Computer Vision
Project Report

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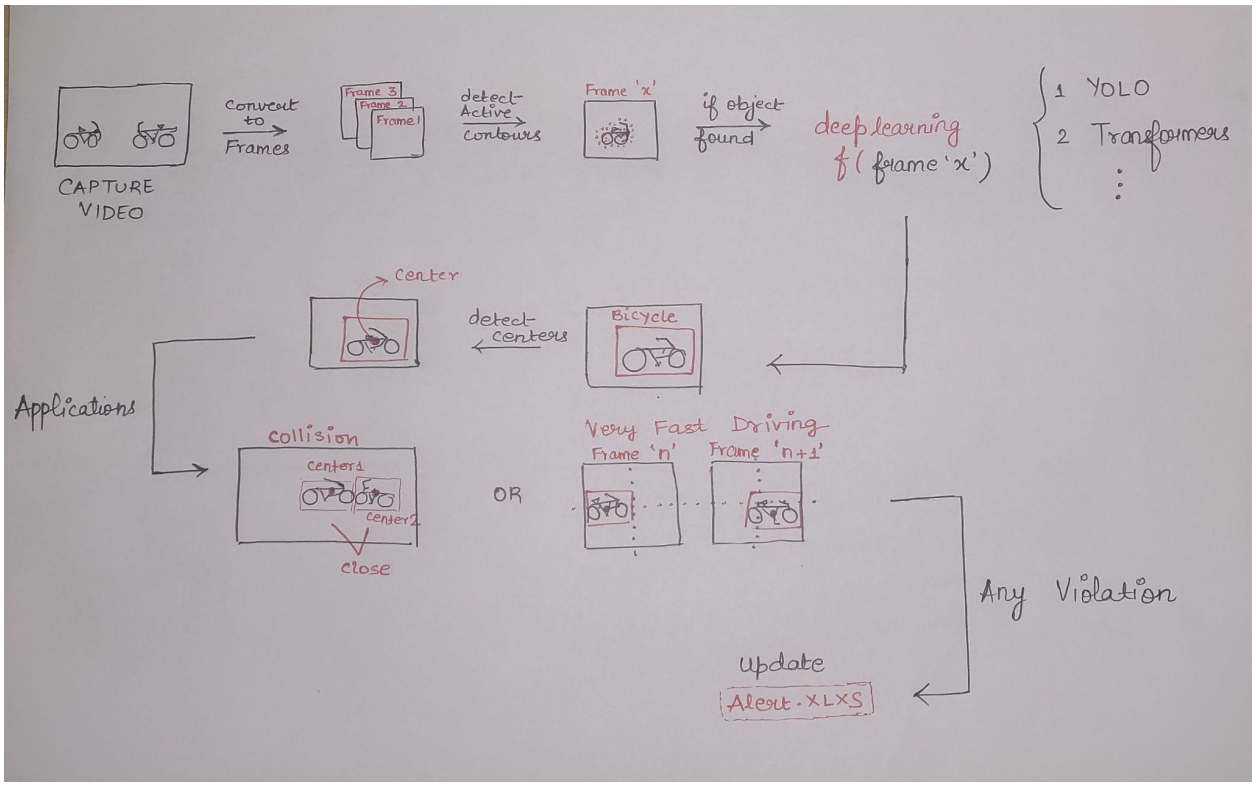
Semantic Segmentation for Vehicle Accident Control

Dataset taken:
We have used **COCO Dataset** for training our model and **custom video** for testing the model.

Main Idea:
We Implemented our project with the **combination of both Non Deep Learning and Deep Learning** approach for the Semantic segmentation of the vehicles on the road to control the traffic and accidents.



Pictorial Representation of Idea

Summary of Algorithm used in Project

Non-Deep Learning approach
Using Active Contours

1. Capture Video
2. Convert into frames
3. Check for motion in vehicles using Contours
4. Check for threshold
    a. If Active Contour area > Threshold
    b. If True -> It is a moving vehicle
5. Find region of Interest

