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Weapon Detection System

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Abstract: Security is always a main concern in every sphere, due to a rise in crime rate in a crowded event or suspicious lonely areas. Anomalydetection and observance have major applications of computer vision to gear various problems. Due to demand in the protection of safety, security of private properties placement of surveillance systems can recognize and interpret the scene and anomaly events play a vital role in intelligence observance. Detection of weapon and militant using convolution neural network (CNN). Proposed implementation uses two types of datasets. One dataset contains pre-labelled images. And the other one labelled manually contains a set of images. Results are tabulated, both algorithms achieve good efficiency, but their operation in real situations can be based on the trade-off between speed and efficiency. Crime is defined as an act dangerous not only to the person involved, but also to the community as a whole. It is to predict the crime using image datasetand finally calculate accurate performance of the detector. The propose algorithms that are able to alert the human operator when a weapon and militant is visible in the image. It is mainly focusedon limiting the number of false alarms in order to allow for real life application of the system. For future work, it is planned to use in live applicationand to improve the detection and reduce the crime.

I. INTRODUCTION

Currently, numerous cases of crimes are reportin public place, home using different types of weapon and militants such as firearms, swords, cutters, etc. To observe and decrease such types of crimes, CCTV camera is installed in public places. Generally, the surveillance footage recorded through these cameras are covered bysecurity staff. Success and failure of detecting crime rely upon the awareness of operator. It isnot always possible for a person to pay attention on all the surveillance footage on a single screen recorded through multiple video cameras. Nature and extent of crime depends on the types of weapons and militant that is used.

If a video surveillance system has the ability to generate a prior alert, then by timely reaction losses may be reduced to the maximum extent. Advantage of weapon and militant classification can also be added to a surveillance system. Weapon and militants may be classified either using standard approaches with machine learningclassifier or by using deep learning-based approach. The trained model is further used for labelling any new input image. Efficiency of suchtypes of approaches depends on the robustness and diversity of extracted features. To overcome these limitations, deep Convolutional Neural Networks is better to be used as it does not bear any explicit feature of the input image. DeepConvolutional Neural Networks consist of a number of convolutional layers, pooling layers and fully connected layers.

II. LITERATURE SURVEY

1) JIANYU XIAO SHANCANG L et al.developed advanced forensic video analysistechniques to assist the forensic investigation. Anadaptive video enhancement algorithm based on contrast limited adaptive histogram equalization (CLAHE) is introduced to improve the closed- circuit television (CCTV) footage quality for theuse of digital forensic investigation. To assist thevideo-based forensic analysis, deep learning- based object detection and tracking algorithm areproposed that can detect and identify potential suspects and tools from the footage.
2) JEONG SEO AND HYE YOUNG PARK et al. proposes a framework for recognizing objectsin very low-resolution images through the collaborative learning of two deep neural networks: The proposed image enhancement network attempts to enhance extremely low- resolution images into sharper and more informative images with the use of collaborative learning signals from the object recognition network. It also utilizes the output from the imageenhancement network as augmented learning data to boost its recognition performance on verylow-resolution objects
3) Harsh Jain et. al implements automatic gun (or) weapon detection using a convolution neuralnetwork (CNN) based SSD and Faster RCNN algorithms. The proposed implementation uses two types of datasets. One dataset, which had pre-labelled images, and the other one is a set of

