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ENHANCING SECURITY THROUGH DEEP LEARNING WEAPON DETECTION USING YOLOV3 ALGORITHM

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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 growing demand in the protection of safety, security and personal properties, needs and deployment of video surveillance systems can recognize and interpret the scene and anomaly events play a vital role in intelligence monitoring.

In this project it implements automatic gun (or) weapon detection using deep learning techniques like convolution neural network (CNN) based SSD, Faster RCNN algorithms and mainly YOLOV3 algorithm. Leveraging the YOLOv3 model's real-time processing capabilities and high accuracy, our system achieves remarkable performance in detecting weapons. Through frame-by-frame analysis, this system ensures comprehensive coverage, allowing for precise detection of weapons in dynamic environments. Moreover, we extend our system to support live video streams, enabling real-time weapon detection for enhanced security monitoring.

Keywords: YOLOV3, Weapon Detection, Convolution Neural Network (CNN), Faster Region Based Convolution Neural Network (RCNN), Single Shot Detection (SSD).

I. INTRODUCTION

Weapon or Anomaly detection is the identification of irregular, unexpected, unpredictable, unusual events or items, which is not considered as a normally occurring event or a regular item in a pattern or items present in a dataset and thus different from existing patterns. An anomaly is a pattern that occurs differently from a set of standard patterns. Therefore, anomalies depend on the phenomenon of interest. Object detection uses feature extraction and learning algorithms or models to recognize instances of various category of objects. Proposed implementation focuses on accurate gun detection and classification. Also concerned with accuracy, since a false recognition could result in adverse responses. Choosing the right approach required to make a proper trade-off between accuracy and speed. Figure 2 shows the methodology of weapons detection using deep learning. Frames are extracted from the input video. Frame differencing algorithm is applied and bounding box created before the detection of object. It uses YOLOV3 weights as the dataset, the neural network model architecture is stored in the yolov3. cfg file, and the pre-trained weights of the neural network are stored in yolov3. weights . There is a file called coco. The dataset is loaded in to the deep learning model such that on providing the input file it detects whether it contains weapon or not. Also it detects the weapon frame-by-frame from the image file, video file and support live video streams.

II. LITERATURE REVIEW

Weapon detection using artificial Intelligence and deep learning for security applications; Harsha Jain ICESC 2020.

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 growing demand in the protection of safety, security and personal properties, 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 automatic gun (or) weapon detection using a convolution neural network (CNN) based SSD and Faster RCNN algorithms. Proposed implementation uses two types of datasets. One dataset, which had pre-labelled images and the other one is a set of images, which were labelled manually.

Automatic handgun and knife detection algorithms; Arif Warsi IEEE Conference 2019. Nowadays, the surveillance of criminal activities requires constant human monitoring

Most of these activities are happening due to handheld weapons mainly pistol and gun. Object detection algorithms have been used in detecting weapons like knives and handguns. Handgun and knives detection are one of the most challenging tasks due to occlusion, variation in viewpoint and background cluttering that occurs frequently in a scene. This paper reviewed and categorized various algorithms that have been used in the detection of handgun and knives with their strengths and weaknesses. This paper presents a review of various algorithms used in detecting handguns and knives.

Weapon classification using deep Convolutional neural networks; Neelam Dwivedi IEEE Conference CICT 2020.

Increasing crimes in public nowadays pose a serious need of active surveillance systems to overcome such happenings. Type of weapon used in the crime determines its seriousness and nature of crime. An active surveillance with weapon classification can help deciding the course of action while identifying the possibilities of any crime happening. This paper presents a novel approach for weapon classification using Deep Convolutional Neural Networks (DCNN). That is based on the VGG Net architecture. VGG Net is the most recognized CNN architecture which got its place in Image Net competition 2014, organized for image classification problems. Thus, weights of pre-trained VGG16 model are taken as the initial weights of convolutional layers for the proposed architecture, where three classes: knife, gun and no-weapon are used to train the classifier. To fine tune the weights of the proposed DCNN, it is trained on the images of these classes downloaded from internet and other captured in the lab achieved for weapon classification

Handheld Gun detection using Faster R-CNN Deep Learning; Gyanendra Kumar Verma IEEE Conference 2019.

