance camera system, specifically Pistols and revolvers are the firearms that usually are used to execute different crimes. As per the United Nations Office on Drugs and Crime (UNODC) report, which incorporates data from 81 nations, the most frequently confiscated firearms for illegal purposes are revolvers (14%), pistols (39%), shotguns (25%), rifles (18%), submachine guns (3%), and machine guns (1%). In addition, the UNODC has found that 46 out of 100,000 men between the ages of 18 and 19 are killed on the American continent. In addition, killings in the Americas involve weapons significantly more frequently than in other regions of the world. These figures back up the conclusion that the use of handguns should be the main focus of this study. The model must have a respectable processing speed for the detections in order to be considered genuine. Consequently, YOLOv4 is the object detection model that was employed in this study. Using a Tesla v100 GPU, this model produced 65 frames per second and an average precision (AP) of 43.5% when applied to the MSCOCO dataset. Three classes—handguns, individuals, and faces—were used to train the model. We have created a dataset of 5,000 photos that we gathered from various online sources. It features surveillance camera footage of people, close-ups of firearms, and individuals brandishing firearms. Bounding boxes are created around each of the specified classes by YOLOv4. We make use of these boundaries in this investigation. The deterministic method of centers, which measures the distances between bounding boxes; the deterministic method of intersections, which quantifies the intersection areas between bounding boxes; and the deterministic method of distances, which locates the bounding box centers inside other bounding boxes, are the three heuristics we suggest to identify those who carry weapons.

©IJRASET: All Rights are Reserved

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue III Mar 2026- Available at www.ijraset.com

II. LITERATURE SURVEY

Machine vision has been a key component in the identification of product surface quality in recent years. This technology's promotion and application have increased detection accuracy and efficiency while mainly avoiding the subjectivity that comes with human detection. Point clouds, which are distinct from the image data frequently used in machine vision, can characterize an object's spatial structure, offer more information than image data, and can be expanded to create multi-dimensional data models. Nondestructive testing technology based on point cloud has gained increasing interest because of the high precision of three-dimensional positional information point cloud and the robust anti-interference capability of point cloud sensors. This study provides an overview of the advancements made in 3D point cloud-based product surface quality detection techniques in recent years. The detection research is separated into five categories based on various data processing techniques: deep learning, template matching, multimodal point cloud, local geometric feature, and point cloud contour. Each of the five approaches is examined and condensed. The main issues with each detection technique are finally covered, along with the upcoming developments in 3D point cloud-based product surface quality detection technologies. The ImageNet Large-Scale Visual Recognition Challenge (ILSVRC-2012) is one of the image recognition benchmarks where deep convolutional neural networks have recently demonstrated state-of-the-art performance. A network that predicts a single bounding box and a confidence score for each object category in the image emerged as the top model on the localization sub-task. Multiple instances of the same object in the image cannot be handled by such a model without naively reproducing the number of outputs for each instance. However, it does capture the context of the entire image surrounding the objects. In this study, we suggest a neural network model for detection that is inspired by saliency. It predicts a set of bounding boxes that are independent of class and assigns a single score to each box based on how likely it is that the box contains any object of interest. At the highest layers of the network, the model permits cross-class generalization and automatically manages a variable number of examples for each class. Using only the top few predicted places in each image and a limited number of neural network evaluations, we achieve competitive recognition performance on VOC2007 and ILSVRC2012.

Due to an increase in crime in crowded regions or suspicious, isolated places, security is always a top issue in all fields. Computer vision is widely used in abnormal detection and monitoring to address a variety of issues. Video surveillance systems that can identify and understand the scene and anomalous events are essential for intelligence monitoring due to the increasing demand for safety, security, and personal property protection. Anomaly detection is a technique used to separate diverse patterns and identify odd patterns with a minimal period, this pattern is called outliers. Numerous actual oddities can be captured in surveillance footage. In video surveillance, anomaly detection entails segmenting the entire procedure into three layers: activity detection, image processing, and video labelers. Therefore, in terms of real-time scenarios, anomaly detection in videos for video surveillance applications provides guaranteed outcomes. In this paper, we found anomalies in photos and videos with 98.5% accuracy.

III. PROPOSED SYSTEM

The overview of our proposed system is shown in the below figure.

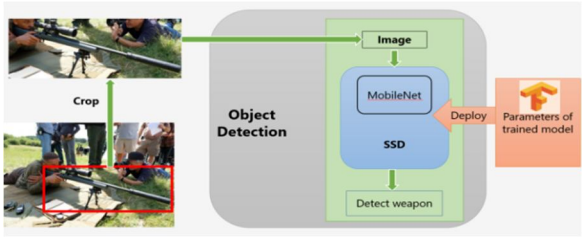


Fig. 1: System Overview

A. Implementation Modules

1) Load Dataset

- This step involves extracting the weapon images from the.zip file and loading the weapon photos dataset into the software.
- The best features can be extracted from this data through analysis in order to preprocess it.

