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Intelligent Video Surveillance System

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ABSTRACT:

Video Surveillance systems gained very immense interest as an application-oriented field which has been greatly studied in past decade. Video Surveillance started with analog CCTV systems, to gather information and to monitor people, events and activities. The vast amount of incoming data is far beyond the capacity of operators, data is heterogeneous type.

Intelligent Video Surveillance System (IVSS) are used to monitor the targeted infrastructure without human intervention. IVSS is able to analyze images, video or any other kind of surveillance data. Detecting multiple pedestrian activities in real-time video is difficult in manual analysis.

One particular use of object detection is in the detection of pedestrians. It exhibits resemblances to and differences from general object detection. It also has significant application value for security monitoring and intelligent driving. With the rapid advancement of deep learning in recent years, pedestrian detection technology has also made significant strides. There is still a sizable disconnect between it and human perception, though. There are other issues that still need to be resolved, and much more research is still needed. In order to assure the effectiveness of pedestrian detection in intelligent driving technologies, essential necessity to guarantee its real-time functionality. The model must also be made lighter while maintaining detection accuracy. It serves as a crucial foundation in a variety of sectors, including the operation of unmanned vehicles, the development of robots, intelligent monitoring systems, and pedestrian analysis. Despite extensive research, there are still a lot of urgent issues with pedestrian detection methods. In many settings, such as intelligent monitoring and multi-target tracking in complex environments, target recognition and target tracking are crucial. This creates a system for detecting and tracking pedestrians. The suggested detection approach, which is based on Yolov7, makes use of the E-LAN backbone network component, which improves the network's capacity for learning without changing the initial gradient path.

Keywords – CCTV, Heterogeneous, IVSS (Intelligent Video Surveillance Systems), Pedestrian, YOLO(You Only Look Once), E-LAN (Extended Efficient Layer Aggregation Network).

1. INTRODUCTION

Video surveillance systems have become more crucial in recent years to improve public security and safety. These systems have a wide range of applications, including smart homes, offices, bank security, traffic, monitoring, and public spaces like malls and airports. This system provides video playback and real-time display of the monitoring scene. Monitoring behaviours, activities, and other changing information, is what is meant by surveillance. Video surveillance is the term for remote observation using electronic devices like CCTV cameras, etc. CCTV stands for closed-circuit television. The system that allows you to see around the property enables you to record footage of live events so that you can archive it for later use. This could also be advantageous for the business systems by increasing use in law enforcement in various situations, such as traffic observation of high-crime areas and domestic crimes so on.

The accuracy of the core technology, which also depended on relaibility, intutive video surveillance, and impressive traffic statictics, is important to the in making of certainity intelligent video surveillance systems. In the area of computer vision and deep learning, pedestrian detection has emerged as one of the most significant study areas. Several public locations have security cameras installed, and pedestrian detection can be done using big data and other IOT devices. Modern algorithms have made progress in the speed and accuracy of pedestrian recognition, but there are still numerous challenges to overcome. For instance, in a situation with many pedestrians, two or more people may block one another, and reliable recognition is still difficult. Due to ambiguity, studying pedestrian detection algorithms is quite difficult. Detecting human movements in their path is one of autonomous vehicles' most important jobs. Identifying and pursuing a criminal in a crowd, preventing accidents, and avoiding moving items and moving cars are all made possible by this. Computer vision techniques are used to detect pedestrians. These detecting activities can be carried out by advanced sensor systems including radar, cameras, and light detection and ranging (LiDAR). Unexpected accidents can be avoided with the help of a system recently created under the name of Advanced Driver Support System (ADS). To divide up various responsibilities, such as the protection of the drivers, the environment, and commuters, this system has a wide range of possibilities. Recognizing pedestrians is one of its well-known features. Later, engineers equipped autonomous vehicles with this feature. There are still a lot of issues with pedestrian detection that need to be resolved, even with this capability. With various inventions, a

number of researchers have tried to find solutions to these issues. Poor pedestrian tracking and recognition, poor obstacle detection in a variety of lighting settings, including clear visibility problems at night, occlusion conditions, low resolution, and the occurrence of microscopic size are some of these challenging problems. To address these challenges, several techniques are employed.

