Weapon Detection in Real-Time CCTV Videos Using CNN

Mandar Maske , Prasad Narsale , Jay Kingre , Kaushal More, Prof.Shwetal.K.Patil
Dept of Computer Engineering,
MMIT, Savitribai Phule Pune University, Pune, Maharashtra, India

Abstract-The weapon detection system introduces a unique convolutional neural network (CNN)-based real-time weapon identification method in CCTV footage. We preprocess and extract features from a carefully selected dataset obtained from CCTV cameras in order to train our CNN model. We show through thorough experiments that our method is successful at precisely detecting guns in practical situations. Our findings demonstrate the potential of deep learning to improve public safety and security by indicating notable improvements over current techniques. The significance of real-time surveillance in protecting public areas is emphasized by this research, which also adds to the continuing efforts to use technology for preemptive threat identification.

We provide a simplified real-time weapon recognition pipeline that includes CNN model training, feature selection, and image preprocessing. Efficiency and precision are given top priority in our methodology, which guarantees quick and accurate weapon identification in dynamic circumstances. We address the pressing need for proactive danger identification in public spaces with our project, which integrates state-of-the-art deep learning techniques with CCTV monitoring systems.

Keywords: CNN, Real-time surveillance, CCTV footage, Threat detection, etc

I. INTRODUCTION

The necessity of reliable and efficient weapon detection systems in public areas has grown in the face of today's ever-changing security environment. Conventional techniques for identifying threats frequently depend on manual monitoring, which is both time-consuming and prone to human mistake. This research presents a unique method for weapon detection in real-time closed-circuit television (CCTV) footage using convolutional neural networks (CNNs) as a response to these difficulties.

CNNs are a kind of artificial intelligence that have demonstrated exceptional performance in image recognition tasks, which makes them a prime contender for weapon detection. CNNs are able to automatically learn to recognize firearms with a high degree of accuracy by evaluating vast volumes of visual data that are gathered by CCTV cameras.Proactive surveillance and quick reaction to security threats are made possible by this capacity, which has the potential to completely transform threat detection.

The main goal of this project is to create a real-time, scalable, and reliable weapon detecting system. We begin by compiling and organizing an extensive dataset of photos taken from different CCTV cameras in public areas in order to accomplish this purpose. The presence or lack of weaponry is meticulously labeled on these photos, giving our CNN model the essential training data.

After that, we preprocess the dataset using methods like scaling, normalization, and data augmentation to improve its quality and diversity. This stage is essential for enhancing our model's capacity for generalization and guaranteeing precise detection in practical settings. After the dataset is ready, we use cutting-edge architectures and optimization techniques to train our CNN model.

After training, the model is used to detect weapons in real time by analyzing live CCTV video feeds and spotting possible threats.

II. METHODOLOGY

Our methodology comprises six key steps, illustrated in Fig.2:

Image Dataset Collection: We compile an extensive collection of pictures taken by CCTV cameras in public areas.

Preprocessing: To improve the quality and diversity of the acquired images, preprocessing techniques such as scaling, normalization, and data augmentation are applied

Feature Selection/Extraction: We extract relevant features from the preprocessed images to facilitate effective weapon detection.

CNN Model Training: Using the preprocessed ataset, we train a convolutional neural network (CNN) model. The model learns to recognize patterns and features associated with weapons through iterative training.
Weapon Recognition: Once trained, the CNN model is deployed for real-time weapon recognition. It analyzes incoming CCTV footage and identifies potential threats.

Detected Image Result: The output of the system is a detected image with annotated regions indicating the presence of weapons.

By using this process, it is ensured that a strong weapon detection system will be developed, one that can precisely identify threats in CCTV footage captured in real time, improving public safety and security.

