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Monitoring activity and detecting unexpected events in surveillance footage using Deep CNN

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ABSTRACT

Security is always a primary concern in any domain, because there is an increasing in crime rate and illegal activities. Computer vision learning places a premium on abnormal detection and monitoring, which has numerous applications for dealing with a wide range of issues. We are all aware that there is a high demand for safety protection, personal properties and security, in recent years, video surveillance in systems has become a major focus in people's lives, particularly in government agencies and businesses. The technique we are employing is anomaly detection, which aids in distinguishing various patterns and identifying unusual patterns in a short period of time; these patterns are referred to as outliers. Surveillance videos provide real-time output of unusual events. Anomaly detection in video surveillance entails breaking the process down into three layers: video labelers, image processing, and activity detection. As a result, it detects abnormalities in videos for video surveillance, providing an application by providing accurate results in real-time scenarios. In this proposed work, abnormal events are detected with 98.5 percent accuracy using images and videos. To prevent virus transmissions across the world the government forced to announce the lockdown due to COVID-19 pandemic. As a result, production at manufacturing plants in most areas was halted, resulting in the cessation of all economic activity. There is an even greater need to ensure the safety of youngsters. While there is a pressing need to revive workforce production. The work helps in maintaining social distance and wearing face masks while at work clearly reduces the risk of transmission. Monitor activity decided to identify violations using computer vision (Not Wearing Mask) Real-time alerts that send a trigger and an email with a photo of a rule violation to the appropriate authority as evidence of a rule violation.

Key words: Covid-19, Deep CNN, Pandemic, Surveillance, Yolo.

1. INTRODUCTION

At that moment and area pass, technology is widely leaking around the earth. The motive of this is to boost us in our everyday residence. Technology has been used for surveillance for decades[8]. Government agencies, businesses, and private properties alike have been interested in video surveillance systems for many years. In today's world, people want better image quality, less expense, and a wider variety of different quantities and scalability. For protection purposes, cameras are the same as they have to be monitor real-time actions, receive data, and break down calculations of what's going on. Often, monitor the real-time activities, collect data, and give out analyses.

The most important thing is to improve an algorithm that can detect mortal activity quickly and easily on video surveillance to take advantage of it [8]. In this case, we're combining simplicity and the necessities of the market. The nation is directly moving towards the end of mechanization as a result of workers' loads. Also, safety issues are a problem in the world. So why not just expand a modern strategy that fulfills the market demands? An easy task doesn't have to be complex. In this work, we discuss a simple software algorithm that let us classify events that occur in a video as normal or abnormal via the content of the video.

- Globally the COVID-19 Pandemic has been severely affecting the World, affecting more than eight million people, according to data obtained by the end of the World Health Organization. To avoid the reach of the infection in common places, face masks should be worn and safe social distance should be followed.
- For detecting masks and social distance, we employ cascade classifiers. With the use of machine learning, a

cascade process can be tested from a pair of beneficial and negative visions to identify odd information.

- In this technique, initially the representation stands with several favorable and unfavorable snapshots or data. Then features like line features, edge features & four rectangle features are extracted from it. This is achieved with the help of Cascade of Classifiers.
- Following these steps, the extracted features from both models are evaluated by comparing with the previously loaded data to figure out whether the image under study contains a weapon, or the person is wearing a mask securely or whether the country in the structure is maintaining a safe distance from among us.
- If any deviation from the training data is observed, the object is labelled to be a weapon and alerts are let out in the form of a buzzing sound, a mobile phone notification and an email notification to the registered email address on the Cloud platform.
- If the individuals in the scene are found to be not wearing a face mask or not located at the specified safe distance, an output window appears displaying the appropriate message.

2. LITERATURE SURVEY

[1] explains about low resolution frames, and can handle uncommon events like crowding and fights without require classifiers and training data sets, this methodology is low cost and able to recognize uncommon events as they occur. This method will increase ATM security by enhancing user authentication. Video surveillance systems face the challenge of detecting unusual events, although the light conditions within the environment may also affect the captured image.

In proposed methodology [2] of cost again rises if we are handling with the event detection. An Algorithm is developed recently to detect an unusual events and also for enhancement of ATM's security by using a low resolution cameras and with the lower cost. It can used in low resolution frames but require proper light condition.

