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ARTIFICIAL INTELLIGENCE ENABLED PUBLIC SAFETY MONITOR

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Abstract - Object detection has been utilized in plenty of areas, which includes surveillance structures. This paper researches the utility of the YOLOV4 algorithm to create a weapon detection system, demonstrating its effectiveness on this task. The system detected the existence of a weapon in a scene through a way of approach of collecting over 1600 gun and knife snapshots which have been fed proper right into a convolution neural network for schooling and validation. Studies display that a fast reaction from regulation enforcement agents is the primary aspect in decreasing the quantity of victims. However, a huge quantity of cameras to be monitored ends in an overload of CCTV operators, producing fatigue and stress, consequently, a lack of performance in surveillance. Convolutional neural networks were proven to be green withinside the detection and identity of objects in images, having occasionally produced extra correct and constant effects than humans.

***KeyWords*: Convolutional neural network, Roboflow, Google colab, Python, Android studio, Machine learning, Deep learning**.

1. INTRODUCTION

An Individual wearing firearms in public settings is a robust indicator of viable risky conditions. Recently there was a boom withinside the range of incidents wherein people or small agencies employ firearms for you to injure or kill as many humans as feasible. Surveillance structures which include closed-circuit television (CCTV) and drones are getting more and more common. Research suggests that the set up of CCTV structures enables mass capturing incidents. Despite assisting to fight crime, the massive range of cameras ends in a massive overhead for its operators.[19] The utility of cameras in surveillance may be on security, then a device able to routinely detect firearms in snapshots could permit a quicker and greater green response from regulation enforcement operatives. One of the maximum promising strategies for the advent of automatic surveillance structures is machine learning and computer vision.

1.1 CONVOLUTIONAL NEURAL NETWORKS(CNN):

In deep learning, a convolutional neural network is a category of deep neural networks, mostly carried out to studying visible imagery. They are also called shift invariant or area invariant synthetic neural networks, primarily based totally on the shared-weight structure of the convolution kernels that test the hidden layers and translation invariance characteristics.[5] They have packages in photo and video recognition, recommender systems, photo classification, Image segmentation, clinical photo analysis, natural language processing, brain-pc interfaces, and monetary time series.

1.2 ROBOFLOW:

Roboflow is a Computer Vision developer framework for higher information series to preprocessing, and version education techniques. Roboflow has public datasets effectively to be had to customers and has got admission to customers to add their personal custom records also. Roboflow accepts diverse annotation formats. In records pre-processing, there are steps concerned which includes photo orientations, resizing, contrasting, and records augmentations.[18] The complete workflow may be coordinated with groups in the framework. For version education, there's a gaggle of version libraries that already exist which includes EfficientNet, MobileNet, Yolo, TensorFlow, PyTorch, etc. Thereafter version deployment and visualization alternatives also are to be had subsequently encompassing the whole state-of-art. Roboflow is utilized in diverse pc imaginative and prescient industries to be used instances which includes – fuel line leak detection, plant vs weed detection, aeroplane maintenance, roof harm estimator, satellite tv for pc imagery, self-driving cars, visitors counter, rubbish

cleaning, and a lot.

1.3 ANDROID STUDIO

Android-Studio is the legitimate integrated development environment (IDE) for Google's Android working system, constructed on JetBrains' IntelliJ IDEA software program and designed especially for Android improvement. It is to be had for download on Windows, macOS, and Linux-primarily based totally working structures or as a subscription-primarily based totally provider in 2020. It is a substitute for the Eclipse Android Development Tools (E-ADT) because of the number one IDE for local Android utility improvement.

1.4 GOOGLE COLAB

Google Colaboratory, or "Colab" for short, is a product from Google Research. Colab permits everyone to put in writing and execute arbitrary python code via the browser and is specifically nicely proper to machine learning, information evaluation, and education.

2. METHODOLOGY

Initially, the dataset is needed to be uploaded in RoboFlow to train and test neural networks and then after uploading, the coding part of roboflow is done using python. Then the execution code needed to be given and run.