Fig.1. Weapons

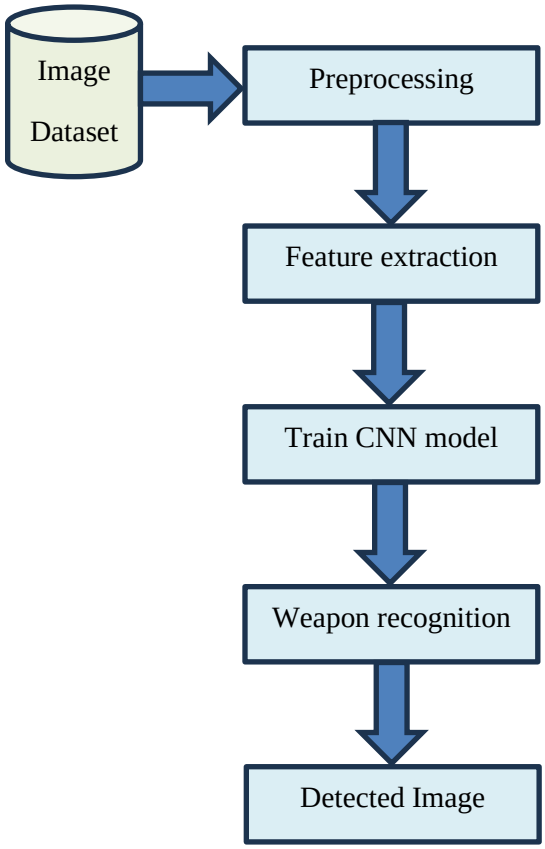

Fig.2. Block diagram

III. CONCLUSION

Finally, our study offers a complete convolutional neural network (CNN)-based real-time weapon identification method in CCTV footage. We have created a strong system that can reliably recognize firearms in changing circumstances by utilizing deep learning technology and dataset preprocessing methods. Through proactive threat detection in public areas, our trials show how effective the suggested methodology is at improving security and safety for the general population. The effective implementation of our weapon detection system demonstrates how CNNs can be used to tackle security issues and emphasizes the value of using technology to detect threats early on. Going ahead, more research and development work can concentrate on making the system more scalable and suitable for deployment in the real world, as well as investigating new features

and modalities to improve detection accuracy and efficiency.

All things considered, our initiative advances the field of surveillance technology and emphasizes how crucial preventive security measures are to the safety of public areas. With the use of real-time surveillance systems and deep learning, we hope to make communities all around the world safer and more secure.

IV.REFERENCES

1.Wei Liu et al., " SSD: Single Shot MultiBox Detector", European Conference on Coputer Vision, Volume 169, pp 20-31 Sep. 2017.

2. D. Erhan et al., "Scalable Object Detect ion Using Deep Neural Networks," IEEE Conference on Computer Vision and Pattern Recognition(CVPR),2014.

3.Ruben J Franklin et .al., "Anomaly Detect ion in Videos for Video Surveillance Applications Using Neural Networks," International Conference on Inventive Systems and Control,2020.

4.H R Rohit et .al., " A Review of Artificial Intelligence Met hods for Data Science and Data Analytics: Applications and Research Challenges,"2018 2nd International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud), 2018.

5.Abhiraj Biswas et. al., "Classification of Objects in Video Records using Neural Network Framework," International conference on Smart Systems and Inventive Technology,2018.

6.Pallavi Raj et. al.,"Simulation and Performance Analysis of Feature Extraction and Matching Algorithms for Image Processing Applications" IEEE International Conference on Intelligent Sustainable Systems,2019.

7.Mohana et.al., "Simulation of Object Detection Algorithms for Video Survillance Applications", International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud),2018.

8. Yojan Chitkara et. al.,"Background Modelling techniques for foreground detection and Tracking using Gaussian Mixture model" International Conference on Computing Methodologies and Communication,2019.

9.Rubner et.al, "A metric for distributions with applications to image databases", International Conference on Computer Vision,2016.

10.N. Jain et.al., "Performance Analysis of Object Detection and Tracking Algorithms for Traffic Surveillance Applications using Neural Networks," 2019 Third International conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud), 2019.

11.A. Glowacz et.al., "Visual Detection of Knives in Security Applications using Active Appearance Model",Multimedia Tools Applications, 2015.

12.S. Pankanti et.al.,"Robust abandoned object detection using region-level analysis,"International Conference on Image Processing,2011.