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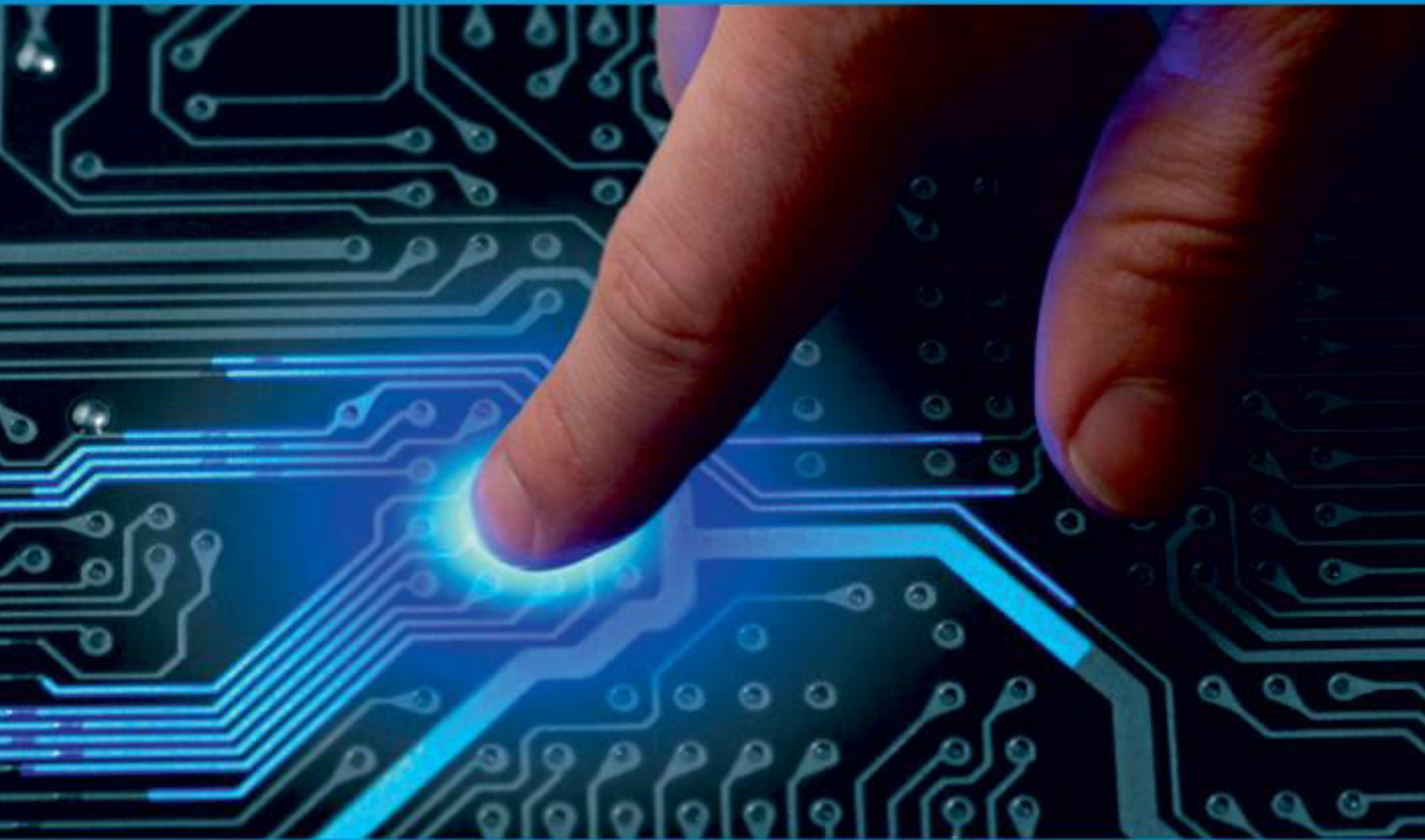

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Anomaly Attack Identification Security System Using Artificial Intelligence and Deep Learning