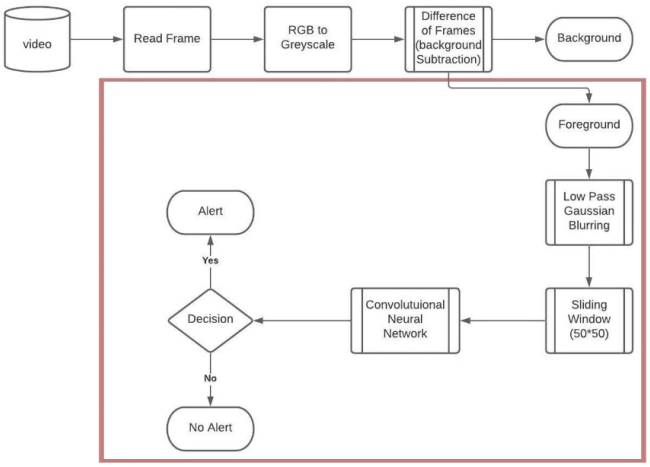


Fig - 1 : Block DIagram of Artificial Intelligence-Based Public Safety Monitor

2.1 RGB TO GRAYSCALE CONVERSION

RGB to Grayscale Conversion is performed in order to simplify the complexity of each frame and speed up the operation of the subsequent Background subtraction and segmentation stages. Grayscale images are computed much faster compared to RGB images when performing segmentation operations such as window sliding.

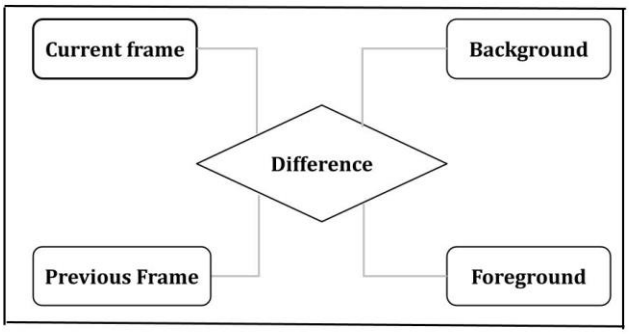


Fig -1: RGB to Grayscale Conversion

2.2 BACKGROUND SUBTRACTION

Background subtraction is one among the key techniques for automatic video analysis, especially within the domain of video surveillance. During this work, three different approaches towards background subtraction and segmentation were tested. The Visual Background Extractor and Improved Gaussian Mixture Model methods and Difference of frame background subtraction algorithm.

2.3 FILTERING OPERATION

Due to various lighting fixtures situations and different interferences, the extracted foreground item is extraordinarily noisy. This impacts the overall performance of consequent operations that could take quickly and call for excessive computational necessities via a means of developing fake areas of hobby which bring minimum information.[17]Dilation and Erosion operations have been accomplished at the extracted foreground item so that you can do away with small white noises that arise due to lighting fixtures adjustments and becoming a member of disparate factors in a picture. The kernel (structuring element) length that yields the specified output is selected after successive experiments.

2.4 SLIDING WINDOW

As the dangerous object may be at any location within the foreground frame a window technique is employed. A window could be a rectangular region of fixed width and height that slides across a picture. The window technique significantly minimizes the world to be inspected by the training algorithm, the dimensions and slide step is chosen after numerous experiments and is subject to vary within the future. Figure shows a frame with multiple windows on the foreground object.