In this paper we present an automatic handheld gun detection system using deep learning particularly CNN model. Gun detection is a very challenging problem because of the various subtleties associated with it. One of the most important challenges of gun detection is occlusion of gun that arises frequently. There are two types of occlusions of gun, namely gun to object and gun to site/scene occlusion. Normally, occlusions in gun detection are arises beneath three conditions: self-occlusion, inter-object occlusion or by background site/scene structure. Self- occlusion arises when one portion of the gun is occluded by another.

III. METHODOLOGY

- **Data Collection and loading**

In this we are going to import the dataset.

- **Data Preprocessing**

In this we will explore the data.

- **Feature Extraction**

Extract relevant features from the dataset by utilizing bounding box algorithms.

- **Model Selection**

Evaluate different deep learning models such as CNN, RCNN, SSD and YOLOV3 algorithms.

- **Object Detection and Classification**

Apply the trained model to new video frames or images to detect potential weapons.

Utilize algorithms for object detection and classification.

Technologies Used:

DEEP LEARNING

Deep learning is a machine learning method that instructs computers to learn by doing what comes naturally to people. Driverless cars use deep learning as a vital technology to recognize stop signs and tell a pedestrian from a lamppost apart. It is essential for voice control on consumer electronics including hands-free speakers,

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tablets, TVs, and smartphones. Recently, deep learning has attracted a lot of interest, and for good reason. It is producing outcomes that were previously unattainable.

A computer model learns to carry out categorization tasks directly from images, text, or sound using deep learning. Modern precision can be attained by deep learning models, sometimes even outperforming human ability. A sizable collection of labelled data and multi-layered neural network architectures are used to train models.

Deep learning models are sometimes referred to as deep neural networks because the majority of deep learning techniques use neural network topologies.

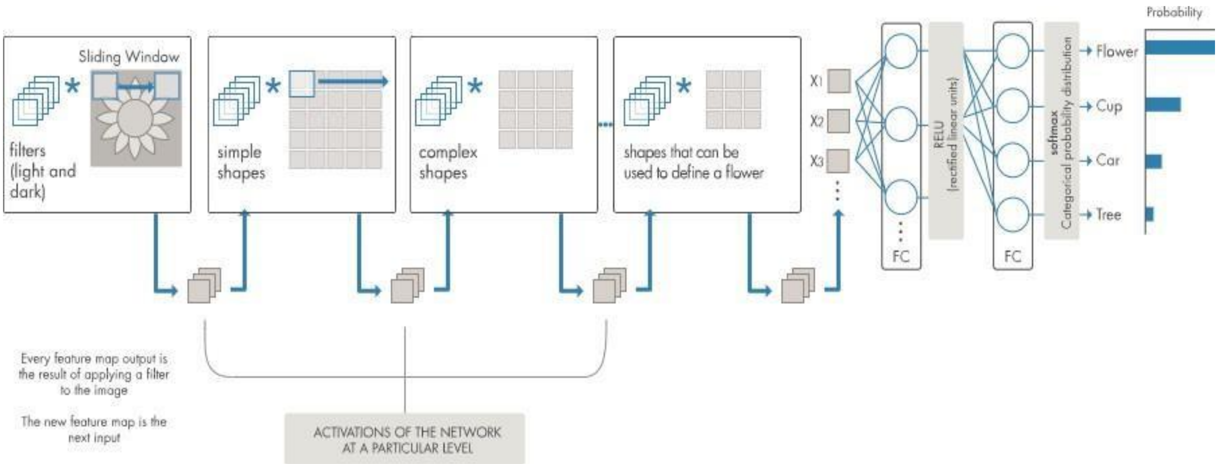

Fig 1: working of deep learning

1. SSD Algorithm A method for police work objects in pictures employing a single deep neural network. Our approach, named SSD, discretizes the output house of bounding boxes into a group of default boxes over completely different facet ratios and scales per feature map location.

2. Faster R_CNN: Faster R-CNN could be a single-stage model that's trained end-to-end. It uses a completely unique region proposal network (RPN) for generating region proposals, that save time compared to ancient algorithms like Selective Search. It uses the ROI Pooling layer to extract a fixed-length feature vector from every region proposal.

3. YOLOv3 Algorithm: YOLO is Associate in Nursing formula that uses neural networks to offer period object detection. YOLO formula is Associate in Nursing formula supported regression, rather than choosing the attention-grabbing a part of a picture, it predicts categories and bounding boxes for the full image in one run of the formula. YOLOv3 (You Only Look Once, Version 3) is a real-time object detection algorithm that identifies specific objects in videos, live feeds or images. The YOLO machine learning algorithm uses features learned by a deep convolutional neural network to detect objects located in an image.