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ABSTRACT: Safety and security are always given top importance across all industries due to an increase in crime rates at crowded events and in remote, unsettling areas. Computer vision is mostly utilized for anomalous identification and monitoring when trying to address various problems. The need to preserve people's safety, security, and property has raised the need for the adoption of surveillance systems with cameras that can recognize and comprehend scene and anomaly occurrences. These technologies are crucial for tracking intelligence. Using the SSD and Faster RCNN algorithms, study implements automatic gun (or) anomaly detection.. The suggested approach uses two different dataset classifications. The labels were manually applied to the images in one dataset while they were automatically applied in the other. The outcomes are tallied in both based on the trade-off between speed and accuracy.

KEYWORDS: Anomaly detection, Computer vision, Convolution Neural Network (CNN), Faster Region based Convolution Neural Network (RCNN), Single Shot Detection (SSD), Deep Learning.

I. INTRODUCTION

Anomaly or weapon detection is the recognition of irregular, unforeseen, unpredictable, rare events or things that aren't regarded as regularly recurring events or daily items in a pattern or things that are given in a dataset and are utterly dissimilar from current patterns. A pattern that deviates from a number of common patterns might be considered an anomaly in nursing [1]. Anomalies therefore depend on the growth of interest. Object detection recognizes instances of several classes of objects using feature extraction and learning methods or models. Correct gun detection and classification are the main goals of the planned implementation. Accuracy is also important because a warning could trigger negative reactions [2]. Selecting the proper approach needed to create a correct trade-off between accuracy and speed. Within the methodology of anomaly detection exploitation deep learning. Frames ar extracted from the input video. Frame differencing algorithmic program is applied and bounding box created before the detection of object [3].

As the dataset is created, trained, and provided to the object detection algorithmic program, the flow of object detection and trailing is complete. For the purpose of detecting guns, a supported application with the right detection algorithmic program (SSD or fast RCNN) was selected. The method uses a variety of machine learning models, including Single Shot Detection (SSD) and Region Convolution Neural Network (RCNN), to address a large number of detections [4].

Anomaly or weapon 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 [5]. Object detection uses feature extraction and learning algorithms or models to recognize instances of various categories of objects. Proposed implementation focuses on accurate gun detection and classification. Also concerned with accuracy, since a false alarm could result in adverse responses [6]. Choosing the right approach required making a proper trade-off between accuracy and speed. This shows the methodology of anomaly 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].

II. RELATED WORK

Wei Liu et al [8] conventionally used cement –a primary binder also a necessitate element in producing concrete rates first in the construction industry. Production of conventional cement requires a greater skill and is energy

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intensive. The usage of waste materials in the production of concrete and reduction in cement content was only the possible alternative in the past decade. Associated risks with the production of Ordinary Portland Cement are well known.

D. Erhan et al [9] Deep convolutional neural networks have recently achieved state-of-the-art performance on a number of image recognition benchmarks, including the ImageNet Large-Scale Visual Recognition Challenge (ILSVRC-2012). The winning model on the localization sub-task was a network that predicts a single bounding box and a confidence score for each object category in the image. Such a model captures the whole-image context around the objects but cannot handle multiple instances of the same object in the image without naively replicating the number of outputs for each instance.

Ruben J Franklin et.al [10] Deep learning has gained a tremendous influence on how the world is adapting to Artificial Intelligence since past few years. Some of the popular object detection algorithms are Region based Convolutional Neural Networks (RCNN), Faster RCNN, Single Shot Detector (SSD) and You Only Look Once (YOLO). Amongst these, Faster-RCNN and SSD have better accuracy, while YOLO performs better when speed is given preference over accuracy.