Deep Learning approaches
Using Transformers and YOLOv3

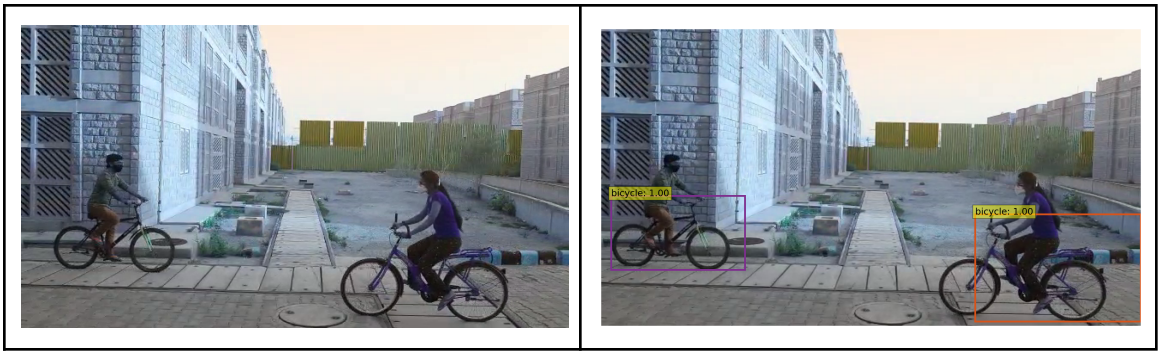
6. Call Deep Learning functions for classification of objects in obtained regions of interest by a non deep learning approach.
7. When object has been labelled and obtained the bounding box
8. Optimisation flow:
    a. We will call the deep learning function ONLY if the label of the detected object is a moving automobile.
    b. Implemented on YOLO and Transformer based detection but our concept can be generalized to any object detection approach using Deep Learning. (After testing its working on YOLO we implemented on Transformer)
9. Real time based Application of project
    a. Calculate the centers of the Vehicle (To detect **Harsh Driving** and **Collision**)
    b. If the center coordinates of two approaching vehicles are in a close range, update the ALERT.XLXS
    c. If any specific vehicle has many alerts in the excel sheet, the Traffic Officer can have a close look on him in future.
    d. Determine the speed of the vehicles using per frame speed.
    e. If the speed of the vehicle is greater than a threshold (say 150 as per our video) then update the ALERT.XLXS.

Implementation and Results

1. Capture Video : Video Link
2. Converted to Frames :

3. Find the Active Contours and pass to Deep Learning Model for vehicle classification

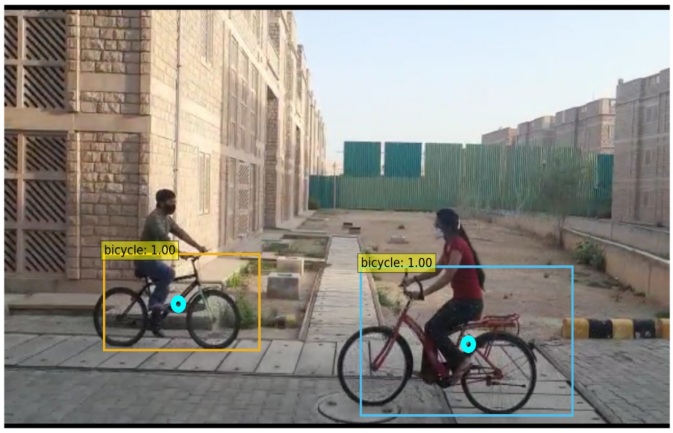
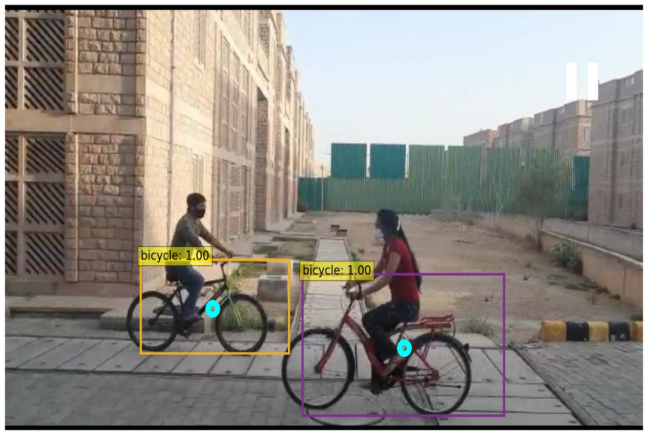
Classification



4. Algorithm optimized by just calling the deep learning function for classification of the detected object like outputs shown:

1	2	3
		
4	**5**	**6**
		

5. Out of all frames, Video generareted of frames **[2,3,4,5]** only, thereby reducing the computational cost manifold times.
6. Traffic Police officers have to analyse only on small videos.
7. Detecting the centers of the Automobile to detect the chances of collision.

