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FIRE AND GUN VIOLENCE BASED ANOMALY DETECTION USINGDEEP NEURAL NETWORKS

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Abstract - On **Abstract:** In latest years, terror attacks seem to happen more often in public areas such as banks, schools and transportation system. In these areas surveillance systems have been used to identify suspicious individuals. Real-time object detection to improve monitoring methods are one of the desired applications of Convolution Neural Networks (CNNs). In this paper, we introduce a low-cost fire detection CNN architecture. The project is close to the discovery of fire and guns in camera-operated areas. Household fires, modern blasts, and rapidly spreading fires are a significant cause of the devastating impacts on the environment.Convolutional neural network-bases approaches have been very successful in image/video cataloguing and object recognition. In this project, the weapons are identified from the video, images, and webcam feeds. These are used to classify them to assistance further investigations by security personnel.

Weapon savagery and mass shootings are also increasing in some regions of the planet. Such events are time consuming and can result in serious loss of life and property. Therefore, the proposed project has developed an in-depth learning model based on the YOLOv3 algorithm that analyses the video frame by frame in order to detect what is confusing in real time and issue a warning to the relevant authorities.

INTRODUCTION

This project aims to develop a cost-efficient system that includes fire and gun detection for security purposes at a low cost. You Only Look Once is a real-time object identification system based on neural networks. Because of its speed and precision, this algorithm is quite popular. This project work uses a YOLO object detection system that uses convolution neural networks to locate the object.Guns and firearms found on CCTV videos on the site take up only a small portion of the entire framework, which is why our main goal is to use a technique that can precisely draw various bounding boxes for low standard videos. In addition, the detection should be constant with high exactness as projected process may be sensitive in time.

Additionally, there should be a low number of false-positive test results since the professionals are being informed once a recognition over the limit is generated. Closed Circuit Television (CCTV) cameras put on video record 24 hours per day , however, there are inadequate staff to monitor each camera for a variety of abnormal events. There are fire detection systems using smoke sensors in many areas such as schools, educational institutions, etc. However, a cost-effective system that combines fire and the gun detection for security purposes is a matter of time. Surveillance programs such as closed televisions and drones are becoming increasingly common. The objective of this project is to improve accuracy by using the YOLOv3 algorithm to segment the image into pixels. Our project involved developing deep neural networks to detect fires and guns in areas monitored by cameras. The main goal of our project is to create a system that monitors location data and sends alerts in the event of a fire or firearm. With the fast development of urbanisation around the world, both the number of permanent citizens and population density is increasing. When a fire breaks out, it poses a serious warning to humankind and results in significant financial damages.

As a result, fire and gun detection is critical to safeguard people's lives and property. Various sensors such as smoke sensors, temperature sensors, and infrared ray alarms are used in contemporary detection systems in cities. Although these alarms can be useful, they have significant drawbacks. To trigger a warning, a large number of particles in the air must first be detected. The aim of early warning is defeated if a fire is already too intense to control when an alert is triggered. Second, most alarm is only useful in a controlled environment, making them ineffectual in public spaces. Finally, there could be incorrect1 alarms. It will automatically activate when the non-fire particle concentration reaches the alarm concentration.

It is important to develop a fire alarm system in advance to prevent fires and slow down the spread of fires. The rapid spread of urban fire fighting systems provides a framework for camera-based fire alarm systems and the development of an automatic camera-based fire alarm algorithm can achieve 24/7 automatic fire monitoring without interruption, greatly reducing human costs.The financial viability of such systems improves dramatically when costs are reduced.

Fire and ammunition detection method that combines a stand-alone fire pixel variant with a RGB color model that tests non-combustible color pixels, based on many flame features. The frame working consistency detection in the pre-processing module is fast. It also has low environmental essentials and does not need to take into account the time of day, the weather, or other factors. Furthermore, the RGB/HIS colour model used is adequately consistent. Flame parameters are then combined using a number of pixel flame points, convex shell, and centroid, taking into account spatial variability, spatial variability, boundary complexity, and form variability characteristics. Finally, to be sure, a support vector machine is used.

Through video processing, a camera-based fire monitoring system can monitor a specified region in real time. It will send a snapshot of an alarm to the controller when a fire or gun is observed based on video. Based on the given alarm image, the controller makes a final validation. For example, if an accident happened on the highway and caused fire or gun violence ,the victims can be rescued promptly using the image supplied by the detection algorithm, saving time and limiting damage.

Literature Survey:

T. Celik et. al.,[1] has proposed a real-time fire detector that combines advanced object information with fire-colored pixel statistics. The first step in this algorithm is removing the background noise and detecting previous objects that are mainly caused by temporary changes or movement of the object in the scene. The second step is used when the front pixels are detected by fire-like colors. The output of this step mainly removes the front, non-flammable material.