4) Shenghao Xu developed a weapon detection system based on TensorFlow, which is an open- source platform for machine learning; the Single Shot Multi Box Detector (SSD), a popular object detection algorithm; and MobileNet, which is a convolution neural network (CNN) for producinghigh-level features.
5) Shuiwang Ji et al put forward a method for theautomated recognition of human actions insurveillance videos. Developed a novel 3D CNNmodel for action recognition Convolutional neural networks (CNNs) are a type of deep modelthat can act directly on the raw inputs. To boost the performance, it includes regularizing the outputs with high level features and combining the predictions of a variety of different models.
6) Shifu Zhou et al suggested a method fordetecting and locating anomalous activities invideo sequences of crowded scenes. The key for method is the coupling of anomdescribon with a spatial-temporal Convolutional NeuralNetworks. This architecture allows us to capture features from both spatial and temporaldimensions by performing spatial-temporalconvolutions, thereby, both the appearance and motion information encoded in continuous frames are extracted.
7) Weapon and militant classification using deepConvolutional neural networks; Neelam DwivediIEEE Conference CICT 2020. This paper presents a novel approach for weapon and militant classification using Deep Convolutional Neural Networks (DCNN). That is based on the VGG Net architecture. VGG Net is the mostrecognized CNN architecture which got its placein Image Net competition 2014, organized for image classification problems.
8) Warsi A et al. have contributed to automatically detecting the handgun in visualsurveillance by implementing YOLO V3 algorithm with Faster Region-Based CNN (RCNN) by differentiating the number of false negatives and false positives [20], thus, taking real-time images and incorporating with ImageNet dataset then training it using YOLO V3algorithm 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.
9) Wu et al. proposed a weapon detection systemthat combines YOLOv3 and CNN. The proposedsystem first uses YOLOv3 to detect objects within an image, including potential weapons. The resulting bounding boxes are then passed to a CNN, which classifies the objects within the boxes as either weapons or non-weapons.
10) Jiang et al. proposed a weapon detection system that combines deep learning and traditional computer vision techniques. The system uses a YOLOv3 object detection algorithm to identify potential weapons in animage, which are then passed to a CNN for classification.
11) Weapon Detection Using YOLOv3 and CNN" by S. Jain and S. K. Dubey. This paper presents a weapon detection system that usesYOLOv3 object detection algorithm and CNN forclassification.

III.PROPOSED SYSTEM

Security and protection are a difficult task in today’s modern day world. In order to provide safety for public it is important to have a system that can recognize the unlawful activities.

To tackle this problem we have created a computer based system to identify weapons and militants from the live surveillance camera.

We have implemented this proposed system using YOLOv3, CNN and python to detect weapons and militant. Initially, a dataset is created by collecting images from different resources which consists of various classes of weapons.

This dataset of annotated images of weapons and militant is split training, validation, testing sets and converting into YOLOv3 format.

The YOLOv3 model is then trained on the annotated dataset and evaluated using variousmetrics such as precision, recall and mAP. Once the model is trained and evaluated, I t is deployedto detect weapons and militants in real time images or videos along with the confidence scoreof each detected object using python libraries likeOpenCV or Pytorch.

IV. METHODOLOGY

In this work, we have attempted to develop an computer based system for security purpose that distinguishes the weapons progressively, if identification is true it will caution the security personals to handle the circumstance by arriving at the place of the incident through surveillance cameras.

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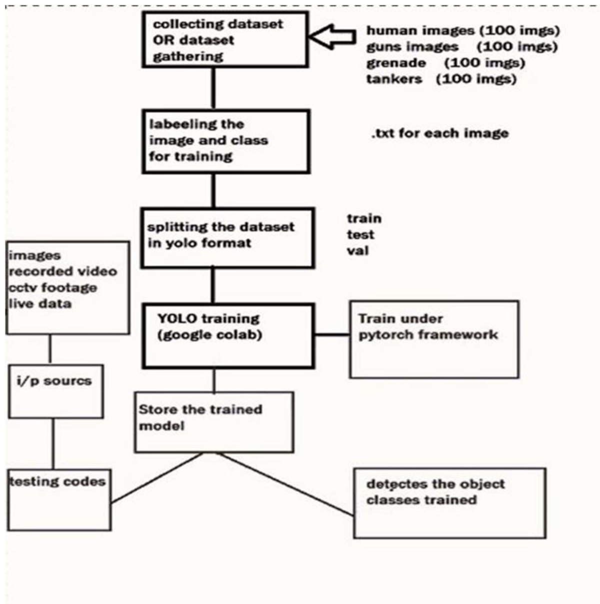


Our work starts with collecting the dataset from various sources, then the collected dataset will undergo complete analysis. The image is selectedfor testing/training purpose only if it matches therequirements and is not repeated. The analysis ofimage involves pre-processing using YOLOv3 which does image sharpening, labelling ofimages, removes noise and background subtraction and considers only the image with finer details. Next step is used to extract featuresfrom the pre-processed image received as input. In CNN, we take the output from the high-pass filter as input, as CNN is a classifier it has a feature extracting process of its own, using its hidden layers which works in iterations to give afinal output.