We are now seeing theft and robbery attacks on the general public in ATMs.[3]. Investigation agencies often have difficulty tracking cases. Our system detects odd events even with videos with low resolution, which use ARM 7 LPC 2148, to provide an enhanced ATM security system. At the moment of detecting a suspicious event in the ATM, a buzzer will sound and SMS will be sent from the GSM module to the ARM 7 telling it what to do.

In [4] USA Social distancing has been shown to be an effective method of preventing the spread of the infectious Corona Virus Disease (COVID-19). It is challenging to track the 6-foot (2-meter) distance between you and your surroundings as individuals are unaccustomed to doing so. The system monitors for violations and releases a warning signal over audio and visual mediums without directly targeting the violator. Its accuracy, however, is lower.

Using [5] open-source Computer Vision (OpenCV) software, which is used for Image processing operations, the system is implemented on the credit card sized Raspberry Pi.

The paper [6] describes a video surveillance system that can be used in a crowded environment and describes an unusual event that occurred on the Lebanese International University Saida Campus.. Here with the help of Histogram of Magnitudes (HOM) we implement our results and we met our expectations.

3. PROPOSED SYSTEM

Activity models occur hardly used for picturing the passionate essence, of a network but are furthermore utilized to establish the executable policy by using advanced and reverse engineering skills.

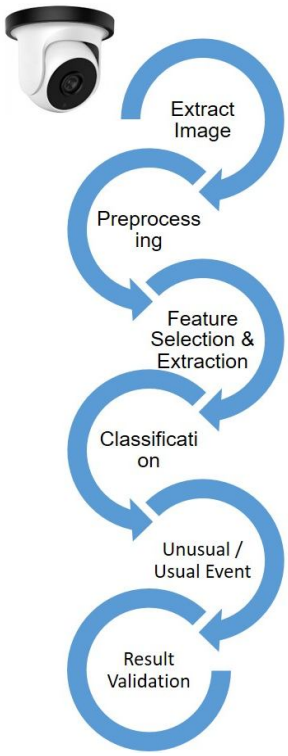

Figure 1: Activity model of proposed system

The figure 1 shows the Activity model of how their laboring technique will be accomplished characterizes the dynamic factors of the network. It occurs in a flowchart that illustrates the sequence from one of the activities to another. The flow can exist sequential, branched, or concurrent. Here the working starts with the camera and then it will extract the image, preprocessing procedure will be applied then it will select the features and extract it next it undergoes for classification if the event is unusual or usual and then it sends a message alert here comes the end of procedure.

OBJECTIVES

- Our project is designed to create an Enhanced security system with automatic alert system of abnormal events.

- It helps in environment to work safe in schools, colleges and in public area and it is a user friendly.
- It helps in detecting who are not wearing a proper mask and who are all not maintaining social distance.

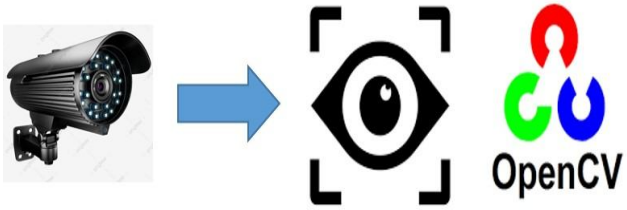

Figure 2: Training model using camera

The Figure 2 shows how we trained our model by using the Web camera, and the camera captures the live video and from that video live, we are going to observe the expression by taking the portrayal of the person into frames. We trained this by using algorithms to detect any unusual activity it must observe all the unusual events and detect them.

4. DESIGN AND IMPLEMENTATION OF ANOMALY DETECTION

It explains how to detect a weapon by observing the figure 3 in that first step, we initialize the web camera and start capturing the video frame. After that it will preprocess the image and reduce the noise, it will extract the feature. In weapon detection, we are using YOLOU3 framework has we seen in the figure 3.

The YOLOU3 framework has been designed to detect objects in the cloud. It takes the entire image in a single object & divides it in a grid format & predict the sounding box coordinates. The advantages of YOLOU3 is increased speed which is necessary for real time applications.

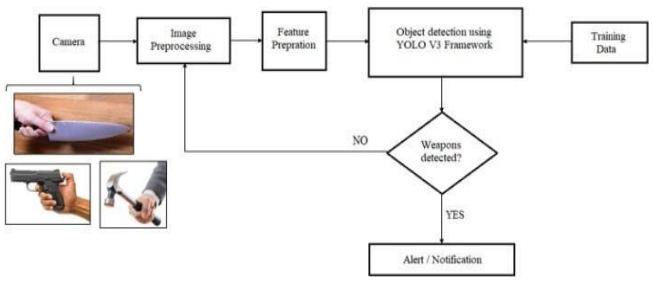

Figure 3: Block Diagram for Weapon Detection

Once weapon is detected, it will send the Alert Notification to authorized person for sending SMS we are using Twilio module.