III. PROPOSED ALGORITHM

A. *System Design:*

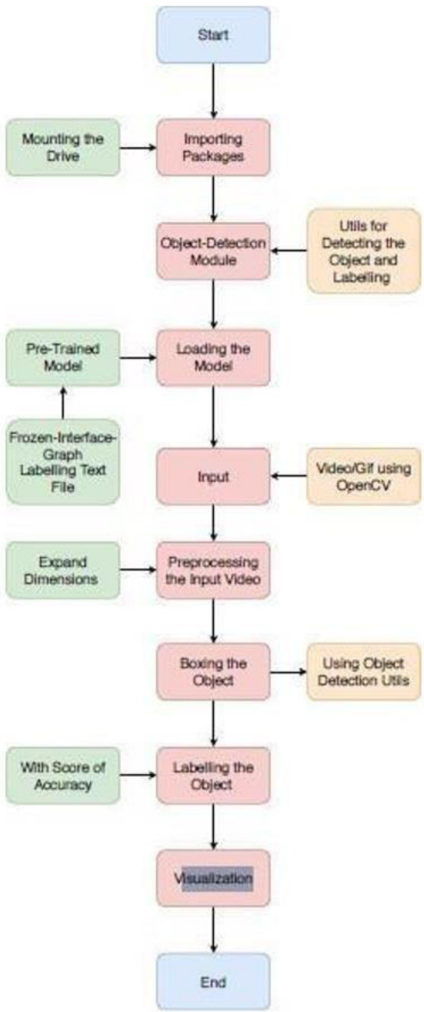

Fig. 1: Flow Chart

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USE CASE DIAGRAM

A use case diagram in the Unified Modeling Language (UML) is a type of behavioral diagram defined by and created from a Use-case analysis. Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals (represented as use cases), and any dependencies between those use cases. The main purpose of a use case diagram is to show what system functions are performed for which actor. Roles of the actors in the system can be depicted.

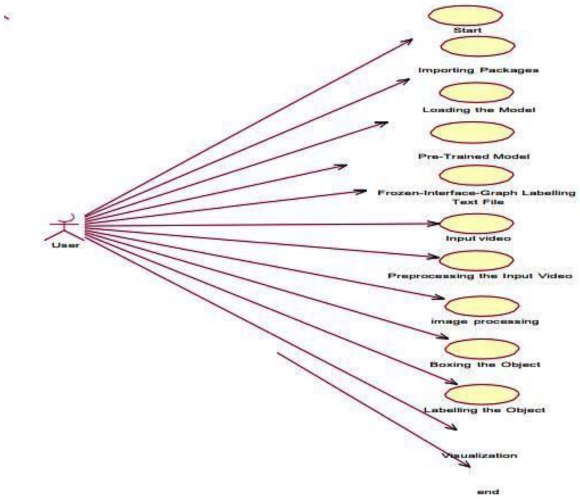

Fig. 2: Use Case Diagram

CLASS DIAGRAM

In software engineering, a class diagram in the Unified Modeling Language (UML) is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among the classes. It explains which class contains information.

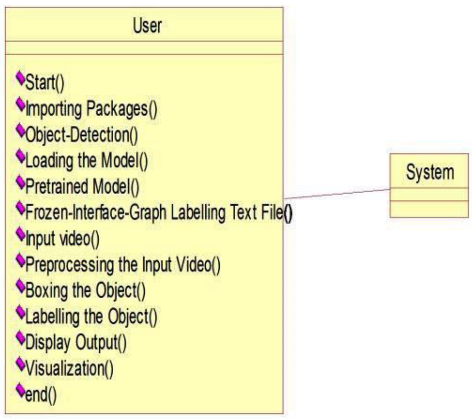

Fig. 3: Class Diagram

SEQUENCE DIAGRAM

A sequence diagram in Unified Modeling Language (UML) is a kind of interaction diagram that shows how processes operate with one another and in what order. It is a construct of a Message Sequence Chart. Sequence diagrams are sometimes called event diagrams, event scenarios, and timing diagrams.