We have adopted the concept of deep learning that is YOLOv3 and convolutional neural network. YOLOv3 is used to detect the object it takes the entire image at a single time into the CNN and predicts the output through bounding box coordinates and class probabilities. Convolutional neural network is used for featureextraction and classification of the input image.

A. CNN Consists of 4 Layers

1) Convolutional Layer
2) Rectifying Layer
3) Pooling layer
4) Fully connected layer and Output Layer

a) Convolutional Layer

Convolutional Layer is the first layer in CNN, here 3*3 part of the given matrix which was obtained from High-pass filter is given as input. That 3*3 matrix is multiplied with the High-passfilter matrix for the corresponding position and their sum is written in the particular position.

0	60	6	79	0
35	52	47	90	0
62	63	35	0	0
0	0	0	0	0
0	0	0	0	0

X

1	0	-1
1	0	-1
1	0	-1

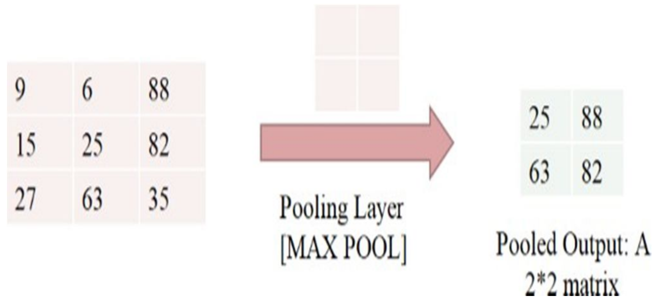
9	6	88
15	25	82
27	63	35

9	6	88
15	25	82
27	63	35

Convolutional Output: A 3*3 matrix

Convolution is followed by the rectification of negative values to 0s, before pooling. Here, it is not demonstrable, as all values are positive.

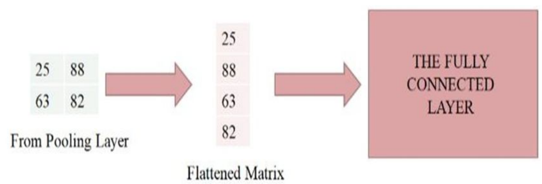
b) Pooling Layer

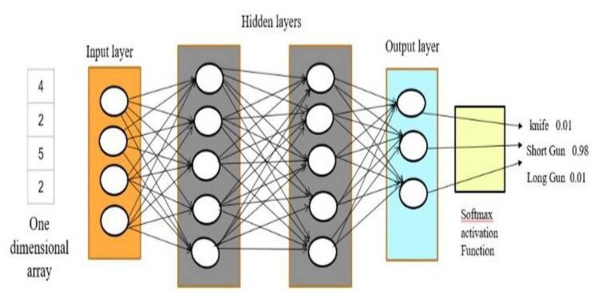


In Pooling layer 3*3 matrix is reduced to 2*2 matrix, which can be done by selecting the maximum of the particular 2*2 matrix for the particular position. Figure 4.16 shows the PoolingLayer.

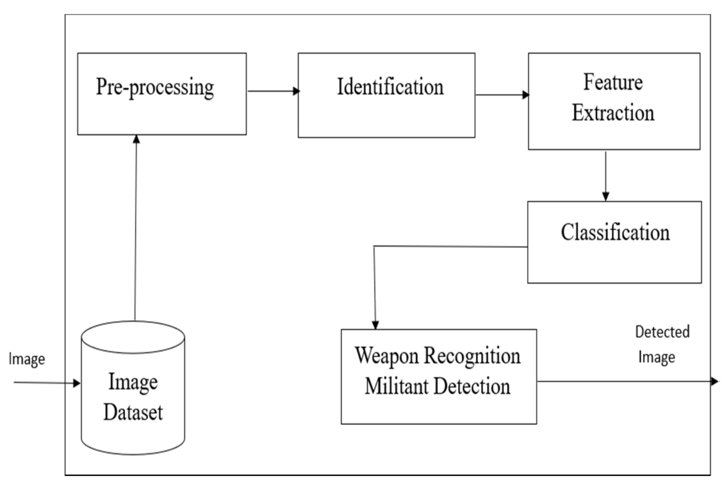
c) Fully Connected layer and Output Layer

The output of the pooling layer is flattened and this resultant matrix is fed into the FullyConnected Layer. In the fully connected layer there are several layers, Input layer, Hidden layerand Output layers are part of it. Then this output is fed into the classifier, in our case SoftMax Activation Function is used to classify the imageinto weapon and militant present or not.