CCTV is created to assist stop and find crime. It can give hope to the public about public security. It is allotted in public places to:

- Come up with the result to related application agencies.
- Reassure community order.
- Check offensive actions and troubles.
- Contribute maintance.
- Acknowledge community well being.

2. LITERATURE REVIEW

Hahnle et al (2013) proposed a survey on FPGA-based real-time pedestrian detection on high resolution images.

In this work, we developed a real-time FPGA implementation of a pedestrian detection system using an SVM classifier and a HOG descriptor. When compared to other implementations, a performance improvement of more than a factor of 4 has been attained in the quantity of detection windows per second [2, 13, 15, 16]. Through the use of a core clock that is twice as fast as the pixel clock and several optimisation approaches, the resources have been considerably reduced while the real-time capabilities of the architecture are maintained. Based on the time-multiplex method, we use 18 scales that are deemed to be necessary in real-world applications.

T. Chen and H. Lu proposed a survey on Pedestrian detection based on deep learning.

Three new models for large pedestrian identification and recognition were created as a result of YoLov4-tiny's slow detection speed and heavy weight. In terms of actual detection accuracy, all three of these models performed better than the original model, which not only complied with the lightweight criteria but also avoided a major drop in detection speed. To improve the efficiency and speed of pedestrian identification, YoLov3 was made more straightforward and the feature fusion structure was improved in the literature. The three main two-stage algorithms are R-CNN, Fast R-CNN, and Faster R-CNN. A faster R-CNN- based target identification technique has been proposed by researchers, and their approach enhanced the small-scale pedestrian detection accuracy.

Z.chen et al 2020 proposed a survey about Research on Pedestrian Detection Algorithm Based on Mobile Net-Yolo.

The YoLov4-tiny network hierarchy's simplicity, poor cocurrence , and absence of improvement pattern are addressed in this article by the MobileNet-YoLo model. The preliminary outcome manifest that MobileNet-YoLo has outperformed the requisite of accessible target detection and identified piece of work in terms of detection precision, sprint, and various parameters. The accuracy difference between YoLov4 and the comparator model is still 9.13%. YoLov3 was made easier and the characterstic fusion structure was upgraded in order to enhance the precision and sprint of pedestrian recognition.

Huang,et al (2020) proposed a survey on NMS by representative region: Towards crowded pedestrian detection by proposal pairing.

Huang,et al. [12] proposed a survey on Nms by representative region: Towards crowded pedestrian detection by proposal pairing. In this work, we suggest R2NMS to remove redundant boxes in a crowded environment effectively without creating a lot of false positives. By comparing the IoU between the two full-body boxes' viewable regions, the R2NMS determines in case the number of boxes are super-imposed or not. To support this assertion, we offer a special Paired-Box Model (PBM) that estimates both the pedestrian's entire box and visible box at the same time.

Galvao et al (2021) proposed a survey on Pedestrian and Vehicle Detection in Autonomous Vehicle Perception Systems.

Vehicles and pedestrians are significant objects in AV percpective. structure must recognise. So, the objective of this analysis was to examine the best car and pedestrian detection algorithms. This work also analyses pertinent generic object identification strategies from various pedestrian and vehicle detection algorithms used the similar or a updated record of the techniques pre-owned in general object detection algorithms. It has been demonstrated that combining various detection algorithms using strategies like ensemble and cascade structures improves accuracy performance. The datasets, caltech and kitti, produced tremendous findings at various speeds.

3. METHODOLOGY

Existing system:

When it comes to the previously presented or existed system’s, they had utilised the sliding window and other methods to select the regions or areas on the given image where candidates are present. And from the selected region or part extract features and it utilizes few classifiers which got trained for classification. But this process has some disadvantages which are mentioned below and they are low relevance, time complexity and very low robustness. And in the previous systems they might use edge detection to get the faster output in detecting the areas where candidates are present and also increases

the detection rate, which causes the low performance with respect to time. There are a few important problems which are predicted during the detection of pedestrian in the existed systems they are suffering in detecting the pedestrians using low quality images, algorithms which got selected manually for detecting the pedestrian features and also with multispectral images which contains so much noise these are the few reasons which will make difficult for real-time monitoring and also minimizes the calculation speed.

