

WEAPON DETECTION USING ARTIFICIAL INTELLIGENCE AND DEEP LEARNING FOR SECURITY APPLICATIONS

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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. 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. Results are tabulated, both algorithms achieve good accuracy, but their application in real situations can be based on the trade-off between speed and accuracy.

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 [3] [4]. Object detection uses feature extraction and learning algorithms or models to recognize

instances of various category of objects [6]. Proposed implementation focuses on accurate gun detection and classification. Also concerned with accuracy, since a false alarm could result in adverse responses [11] [12]. Choosing the right approach required to make a proper trade-off between accuracy and speed. Figure 1 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 [7] [8] [14].

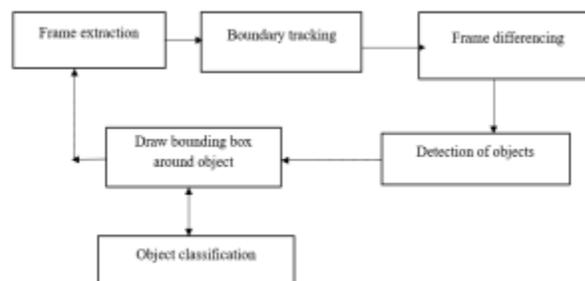


Fig.1.Methodology

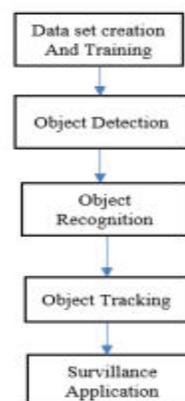


Fig.2. Detection and T racking

The flow of object detection and tracking as shown in figure 2. Dataset is created, trained and fed to object detection algorithm. Based on application suitable detection algorithm (SSD or fast RCNN) chosen for gun detection. The approach addresses a problem of detection using various machine learning models like Region Convolutional Neural Network (RCNN), Single Shot Detection (SSD) [2][9][15].

II. SYSTEM ANALYSIS

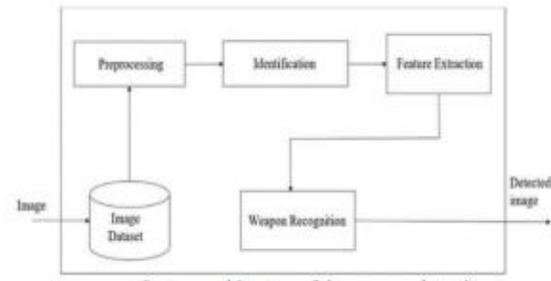
EXISTING SYSTEM:

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 [3] [4]. Object detection uses feature extraction and learning algorithms or models to recognize instances of various category of objects.

PROPOSED SYSTEM:

Proposed implementation focuses on accurate gun detection and classification. Also concerned with accuracy, since a false alarm could result in adverse responses [11] [12]. Choosing the right approach required to make a proper trade-off between accuracy and speed. Figure 1 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.

SYSTEM ARCHITECTURE



III. IMPLEMENTATION

MODULES DESCRIPTION:

User:

The User can start the project by running mainrun.py file. User has to give -input (Video file path). The open cv class VideoCapture(0) means primary camera of the system, VideoCapture(1) means secondary camera of the system. VideoCapture(Videofile path) means with out camera we can load the video file from the disk. Vgg16, Vgg19 has programitaically configured. User can change the model selection in the code and can run in multiple ways.

FASTER R-CNN

Layers of CNN and faster RCNN architecture depicted in respectively. It has two networks RPN to generate region proposals and network for object detection. To generate region proposals it uses selective search approach. Anchors or region boxes are ranked by RPN network. Dataset Creation and Training Images are downloaded in bulk using Fatkun Batch Image Downloader (chrome extension) which can download multiple Google Images at once. Then the downloaded images are labelled. 80% of total images used for training and 20% images for testing. The created ammunition dataset was then trained using Single Shot Detector (SSD) model and made 2669 iterations/steps on the model to ensure that the loss is less than 0.05 in order to increase the accuracy and precision. Figure 5 shows folder

with test and train images. Figure 6 shows image with labels

VGG16:

VGG16 is a convolutional neural network model. Deep Convolutional Networks for Large-Scale Image Recognition". The model achieves 92.7% top-5 test accuracy in ImageNet, which is a dataset of over 14 million images belonging to 1000 classes. It was one of the famous model submitted to ILSVRC-2014. It makes the improvement over AlexNet by replacing large kernel-sized filters (11 and 5 in the first and second convolutional layer, respectively) with multiple 3×3 kernel-sized filters one after another. VGG16 was trained for weeks and was using NVIDIA Titan Black GPU's.

Object Detection and Recognition

To make sure object is detected, changes are made in the label map and tf_record file. Label map is the file which stores the total number of types of objects that will be detected. weapon is added in the label map. It is a popular approach in deep learning where pre-trained models are used as the starting point on computer vision and natural language processing tasks given the vast compute and Object recognition is refers to a collection of related tasks for identifying objects in digital photographs.

Region-Based Convolutional Neural Networks are a family of techniques for addressing object localization and recognition tasks, designed for model performance. You Only Look Once, or YOLO, is a second family of techniques for object recognition designed for speed and real-time use.

IV. CONCLUSION

SSD and Faster RCNN algorithms are simulated for pre labeled and self-created image dataset for weapon (gun) detection. Both the algorithms are efficient and give good results but their application in real time is based on a tradeoff between speed and accuracy. In terms of speed,

SSD algorithm gives better speed with 0.736 s/frame. Whereas Faster RCNN gives speed 1.606s/frame, which is poor compared to SSD. With respect to accuracy, Faster RCNN gives better accuracy of 84.6%. Whereas SSD gives an accuracy of 73.8%, which is poor compared to faster RCNN.SSD provided real time detection due to faster speed but Faster RCNN provided superior accuracy.

REFERENCES

- [1] Wei Liu et al., "SSD: Single Shot MultiBox 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.
- [7] 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.

[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 regionlevel analysis,”International Conference on Image Processing,2011.

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

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

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