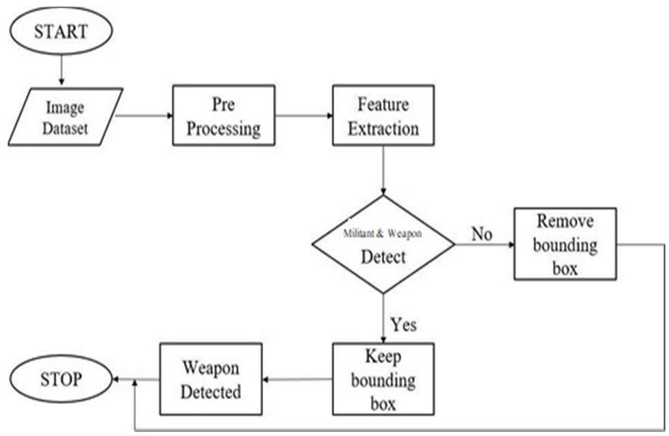




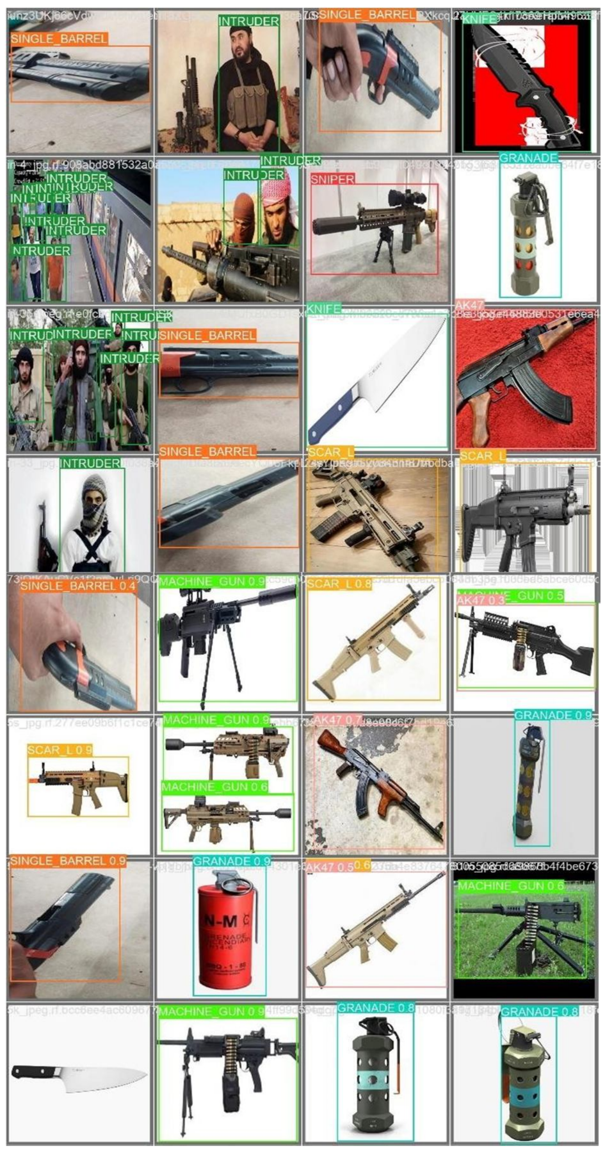
B. System Architecture



C. Flowchart



V. RESULTS



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VI. CONCLUSION

In this stage one-dimension array is used for the final classification process. The output image obtained from feature extraction is given as input tothis process. Where continuous classification of allthe features obtained from the previous stage. Eachnode of the input layer has a value from a one dimension array which represents the feature from the extracted region. That is sent to the hidden layer. Multiple features are getting from the input layer and undergo multiple iteration in the hidden layer. Finally get the predictive values by applying SoftMax activation function to it. Then, get some output values from this process and these values undergo further process. The highest value in the predictive value is considered as output identified as weapon and militant. By using these methods, the weapon and militant will be detected by considering highest accuracy values.