2) Data Augmentation

- process of expanding the amount of the data set is known as data augmentation. Among other methods, the process can be carried out by rotating, flipping, shearing, and introducing random noise. The addition of fresh photos to the dataset will aid in both network training and improving the classification effectiveness of either new or testing data.

3) Preprocessing

©IJRASET: All Rights are Reserved

- The image data is pre-processed and converted into numpy array data in this module. To determine the characteristic of the image data, this phase is crucial.

4) Train Model

- This module's data is split into train and test data in an 80% and 20% ratio, respectively. The model can be trained using the train data, and its performance can be tested using the test data. In this project, we used the CNN model, and we used Python programming's fit() technique to train the model.

5) Classification

- In this module, we identified the weapon using the model we suggested.

6) Evaluate Model

- To further assess the models, we create and compute classification metrics and confusion matrices in this module.

IV. RESULTS

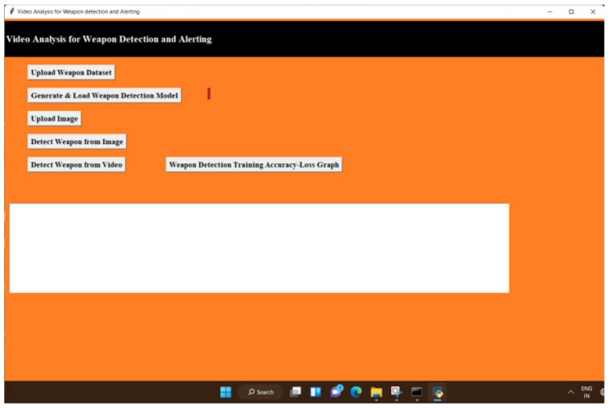


Fig. 2: Home Page

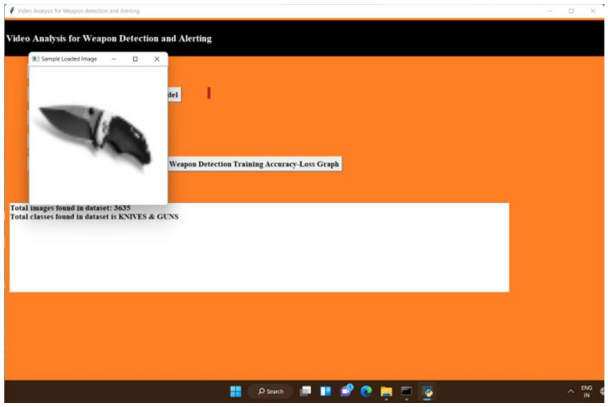


Fig. 3: Upload Weapon Image Dataset

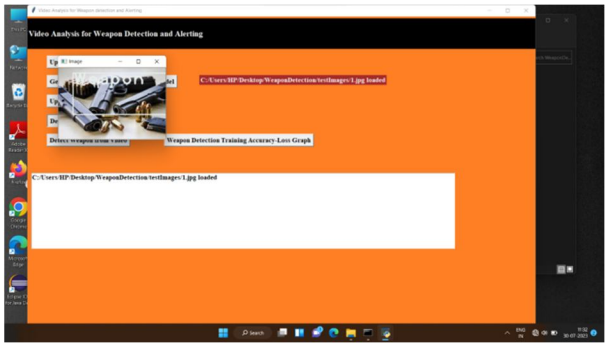


Fig. 4: Upload Weapon



Fig. 5: Comparison Graph

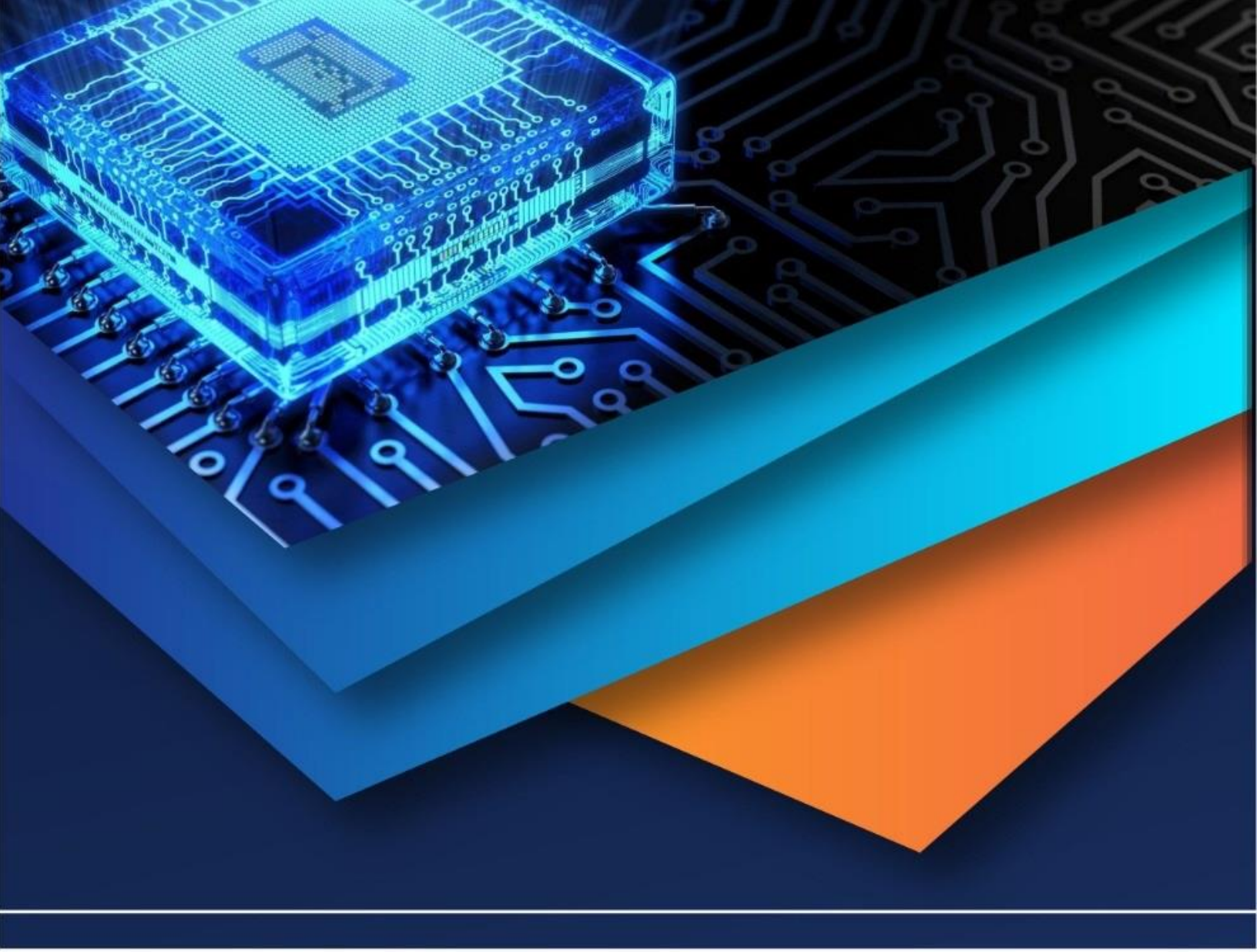
V. CONCLUSION

For weapon (gun) detection, SSD and Faster RCNN algorithms are simulated for pre-labeled and self-generated image datasets. Both algorithms are effective and produce good results, but using them in real time requires balancing accuracy and speed. With a speed of 0.736 s/frame, the SSD algorithm provides faster performance. Faster RCNN, on the other hand, only provides 1.606 s/frame, which is not as fast as SSD. Faster RCNN provides improved accuracy of 84.6% in this regard. In contrast, SSD's accuracy of 73.8% is subpar when compared to RCNN's speed. higher RCNN offered better accuracy, but SSD's higher speed allowed for real-time detection. Furthermore, by using GPUs and expensive DSP and FPGA packages for training, it can be applied to larger datasets.