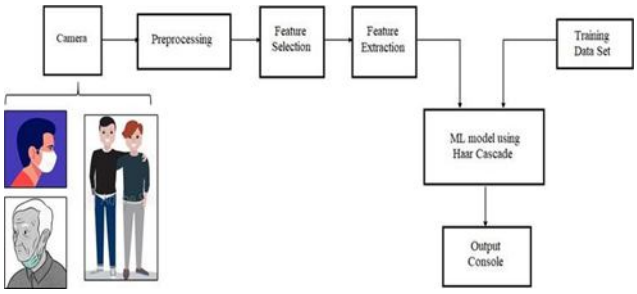

Figure 4- Block Diagram for Face mask and Social distance Detection

In figure 4 it explains detection of Face mask and Social Distancing, and in this diagram first camera will open in here. We are using open cv packages in that we are using cv2 library.

After that it will initialize the video frame & start capture the face of the person image preprocess the image means it will remove noise and unwanted images it will select only person image. After that it will select only person image. After that it will extract the features. We are using Haar cascade algorithm.

In this algorithm, initially, the prototype is to be provided with various beneficial and unfavorable pictures or data.

Then the features like line, edge, and four–rectangle features are extracted from it. After feature extraction it will train the image and create the model once the model is created it will test the image. The person is wearing a mask securely, or the people in the frame are keeping their distance from each other.

5. IMPLEMENTATION OF CASCADE OBJECT DETECTOR (HAAR CASCADES)

In Figure 5 Our benefit will be implemented utilizing the Haar Cascade classifier. In the 2001 journal “Rapid Object Detection using a Boosted Cascade of Simple Features", Paul Viola and Michael Jones proposed a multi-class Haar Cascade classifier as a beneficial object detection approach. Through the cascade function, a lot of favorable and unfavorable images are trained. This method is then used to detect items in other images based on the training. As you can see, they are huge individuals

Matching templates find identical tracts in the bigger portraits by comparing them to a minor image, or template. Blob estimation observes items in attention by segmenting and analyzing blob property. With the Viola-Jones algorithm, pre trained objects such as faces, noses, and eyes can be identified by features similar to those in the Haar algorithm. A custom classifier could also be trained.

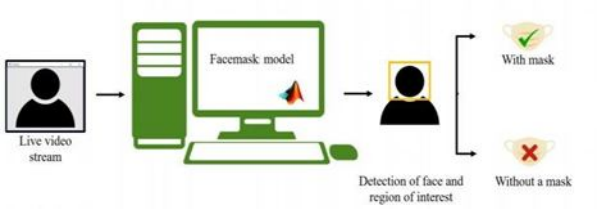

Figure 5: Live video stream is given as an input to the Facemask model

FACIAL RECOGNITION ALGORITHM

This section describes Viola-Jones algorithm here, as it is one of the popular features-based algorithms. The Viola-Jones framework is a powerful framework despite its age. It has shown exceptional results in real-time face recognition. In spite of its slow training time, this algorithm can detect faces in real-time very quickly. The algorithm (which works on grayscale images, seeks out specific features in each sub region) takes a large portion of an image and looks at many smaller sub regions. In an image there are often many faces of varied sizes, so different positions and scales must be checked. Using this algorithm, Viola and Jones identified faces using features similar to those in the Haar algorithm.

1. The video should be captured.
2. By dividing the video into frames, you will be able to understand what's happening.
3. You can also use YOLOv3 to get the bounding boxes around people in each frame. If it reaches the end of the frame, stop
4. Furthermore, you should use Haar cascade to see where the faces are captured so that you can calculate their positions.
5. If a person is wearing a mask, you need to detect the mask with the mask net and face net models.
6. You can detect masks on a person and learn how much distance exists between their faces by using bounding boxes.
7. Show the results on a results board above the video.
8. The results should be displayed in an output stream.
9. Repeat this process until the file is full

DETECTION AND IDENTIFICATION OF WEAPONS

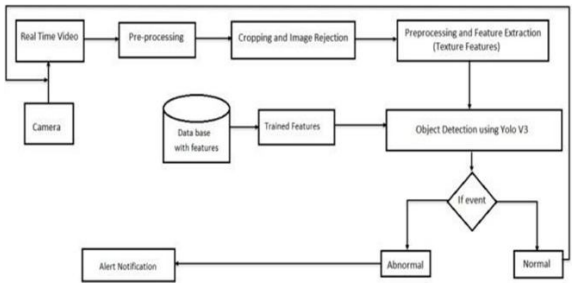

Figure 6: Block Diagram

We build a machine learning model using the Tensor flow backend and Python Programming Language as shown in figure 6. We train this model by passing a good amount of data and teaching it to distinguish between various types of detection made.