Frame ‘n’	**Frame ‘n+1’**
	

8. Estimate the speed of the vehicles based on the pixel differences approach.
9. Speed of (**Deepshikhar** : Bicycle 1) : 96 units per frame (moving in forward direction)
10. Speed of (**Vyoma** : Bicycle 2) : -86 units per frame (moving in opposite direction)
11. **Observation :** Speed of Deepshikhar's Cycle > Vyoma's Cycle
12. For Real world applications, we can define a threshold (say maximum speed per frame is 150) if object speed > 150 update an alert in the ALERT.XLSX sheet
    Assumption : Threshold is based on above frames
13. Collision Detection : If centers of two automobiles are closer (based on equation center1 (x1,y1) == center2(x2,y2)) in a range then update the ALERT.XLSX sheet

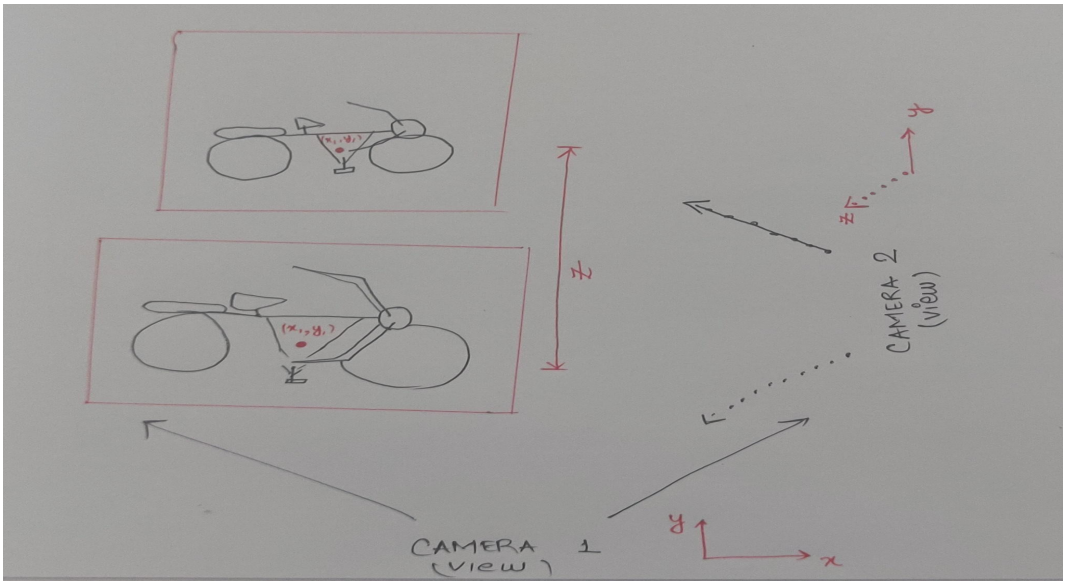
Collision Prone Situtation arised at :	2021-05-21 19:22:30.306244	2021-05-21

Excel Sheet with Traffic Officer

[Excel Sheet Link]

Limitations

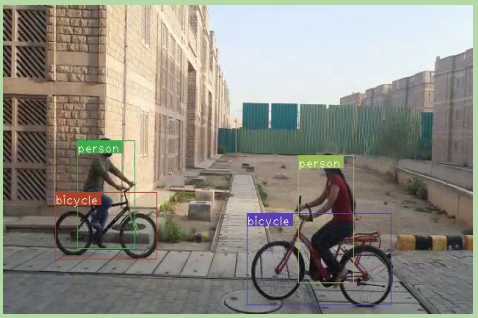
1. Our implementation has not considered the depth coordinate.
2. For Real world application we can proceed with 2 other approaches
    a. Use 2 cameras perpendicularly to detect the depth of the vehicles.
    Camera 1 captures (x,y) and Camera 2 captures (y,z)



same value of (x,y,z) pair will generate an alert of collision efficiently

Outputs using YOLO

[Output Video Link]

1	2	3
		
4	5	6
		

Observations:

We can generalize our project on various deep learning based object detection algorithms, we tried implementing on YOLO and transformer.

References

1. Yolov3: An Incremental Improvement [Paper Link]
2. Snakes: Active Contour Models [Paper Link]
3. Vehicle Tracking and Speed Estimation from Traffic Videos, CVPR 2018
4. Facebook Transformer

Code Link : [Colab Code Link]