Disadvantages:

- Less Accurate & less Robust.
- Slow calculating speed, insufficient for in-the-moment monitoring.
- Low performance at highest rate of fps
- Model rejects the images when the images has low quality, Blurriness and multi-spectral.

Proposed system and Advantages:

In this proposed system we have overcome few problems in the existed system, the multispectral image is the one of the finest solutions for the pedestrian detection problems. And this can able to help us to overcome the low light situations and blurred images .ADAS also requires the correct and accurate detection of pedestrians in the real time scenarios for better results, for this purpose we use Yolo model of version 7 which can make the pedestrian detection based on the real time scenarios of data set which contains bit stream images. And these images can be used for training the model with required number of epochs which can increase the detection accuracy and it also overcomes the insufficient ability of existing systems to represent the existed features the pedestrians and also the their multi level futures. This Yolo 7 provides the basic knowledge or information to understand the detection when the background is rich and when the image contains multiple people in the frame. The system takes input from GUI provided. Either we can upload a pre-recorded video or image in addition to that we can also able to upload a live video using Webcam as input. From input, pedestrian images are taken at different periods, including day and night. Then, we use a ELAN (Extended Efficient Layer Aggregation Network) network to enhance the resolution of low-quality images that can help distinguish pedestrians from the blurred background. Finally, based on these enhanced images, we perform classification and localization.

- No need of manual observation.
- It offers the essential data necessary for the semantic interpretation of the video clip.
- Time saving & High Accuracy.
- Speed response in Emergency situations.
- Because it has the potential to enhance safety systems, pedestrian detection is a natural extension to vehicle applications.

MODULES:

The model you only look once of version 7 has the highest speed and accuracy in detecting the pedestrians when compared to the other detectors, either it's an object or pedestrian. And there is a specific range from nearly 5 frames per second to 160 frames per second and also a specific highest accuracy of nearly 56.8 % AP among the available detectors which have 30 frames per second. And this Yolo seven has many subversions in it. For example yolo V7 -E6 has Has the capability of nearly 56 frames per second and the average position of nearly 55.9% AP and also better than detector called SWINL cascade mask and R-CNN which has 9.2 frames per second(FPS) and 53.9% AP. An updated YOLOv7 pedestrian detection approach is developed in order to increase the accuracy of the pedestrian detection method and separate pedestrians from people-like items. YOLOv7 is utilised to enhance the network's capacity for feature extraction and minimise feature information loss.

The entire process can be summarized in 3 modules:

- Data preparation
- Training the model
- Inference

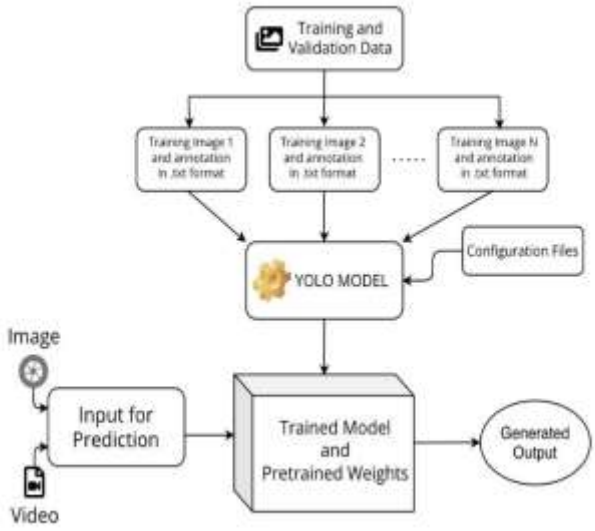

Fig.1: Project Architecture

The steps to implement project:

- Requirements installation
- Source code of YOLO V7
- Download the dataset
- Training code with dataset
- Generated Pre-trained weights for dataset
- Export the model and deploy flask application
- Validate model using application