2.5 CLASSIFICATION

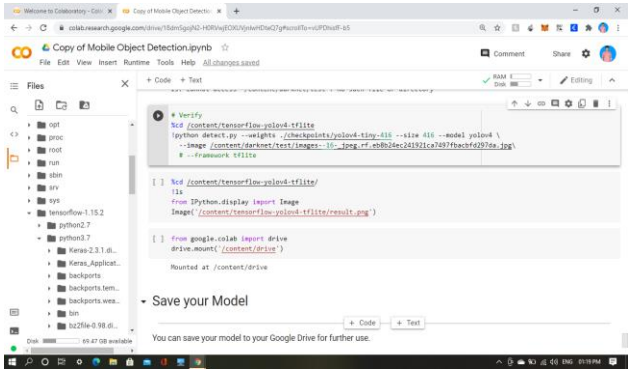
Classification of an object as either a treat (gun) or non-treat is completed by a Tensorflow based implementation of Convolutional Neural Network (CNN) algorithm. The input to the CNN is a picture of either fixed or variable dimension that's generated by the window operation within the previous stage. Then the image is resized to a predetermined size and shape into the Convolution Neural Network for classification.

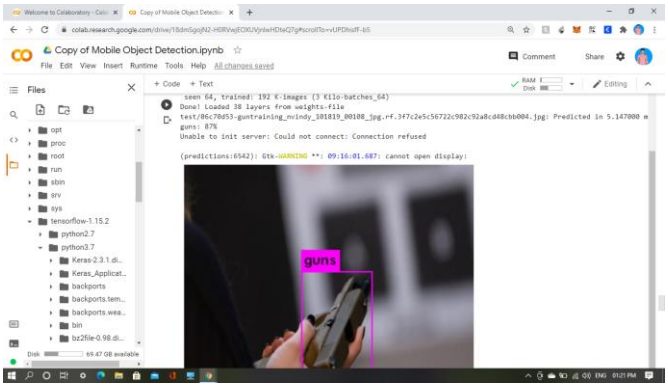
3. RESULT AND DISCUSSION

A set of videos accustomed to test the proposed firearm detection method were obtained which were utilized by researchers. The CNN training\testing dataset consists of 4000 images with 30% split. to cut back the training time and therefore the computational complexity of the training algorithm, the dataset is augmented (such as blurring, greyscale, etc) and therefore the color information is discarded. Experimental results have shown that the data carried by the annotation is quite enough to explain the gun and knife object thus the colour is discarded to cut back the dimensionality.

From the experimental results and observations made it absolutely was clear that the predictive models like YOLOv4 provides a way more detailed result and also are far better immune to noise and sudden intensity changes that occur especially when operating in an outside environment. Out of the 2 methods, the YOLOv4 algorithm is substantially faster and offers a higher result. But both the algorithms are comparatively much slower, requiring high computational power and memory. The Frame Difference method, on the opposite hand, is way faster and is a smaller amount computationally intensive but gives a less detailed result which is stricken by noise significantly. Automatic detection of firearms is usually meant to be from security cameras found inside an internal environment (Theaters, Mall, Classrooms, etc.) that have a controlled scenery with less frequent intensity changes and high frequency moving objects (trees). Thus the Frame Difference approach is often used without the loss of much detail available for the subsequent stages of the system .[1] Performing morphological operations on the extracted foreground object has shown effect of reducing small flickering white noises that occur because of sudden lighting changes and camera autofocus, but this operations have undesired effect on the performance of the greyscale detection because the foreground objects get significantly diminished those causing discontinuities in the output of the operation. Therefore during this work morphological operations are taken as optional only applied if the scenery is extremely noisy, otherwise, results without morphological operation appear to be desirable.

4. OUTPUT





5. CONCLUSIONS

In this proposed paper we propounded and applied a unique hand-held gun detection technique for surveillance and alert systems. The device consists of CNN primarily based totally VGG-16 architecture as a characteristic extractor, accompanied with the aid of using cutting-edge classifiers carried out on a general gun database. With 93% accuracy, the maximum auspicious outcomes had been procured. Our device can determine the life of several weapons in actual time and it's far strong throughout the version in affine, scale, rotation and partial closure or occlusion. Although, we presume that through imposing the radical method, the overall performance of our device may be subtle and its actual time processing necessities like complexity of area and time may be diminished. For evaluating the accuracy of the device comes 93.1%, that's more than both methods. Also, in the future, with the availability of more and more images, representing diverse cases, the efficiency of the models may be scaled up.

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