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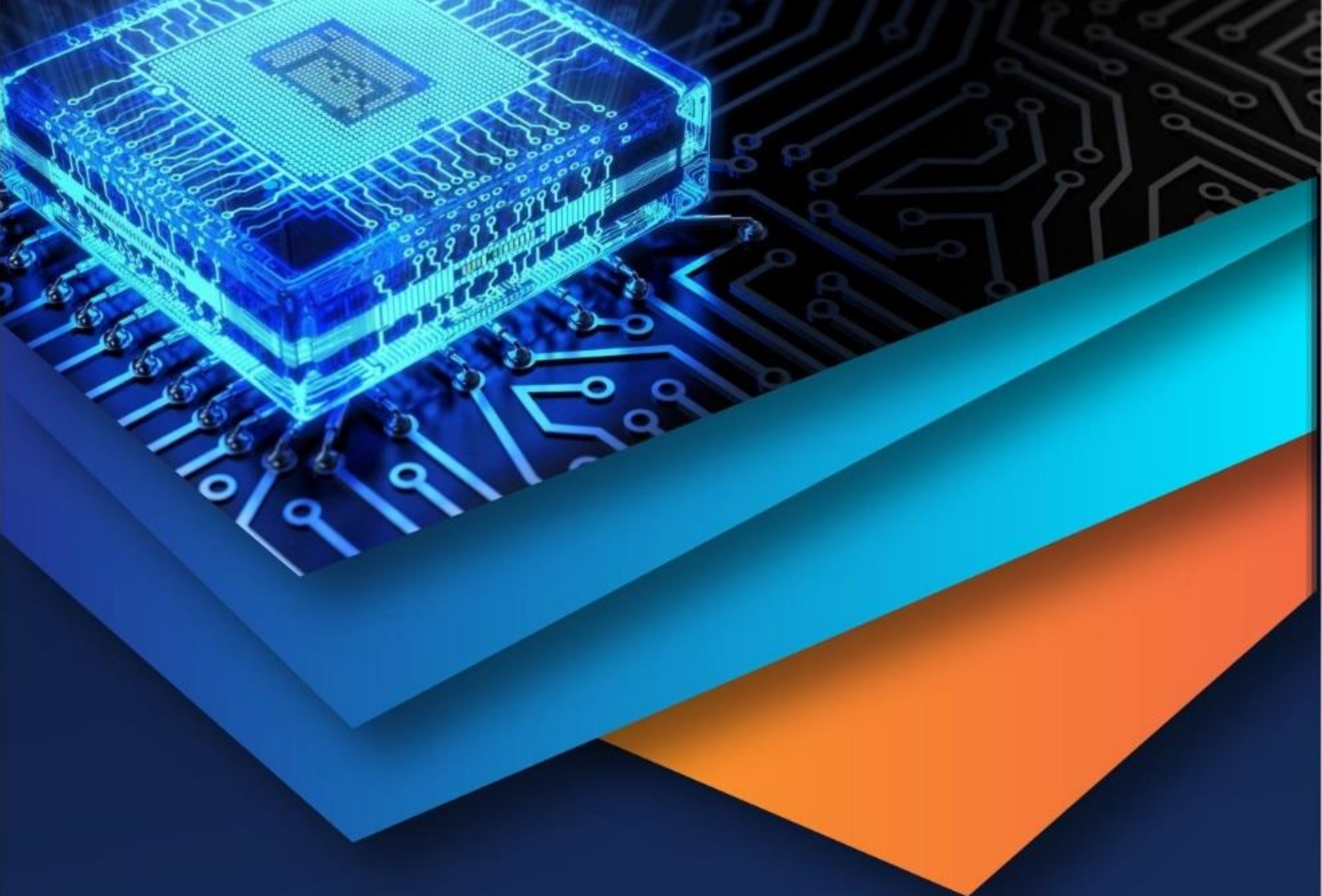

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