AI Based Surveillance System for Crowd Monitoring

Awdhoot Kanawade[1] Kanchan Khare[2] Shubham Band[3] Ganesh Mahale[4]
[1,2,3,4]Department of Information Technology
[1,2,3,4]Amrutvahini College of Engineering Sangamner, India

Abstract— Crowd security is important topic nowadays, sometimes due to lack of manpower or just because of shear amount of people gathering manual surveillance is very frustrating. Hence in this paper we have proposed an approach using Tensorflow object detection API coupled with deepsort tracking algorithm to robustly detect and track lethal weapons in large public gatherings using computer vision.

Keywords: Tensorflow, YoloV3, Deepsort, Detection and Tracking

I. INTRODUCTION

In any smart surveillance system object detection and Subject tracking are most important aspects. To achieve good results object detector must able to detect objects in complex scenes with good accuracy and tracker should track those objects seamlessly

In past years many approaches were suggested to achieve these results but many of those were unable to address the issues such as no detection is cluttered images and tracking inconsistencies when the subject makes sudden changes.

To resolve these issues many techniques were suggested such as background subtraction, filters, optical flow but some had drawbacks and some introduced performance overheadon the system.

To address those issues, in this paper we have suggested tensorflow based object detection method coupled with deep- sort algorithm to detect and track subjects in complex scenes seamlessly. As we know Tensorflow is one of the best frame- work to run object detection models efficiently with GPUacceleration using their CUDA libraries. Deepsort algorithm which is based on convolutional neural network is best learneramong all.

Using these algorithms can yield acceptable results while tracking objects.

II. LITERATURE SURVEY

Over the years many ways to improve accuracy and ro-business are suggested by many people, in this literature survey object feature point detection, background substation, segmentation are discussed

Human tracking is considered as special case of object detection. CNN based algorithms are implemented to track pedestrians[2]

Complex or moving backgrounds can introduce errors in object detection systems, to overcome those issue background subtraction based approaches are suggested.[3]

Dr.Koller suggested occlusion based techniques to implement robust detector which can detect and track multiple objects [4]

Chan Y and X yang suggested deep convolutional Neural Network based object tracker[5]

W.XU along with other researchers proposed CNN based human action detectors and human trackers [8][9]

III. METHODOLOGY

Proposed system consists of two phases, first is object de-tection using YoloV3 wrapped in Tensorflow object detection API and second being subject tracking using deepsort. Generalblock diagram of proposed system is given below Fig-1

In given system video can be captured using Drones, CCTV cameras which is then fed to system using OpenCV

First stage of system is object detection. In below flowchart object detection is explained briefly (fig-2)

Tensorflow is framework design by google for accelerated AI computation by the use of CUDA libraries, Tensorflow object detection API is built on this solid framework to get good results

In figure we can see overall workflow of system in initial stage Graphics device are listed according to computing capabilities and higher one is chosen, Cuda dynamic libraries are then loaded for computation.

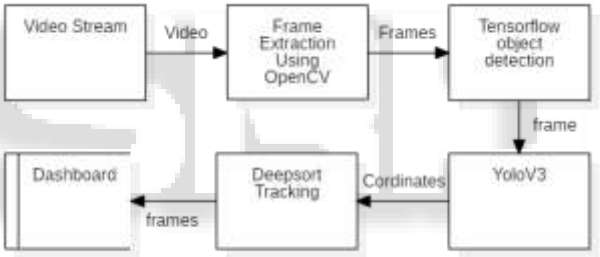

Fig. 1: Block diagram of system

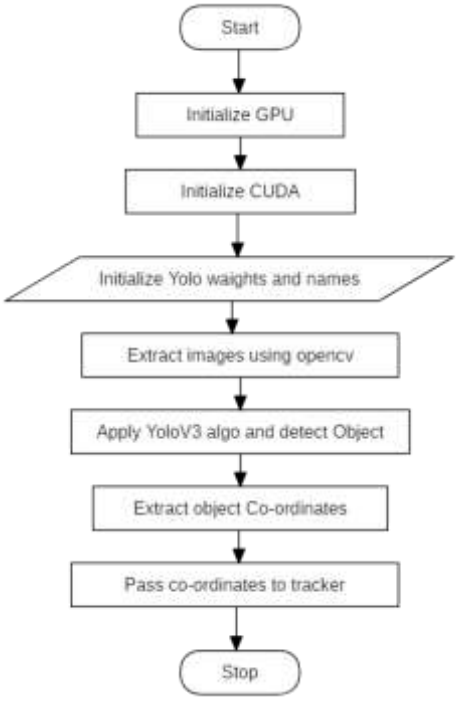

Fig. 2: Object Detection Data Flow

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To run object detector Yolo waight files (which is convertedto tensorflow record file) is loaded along with label files.Afterthat openCV invokes its cv2 instance which then grabs the video feed and extract the frames for further processing.