4. YOLOV3 Weights: YOLOv3 is the version three of the YOLO system (YOLOv3 Paper). The neural network model architecture is stored in the yolov3. cfg file, and the pre-trained weights of the neural network are stored in yolov3 weights .There is a file called coco.

OpenCV

OpenCV is the huge open-source library for the computer vision, machine learning, and image processing and now it plays a major role in real-time operation which is very important in today's systems. By using it, one can process images and videos to identify objects, faces, or even handwriting of a human. When it integrated with various libraries, such as NumPy, python is capable of processing the OpenCV array structure for analysis. To Identify image pattern and its various features we use vector space and perform mathematical operations on these features.

OpenCV library modules

OpenCV can read and write images from scratch, draw an image through code, capture and save videos, process images, perform feature detection, detect specific objects and analyze videos, and determine the direction and the motion of an object.

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Image Processing

This module covers various image processing operations such as image filtering, geometric image transformations, colour space conversion, histograms, etc.

Video

This module covers the video analysis concepts such as motion estimation, background subtraction, and object tracking.

Video I/O

This module explains the video capturing and video codecs using the OpenCV library.

Architecture

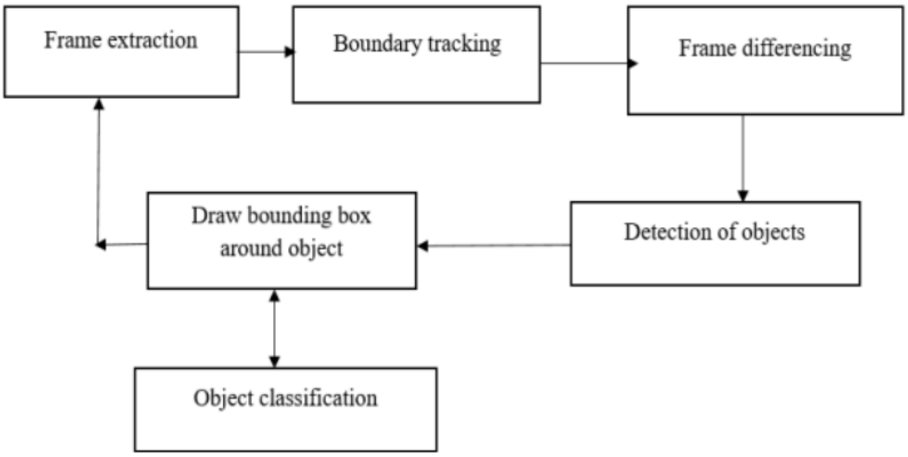
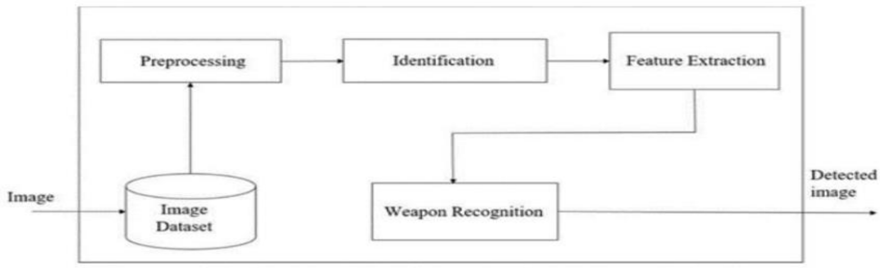
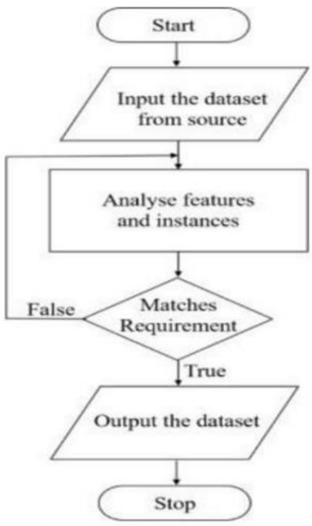


Fig 2: Flow chart of Methodology



System architecture of the weapon detection



Flowchart for the module

Fig 3:

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IV. RESULTS AND ANALYSIS

Output screen1:

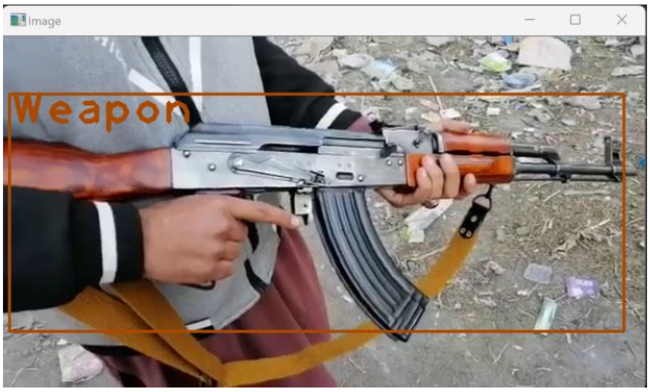

Fig 4: weapon detection

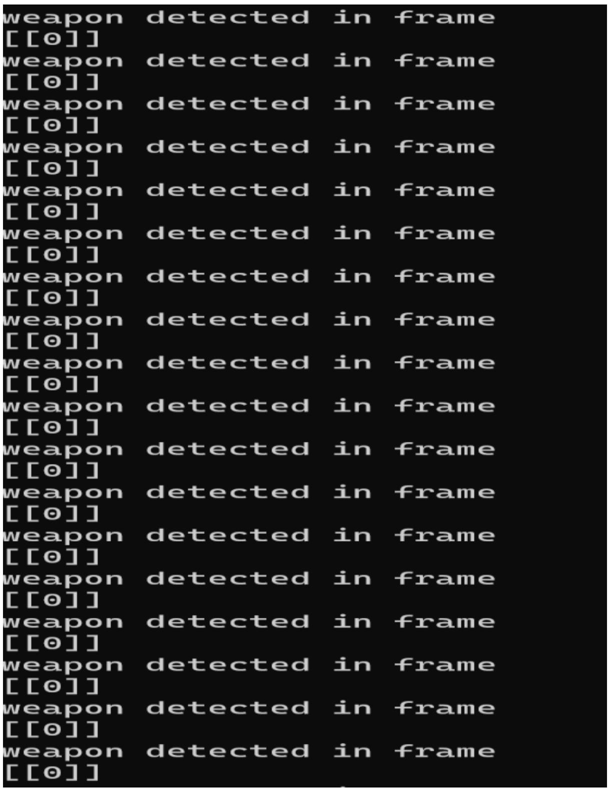

Fig 5: frame-by-frame weapon detection

Output Screen2:

Fig 6: The weapon less input file

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Fig 7: no weapon in the frame

V. CONCLUSION

In conclusion, our study demonstrates the effectiveness of the YOLOv3 algorithm in weapon detection through deep learning techniques. By leveraging the strengths of YOLOv3, namely its real-time processing capabilities and high detection accuracy, we have developed a robust system capable of detecting weapons. The model exhibits a high degree of resilience to variations in lighting conditions, object orientations, and background clutter, making it suitable for deployment in real-world security applications. It underscores the potential of deep learning-based approaches like CNN, RCNN, SSD and particularly the YOLOv3 algorithm. SSD and Faster RCNN algorithms are simulated for pre labelled and self-created image dataset for weapon (gun) detection. Thus implementation of deep learning techniques have successfully accomplished for weapon detection.

VI. REFERENCES

[1] Wei Liu et al., "SSD: Single Shot Multi Box Detector", European Conference on Computer Vision, Volume 169, pp 20-31 Sep. 2017.

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

[3] Ruben J Franklin et.al., "Anomaly Detection 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 Methods 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.

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

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

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

[9] 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.

[10] A. Glowacz et.al., “Visual Detection of Knives in Security Applications using Active Appearance Model”, Multimedia Tools Applications, 2015.

[11] S. Pankanti et.al., “Robust abandoned object detection using region level analysis, ”International Conference on Image Processing,2011.

[12] Ayush Jain et.al., “Survey on Edge Computing - Key Technology in Retail Industry” International Conference on Intelligent Computing and Control Systems,2019.

[13] Mohana et.al., Performance Evaluation of Background Modelling Methods for Object Detection and Tracking,” International Conference on Inventive Systems and Control,2020.

[14] J. Wang et.al., “Detecting static objects in busy scenes”, Technical Report TR99-1730, Department of Computer Science, Cornell University, 2014.

[15] V. P. Korakoppa et.al., “An area efficient FPGA implementation of moving object detection and face detection using adaptive threshold method,” International Conference on Recent Trends in Electronics, Information & Communication Technology,2017.