Photographic, film, or video camera: A device that records visual images. It constantly works like a surveillance system.

Pre-processing an image is a method of improving the data of images, aiming to suppress undesired distortions or enhance certain features that will be in the image once further analysis is completed. The image information content is not increased.

Cropping and Image rejection: Cropping the image lets us extract the area of interest in an image. Rejection removes background details.

Feature extraction: This process reduces the weight of dimensionality of raw data by dividing it up into smaller, more manageable sets

Object detection using YOLO V3: One of the earliest possible real-time objective detection algorithms is YOLO (You Only Look Once) which is approximately 4.5 frames per second faster than the R-CNN clan (R-CNN, Fast R-CNN, Faster R-CNN, etc.)

If statement for Event: It triggers an alarm if there's an unusual event detected otherwise it continues scanning for Weapons within video frames.

Alert Notification: If a weapon is detected then it sends an alert notification to the registered user and emails them a picture of the offender along with the weapon detected.

Database: Dark net is a C and CUDA-based neural network framework. The framework brings out You Only Look Once (YOLO), a state-of-the-art, real-time object detection system Trained features: We train our model using COCO datasets for weapons and human detection.

6.RESULTS

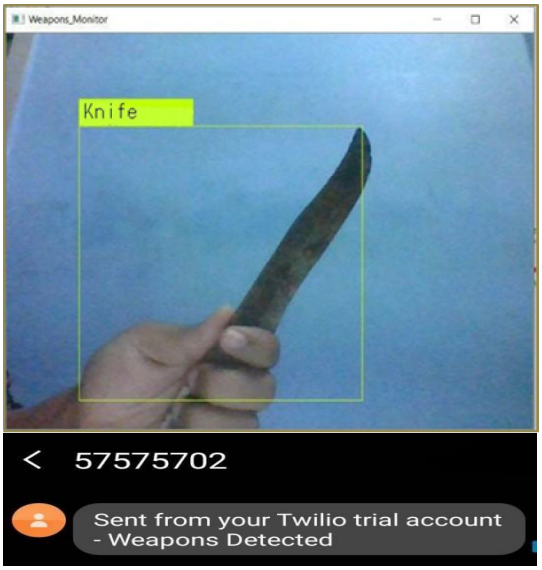

Figure 7: Output of Weapon Detection

In Figure 7 it shows an Output of Weapon Detection as Security is the main thing in today's situation in public places, like if any events going on as so many people are getting together we can't check all so here we implemented to detect a weapon by training all the types of weapons before itself. Here in figure knife is detected and it gives us a message alert by using Twilio account i.e. "WEAPON DETECTED".

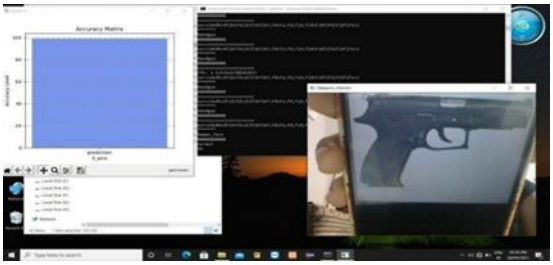

Figure 8: Handgun Detection

We get a 98.5% of accuracy matrix graph which shown in above figure 8 and it gives an message alert by using Twilio account i.e. "HANDGUN DETECTED".