Images then passed to YoloV3 detector through tensorflow API to detect the object, which returns coordinates of the objectarea and shows bounding box around it.Those coordinates are then passed to tracker algo to track the object in scene.

Next part of this system is equally important, In tracking phase we start the process by loading weights and checkpointsas described in fig-3

In previous step we passed the coordinates after object detection, those coordinates are then catched in this phase alongside the frame. After that next frame is passed to thetracker, tracker again draws boundary box over the object. If subject gets out of frame control is then passed to objectdetector to again find the object. If the last frame flag raised with frame the tracker exits out of loop

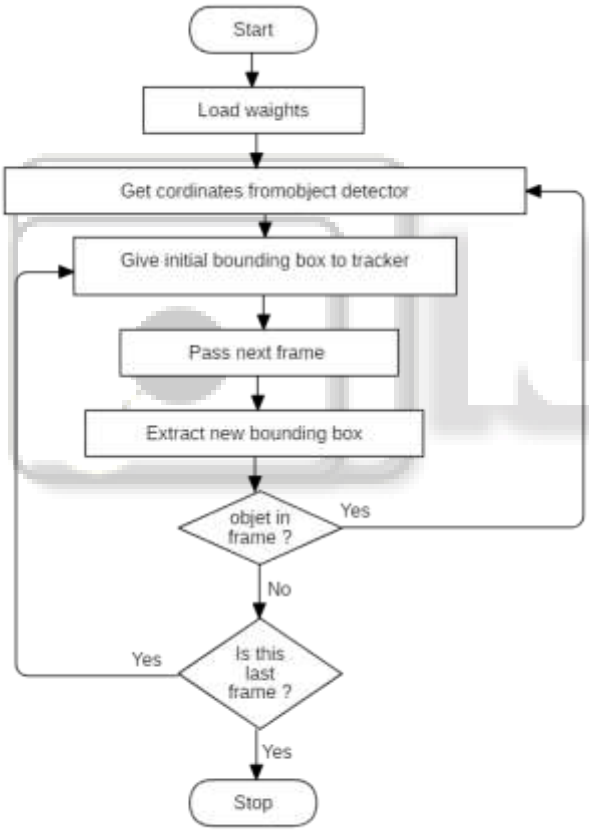

Fig. 3: Object Tracker Data Flow

GUI is also important part of any system it helps naive usersto interact with system easily

In this system GUI consist of a main video player window along with a mini map of area of operation which also serves as a means to extract longitude and latitude to send with alert signals

Three action buttons are also provided for interaction. First one is used to take screenshots which can be used for later analysis or as a proof, the next one will send alert with screenshot to the field agents, last one can send screenshot andlocation to headquarters that be use to call extra reinforcement

Fig. 4. Graphical User interface

IV. RESULT

This system is implemented in python 3.6 under Anaconda wrapper and trained on Nvidia tesla T4 powered server. Testingis done on local machine powered by Geforce GTX 1050 ti(compute power 6.1) coupled with Intel kaby lake i5 cpu clocked at 2.50 GHZ. Video stream was provided via 720p webcam.

The proposed System is tested in various conditions and every time it yielded acceptable results. System was tested indoors(fig-5) and outdoors(fig-6) with and without artificial lighting with firearms and knives

Fig. 5. System test indoors using kitchen knife

Fig. 6. System test outdoors using gun image

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V. CONCLUSION

In this paper tensorflow and deep sort based tracking is shown, which can be implemented for various operations including surveillance, public safety, smart CCTV, military operations etc.

This system seamlessly detect and tracks objects in complex senses with very little inconsistencies. This proposed approach can achieve above 80 percent accuracy it can be improved further by increasing training samples and epochs.

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