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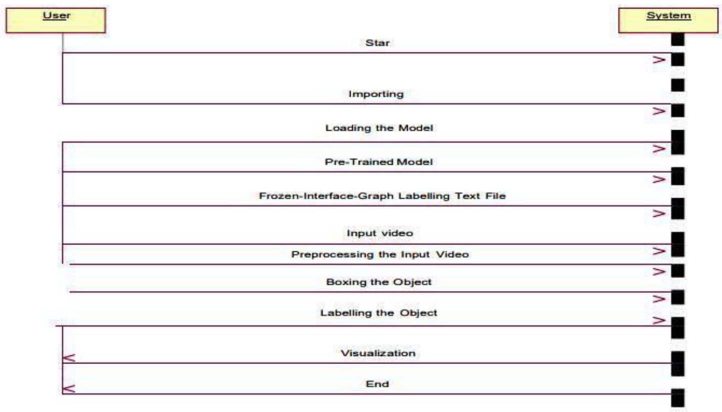

Fig. 4: Sequence Diagram

B. *Description of the Proposed Algorithm:*

This concludes that the pre labelled dataset provided better accuracy because it is trained for millions of images in comparison to the self-created dataset

Aim of the proposed algorithm is to maximize the superior accuracy and speed. The proposed algorithm is consists of following main steps.

Step 1: 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.

Step 2: Create CSV files for the image labels
XML data is converted into CSV file by executing this command in Anaconda Prompt: python xml_to_csv.py

Step 3: Generated CSV file of test and training dataset.
The training of Faster R-CNN algorithm with training loss less than 0.15.Figure 11 describes pseudo code of faster RCNN

IV. PSEUDO CODE

Pseudocode of faster RCNN

Step 1: **Initialize the parameters**
confThreshold->0.5 #Confidence threshold for bounding box predictions
maskThreshold -> 0.3 #Mask threshold for binary masks
Load the models
weightsPath>.../frozen_Inference_graph. Pb #pre-trained weights
configPath>.../rcnn_inception_v2_coco_pets, pbtxt #text graph file to load model onto OpenCV

Step 2: **Initialize the video stream**
vs -> cv2.VideoCapture.../ anomaly_video.mov) #loading the video

Step 3: **Process each frame**
grabbed, frame -> vs. read () #reading each frame and returning the coordinates of the frames
blob-> cv2.dnn.blobFromImage(frame) #creation of 4D blob from a frame
net.setInput (blob) #passing the blob as an input to the ConvNets