4. IMPLEMENTATION

Setup Anaconda Environment:

conda create --name environment_name

Ex: conda create --name pro

To Activate Environment:

conda activate environment_name

Ex: conda activate pro

To Train Model:

python3 train.py --batch-size SIZE --epochs EPOCHS --img RESOULUTIONS --data data/ CUSTOM.YAML --cfg cfg/training/CFG_ CONFIG. YAML--name OUPUT_DIR_NAME --hyp data/ HYPERPARAMETERS.YAML

Ex: python3 train.py --batch-size 20 --epochs 30 --img 640 640 --data data/custom.yaml --cfg cfg/training/yolov7Custom.yaml --name Pedestrian Detection --hyp data/hyp.scratch. p5.yaml

To Perform Detection:

python3 detect.py --weights WEIGHTS.PT --source SOURCE_FILE --class 0 1 2 3 5 6 7 9 11 --exist-ok

Ex: python3 detect.py --weights best.pt --source 1.jpeg --class 0 1 2 3 5 6 7 9 11 --exist-ok

To Export Model:

python3 export.py --weights yolov7.pt --grid --end2end --simplify --iou-thres 0.65 --confthres 0.35 --img-size 640 640 --max-wh 640

Steps To Deploy Flask Application:

Export App

export FLASK_APP=app.py

Run Flask App

python3 -m flask run

Copy URL and enter it in Browser

An improved YOLOv7 pedestrian detection method is proposed. YOLOv7 is used to decrease feature information loss and enhance the network's ability to extract features. FCNN (Fully Connected Neural Network) is the foundation of YOLO architecture. The YOLO framework is made up of three primary parts:

- Backbone
  - Head
  - Neck

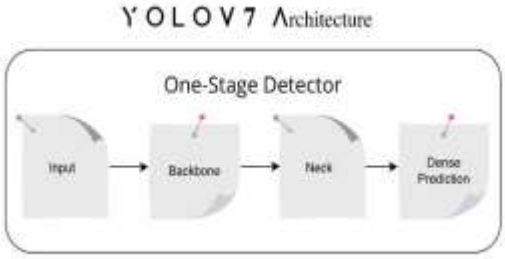

Fig.2: Architecture of YOLO V7 Model

The Backbone will obtain the necessary aspects of an image and transmit them to the Head via the Neck. The Backbone provides feature maps to the Neck, which gathers them and builds feature pyramids. The Head is made up of output layers with final detections.

5. EXPERIMENTAL RESULTS

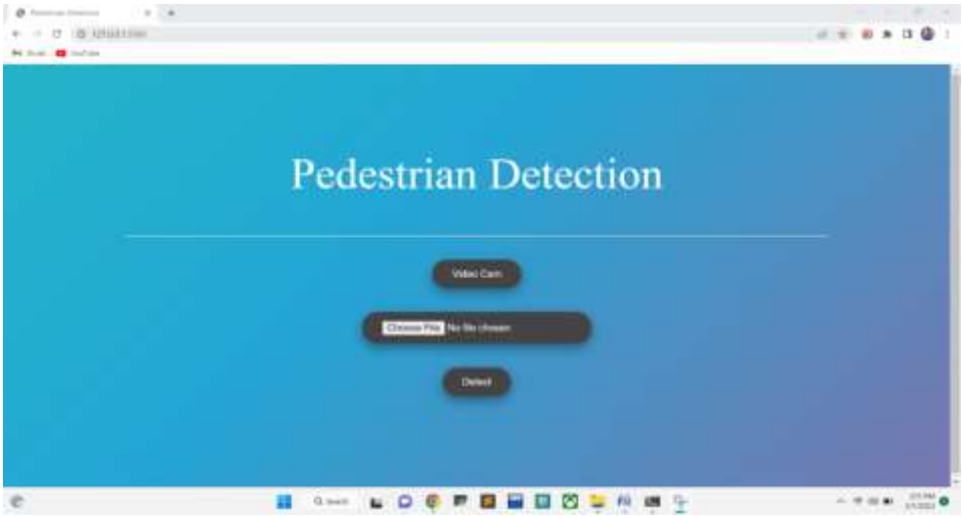

Fig.3: GUI (Graphical User Interface)