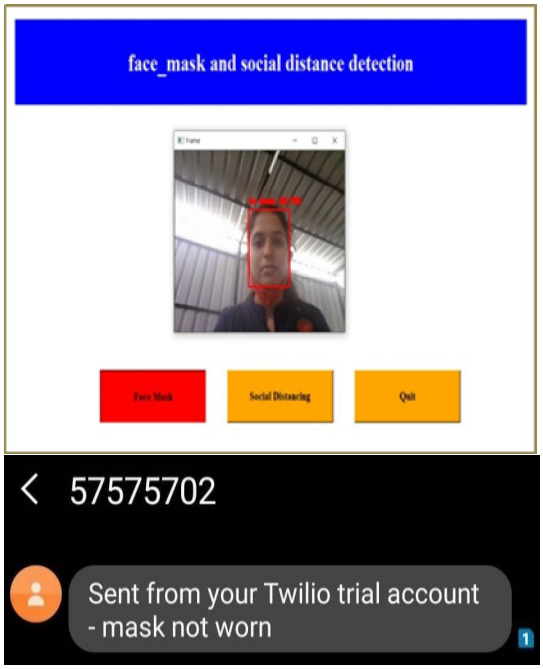

Figure 9 : Output of Face Mask Detection

In figure 9 it shows an Output of Face mask detection, Wearing a Face Mask is one of the great meaningful creatures in this Pandemic Situation but people are neglecting and not wearing the face mask properly, So here we implement that the people who wearing a face mask and who are not wearing a face mask, as the figure tells u that the people who are wearing a face mask it marks all them as in GREEN color and people who are not wearing the face mask with the RED color mark along with this it gives a message alert like "PLEASE WEAR FACE MASK".

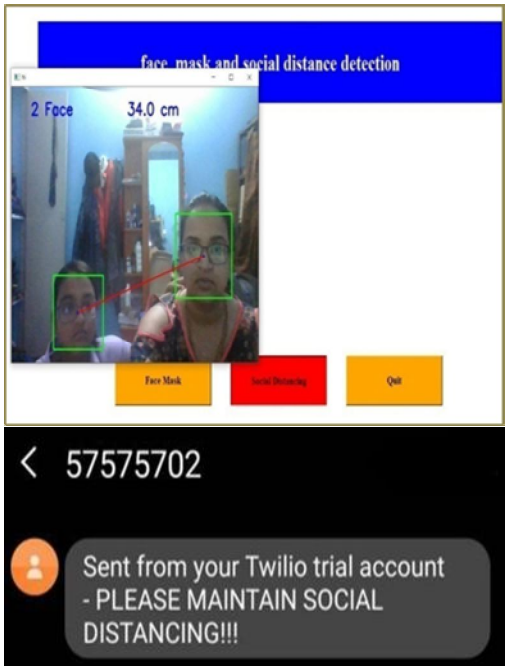

Figure 10: Output of Social Distance Detection

In figure 10it shows a Output of Social Distance Detection, as you know that maintaining a Social Distance is also one of the important criteria in today's pandemic condition, as the people are not maintaining the distance properly so here by using camera we can identify who are all not maintaining the minimum distance of 19cm it gives an RED color mark to that person it sends an message alert like "PLEASE MAINTAIN SOCIAL DISTANCE" and the people who are all maintaining the social distance shows as GREEN color mark .

7. CONCLUSION AND FUTURE ENHANCEMENT

This model is more reliable in providing security. This is also much anticipated solution to the problem of illegal or rules violation in any places and also it can be used to monitor social distance and also mask detection by interfacing a camera to capture live face images. If mask is not detected and not maintaining social distance then it send a alert about the violation to authorized person.

Also our model also helps in detecting Weapon and unusual activity and sending alert to the consult person.

Advantage and Disadvantage:

Advantage:

- ❑ Gives Assurance of safety from contagious COVID-19
- ❑ It Increases safety due to detection and alert system
- ❑ Opportunities to avoid greater loss or damage due to prior alerts and notifications
- ❑ Helps in detection of particular objects like dangerous weapons, face mask

Disadvantage:

- ❑ Fake weapons are also detected
- ❑ Social distancing detection applicable for 3 or less people

Applications:

- Our Model Can be set up in crowded places like
- Railway stations
- Airports
- Bus stand
- Malls

It also useful in buildings that requires high security like

- Banks
- Museums
- Jewelry shop
- ATMs

Future Enhancements:

- ❑ Algorithm can be modified and more intricate data can be fed to make the machine capable of Crowd Detection in order to ensure social distancing as a contribution to prevailing pandemic situation.
- ❑ Sensors and required circuits can be paired with the hardware model in order to detect and monitor accidents like fire breakouts, gas leaks, explosions.
- ❑ The project can make good use of upcoming advancements in CCTV surveillance technology to improve its efficiently, ease of access and output accuracy.
- ❑ Model can be upgraded and trained much more efficiently to differentiate between real and fake objects and situations.

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