Extract the bounding box and drawing the box for each detected object

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```
for i in range(numDetections):
        box -> boxes [0, 0, i]
        mask-> masks[1]
                left> int (frameW box [3]) #Acquiring bounding boxes
                top>int (frameH box [4])
                right> int (frameW□ box [5])
                bottom-> int (frameH box [6])
cv2.rectangle(frame, (startX, startY), (endX, endY), colour, 2) #drawing bounding boxes
```

V. SIMULATION RESULTS

For the problem of gun detection, Faster R-CNN trained using Google Net obtained a 55.45% of AP50 (AP at IoU=0.50). Faster R-CNN using a Squeeze Net obtained 85.44% of AP50, a significant difference over Google Net. The precision recall curve acquired for Squeeze Net is shown in Figure 2. This detector achieved good results, improving upon previous results described in the literature.

Sr.No	Algorithms	Precision	Recall	F1-score
1	VGG16	80.00%	83.47%	81.69%
2	Inceptionv3	84.36%	84.36%	84.36%
3	Inception-ResNetV2	85.52%	85.98%	85.74%

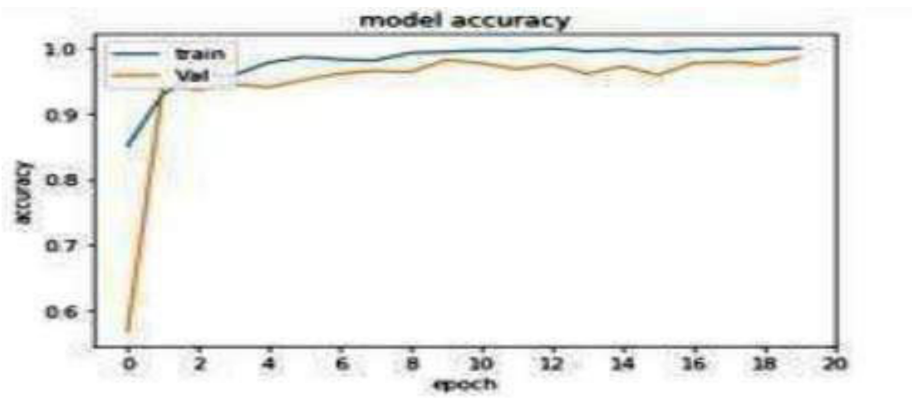

Fig. 5: Model Training Accuracy vs Validation Accuracy

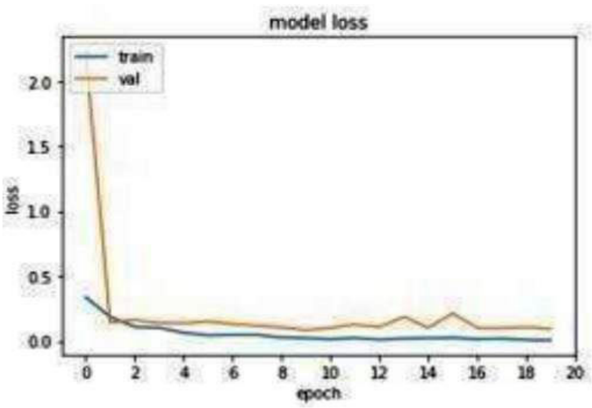

Fig. 6: Model Training Loss vs Validation Accuracy

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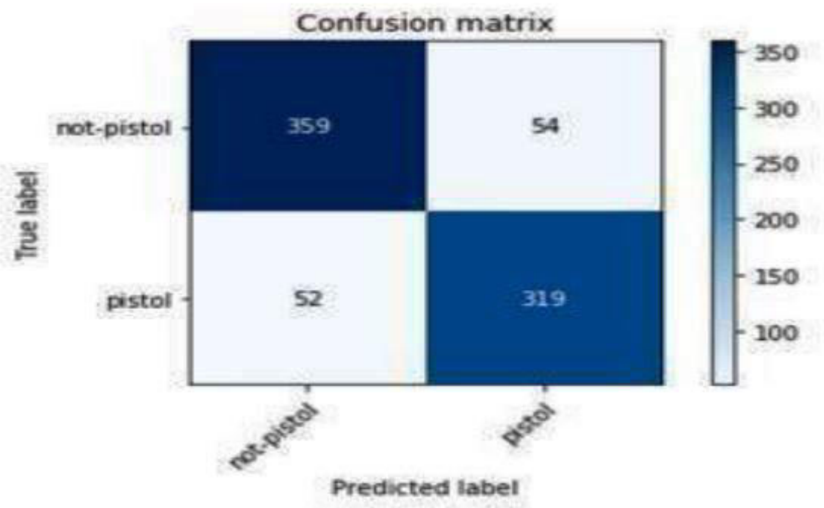

Fig. 7: Confusion Matrix

VI. CONCLUSION AND FUTURE WORK

For the purpose of detecting anomalies (such as guns), pre-labeled and self-created image datasets are subjected to SSD and Faster RCNN simulations. Both algorithms are effective and produce good results, but they cannot be applied in real time without sacrificing accuracy for speed. The SSD algorithm offers a faster speed with 0.736 s/frame. In contrast, Faster RCNN has a poor performance of 1.606s/frame when compared to SSD. Faster RCNN provides superior accuracy, with a score of 84.6%. While RCNN is faster, SSD only provides an accuracy of 73.8%, which is subpar. Due to its higher speed, SSD allowed for real-time detection, but faster RCNN offered greater accuracy. Additionally, it may be used to bigger datasets by employing GPU training

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