REFERENCES

[1] "SSD: Single Shot MultiBox Detector," by Wei Liu and colleagues, European Conference on Computer Vision, Volume 169, pp. 20–31 September 2017.
[2] D. Erhan and colleagues, "Deep Neural Networks for Scalable Object Detection," IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2014.
[3] "Anomaly Detection in Videos for Video Surveillance Applications Using Neural Networks," written by Ruben J. Franklin and colleagues, International Conference on Inventive Systems and Control, 2020.
[4] The article "A Review of Artificial Intelligence Methods for Data Science and Data Analytics: Applications and Research Challenges" was written by H R Rohit and colleagues. I-SMAC (IoT in Social, Mobile, Analytics, and Cloud) had its second international conference in 2018.
[5] Using a Neural Network Framework to Classify Objects in Video Records, Abhiraj Biswas et al., International Conference on Smart Systems and Inventive Technology, 2018.
[6] IEEE International Conference on Intelligent Sustainable Systems, 2019; Pallavi Raj et al., "Simulation and Performance Analysis of Feature Extraction and Matching Algorithms for Image Processing Applications."
[7] In 2018, Mohana and colleagues presented their work, "Simulation of Object Detection Algorithms for Video Survillance Applications," at the International Conference on I-SMAC (IoT in Social, Mobile, Analytics, and Cloud).
[8] In 2019, Yojan Chitkara and colleagues presented their findings at the International Conference on Computing Methodologies and Communication on "Background Modelling techniques for foreground detection and tracking using Gaussian Mixture model."
[9] Rubner et al. (2016) presented "A metric for distributions with applications to image databases" at the International Conference on Computer Vision.
[10] "Evaluation of Object Detection and Tracking Algorithms for Traffic Surveillance Applications with Neural Networks," Third International Conference, 2019 N. Jain et al.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)