Fig.4: User chooses file

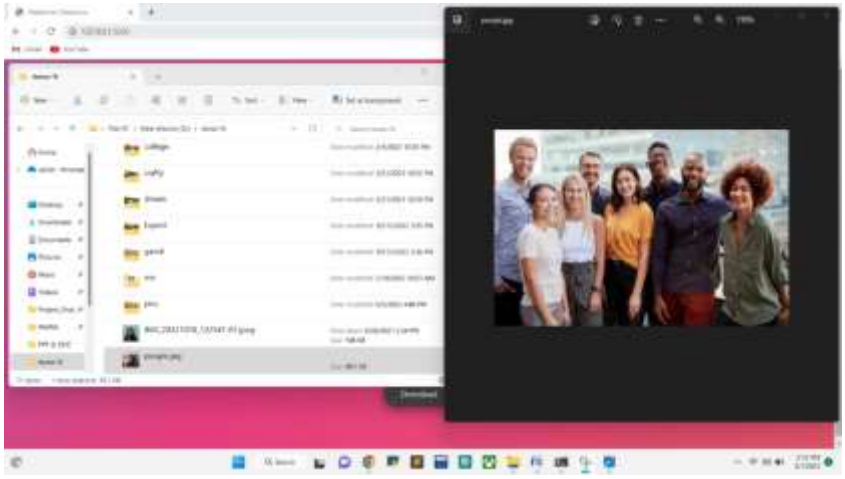

Fig.5: Image before detecting pedestrians

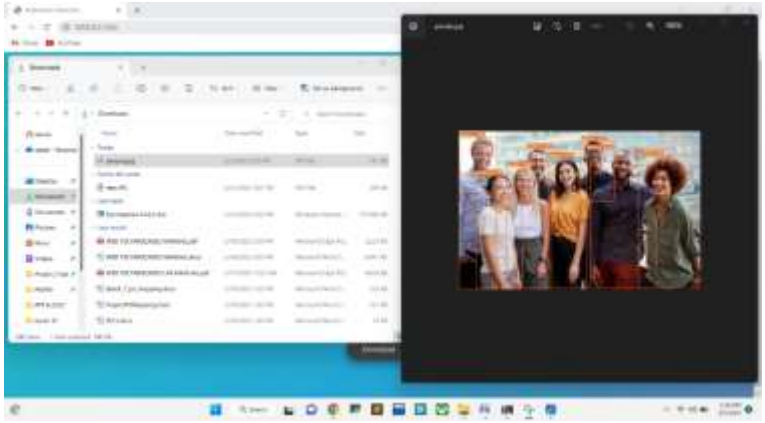

Fig.6: Image after detecting pedestrians.

Fig.7: Project Results

6. CONCLUSION

As operational studies have accerlated over the past ten years, video surveillance system gaining a lot of attention. Recent research has focused on incorporating artificial intelligence, image processing and computer vision into videotape surveillance operations. This system recognizes, keeps track of security pitfalls of the real terrain which threatens particular safety, and protects the individualities from them with visual bias gathering videotape information similar as CCTVs and IP cameras. As it's extensively stationed on open IP- grounded network, all security pitfalls considered in the heritage IP- grounded operations might hang the dependable operations of videotape surveillance, performing in critical sequestration violation, abuse of videotape resource, increase of unanticipated intelligent crime using unauthorized videotape access, and so on. The Intelligent Video Surveillance System deals with object discovery which makes prognostications about the presence and locales of objects. This system generates a set of proffers and upgrade. These proffers and make final prognostications through YOLO model. The YOLO V7 model is prominent for the surveillance systems in the task of detecting the climbers and is considered as popular object discovery model known for its speed and delicacy. This model performance single duplications of an image where detecting region of interest and recognition on those images are performed with help of single completely connected sub caste YOLO's completely connected sub caste predicts both class chances and bounding box equals as in object discovery. It's common for multiple bounding boxes to be generated or may lap or be located at different positions, but they all represent the same object this can be resolved spare or incorrect bounding boxes and converts to a single set box.

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