Lucio Marcenaro et. al.,[2] raised the issue of premature fire detection and smoke based on color factors and movement analysis. Early fire noticing is classified into three stages

a) Classification of fire/smoke pixels

b) Region segmentation

c) Analysis of the eligible regions

As a result of this project , fire/smoke images are classified into pixels, clustered into regions, and the internal motion of the regions is analyzed.

S. Nadon et. al.,[3] proposed fire detection algorithm to monitor fires using AVHRR images. Fire detection is achieved in two steps:Marking potential fires and removing false fires. The results provide important information across the country about fire operations.

J. Redmon et. al.,[4] Introduced YOLO, a new discovery method. The previous acquisition function is altering the dividers to access. Their outputs allow them to combine each component of object detection into a single neural network. C Wolf et.al.,[5] Using continuous streaming video captured on surveillance cameras, the authors propose a method to locate and detect acts of interest almost in real time. In response to an input frame, the model is able to provide a label based on a single frame.

Limin Wang et.al.,[6,7,8] proposed an action assimilation and recovery system and a real-time tracking method in the identification of human action from videos that have not been temporarily trimmed with a combination of animation and appearance. They've applied sliding window protocol to detect action and temporary films by integrating motion and

visibility as an output features.

METHODOLOGY

Proposed Approach:

There are times when a fire is discovered after it has grown a little, so it is not possible to find it in real-time. YOLO is a system used to detect objects using convolution neural networks and is shown in this project. It's one of the fastest algorithms that provides accurate results without much degradation. As part of this approach, we adopt a deep learning framework called You Only Look Once v3 model, based on Darknet, that is used to train neural networks. Darknet was created in C and serves as the foundation for YOLO.

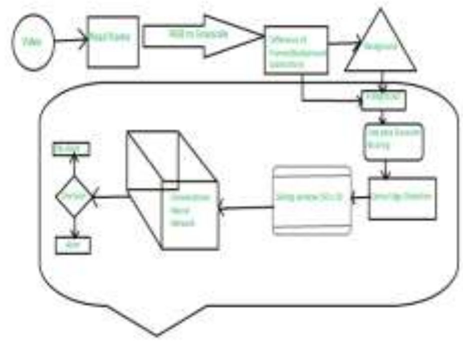
Despite its real-time ability, Yolov3 is the ideal choice since it is accurate and provides real-time detection. It uses darknet53, which contains 53 layers followed by Leaky ReLu activation and batch normalization layers, it can be considered as a fully convolutional network (FCN).

YOLOv3:

YOLOv3 is a real-time tracking system that identifies specific objects in videos, live feeds, and photos. It uses learned features to find something. Joseph Redmon and Ali Farhadi came up with the first three versions of YOLO.YOLO is a Convolutional Neural Network (CNN) that makes real-time object identifications. A classifier-based network translates pictures into organised data arrays and recognizes patterns. YOLO is faster than other networks, and the accuracy is better too. When the model is tested, it can examine the entire image, enabling it to make predictions based on the image's overall context. A convolutional neural network algorithm such as YOLO scores areas by comparing them to predetermined categories. Positive detections of whichever class they most closely identify with are highlighted in high-scoring locations. Compared to YOLOv2 and YOLO, YOLOv3 is a better version. YOLO is implemented using Keras or OpenCV deep learning libraries.

YOLO performs high-accuracy object detection, which can also be performed in real-time due to its speed detection capabilities. By adjusting the size of the model, the third version allows a more economical trade-off between speed and accuracy than the previous version, and it does so without requiring retraining. After learning through convolutional layers, a classifier predicts whether an object will be detected, as is standard for object detectors. In YOLO, we use a convolutional layer with 11 convolutions to make our predictions. YOLO's prediction uses 11 convolutions, so it has exactly the same size as the feature map before it. We have trained the parameters of YOLO into our model and determined the loss. We developed a bespoke dataset because there were no available data on gun images from CCTV view. The result is that firearm photographs were collected from a variety of angles, including many CCTV images of a person holding a gun. To see how well our algorithm performs on video, we have included four films with gunshots and fire. Here you can see examples of our model's successful predictions based on photos in our dataset. The model also performs well in video applications that process frames by frames.

Architecture Diagram:



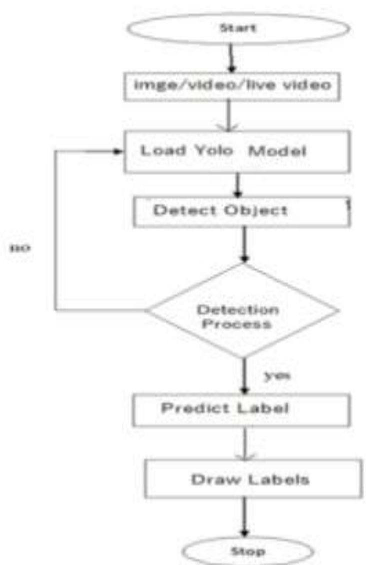
Dataset description:

Our model was trained using 3,000 photographs of guns from the UGR gun website. The data set contains images of guns with different angles, locations and positions. The website also contains annotation in the format () converted to the appropriate YOLO () format. More than 500 fire-retardant images were also computer-generated from Google and translated using Label - a clear image annotation tool. To test gun detection, we use a UGR handwriting test set data and the IMFDB website. The IMFDB data set contains approximately 4000 images of various guns, rifles, shotguns, etc. These are pictures of scenes from many movies. The negative images on the site contain images of gun-shaped objects such as hair dryers, drills, etc. To test the performance of our model on fire-containing images we use images in the FireNet Dataset. We also created a custom data set of 19 images downloaded from Google that contained images of people with guns on CCTV and various angles as well as adding a few videos from the Gun and FireNet Dataset film site. Our data set is called the Fire-Gun dataset [19].

IMPLEMENTATION DETAILS

Our model is trained in YOLO frame works. Firearms are marked with label 0 and label 1.After training through 4000 repetitions, the loss is 0.2864.A customized dataset was created because there were no available data on firearms images from CCTV view. As a result, 19 photographs of firearms were collected from various locations, most of which were CCTV footage of people with guns.To test the effectiveness of our model on videos, we also included 4 videos that contain guns and fire.As well as on video, the model results in good performance when used frame by frame.

Process/Workflow:



Step 1: upload video, image or live web cam streaming with fire and gun detection scenario and pass data to pre-processing.

Step 2: Load Yolo model which is trained using CNN algorithm which has features and label information which is used for prediction and labelling given input data from each frame.

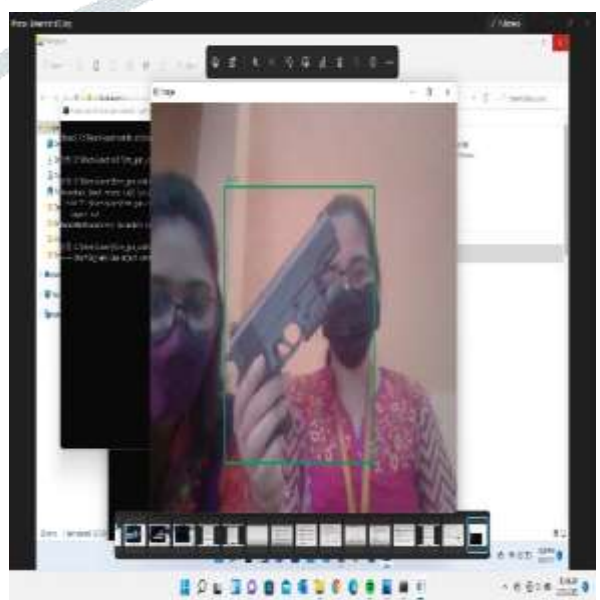
Step 3: Data is taken in frames if it is image or live video or input video each frame is resized and data inside image is taken as array.

Step 4: detecting objects function will take input of image data and passed to OpenCV function called as DNN (deep neural network Model) which will take input as image data, and trained yolo model and predicts details inside image and gives output

Step 5: output from DNN is given as input to draw labels which will store labels to and draw boxes on each detected image file and write name of detected label on to image and display on live stream or image.

RESULT

Through this project, a real-time frame-based efficient fire and gun detection deep learning model with a high accuracy matrix was introduced. Even though the Darknet53 model is bulky, it has good detection abilities.



CONCLUSION

The latest advanced technology of intelligent technology has shown impressive results in monitoring systems to detect various unusual events such as fires, accidents, and emergencies. A fire is one of the most dangerous things that can happen to a person if it is not managed in a timely manner. This increases the importance of conducting early fire identification programs. Therefore, we offer affordable fire detection facilities for video surveillance. This will allow the CCTV system to deal with complex situations in the real world. The YOLO v3 object detection model was used and trained over our collected database for weapons acquisition. This model provides a visual aid to a machine or robot to identify an unsafe weapon and will notify anyone if a gun or fire is detected. Smart surveillance systems will completely replace current infrastructure with increasing availability of less expensive storage, video infrastructure, and better video processing technology. Digital surveillance systems in terms of robots can completely replace current surveillance systems with the growing availability of cheap computer, video infrastructure, state-of-the-art technology, and better video processing. Introducing a new high-level confusing database that encompasses a wide variety of real-world anomalies. Experimental results from this database show that our proposed confusing method works much better than basic methods. The test results show that the trained YOLO v3 has greater performance, and our dataset improves the accuracy of gun detection in real situations compared to the existing data set.

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