Safe Lane-Changing Solution For Automobiles

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1   Project Title :

Group Number : 22 - comprising of Team Numbers : 43 and 44.

2   Brief Description of end goal :

The final outcome of this project is expected to be a mechanism which could aid in reducing the number of accidents due to sudden/unexpected lane changes by the drivers. Characteristics of the mechanism are as follows:

- If another vehicle is trying to overtake, the driver is warned to prevent a sudden lane change into the lane of the overtaking vehicle.

- If the driver is overtaking another vehicle, the driver is notified when he is far enough from the other vehicle to ensure a safe lane change.

- If the automobile is at rest and the driver wants to open its door from inside, the driver is restricted from doing so if there is an approaching vehicle on that side of the automobile thus preventing collisions.

3   Dataset to be used or collected :

A dataset, big and diverse enough, to recognize vehicles in an image and differentiate between their front and rear views is required.

- Stanford Cars Dataset
- Multi-View Car Dataset
- Car Front/Rear Dataset
- Some additional self-collected images will also be used.

4   Proposed plan of execution :

- Two cameras studded at the top of the side-view mirrors will be used to collect real-time data of the traffic behind.

- The orientation and placements of the cameras will be such that, adjacent lanes on either side of the automobile are clearly visible. Also, our Region of Interest will be the immediate adjacent lanes determined using lane-detection algorithms, rest of the image will be cropped out. This is done in order to eliminate unnecessary warning due to vehicles in far away lanes.

- The images so captured will then be processed in order to detect vehicles in the adjacent lanes (on both sides) and then using the depth-detection algorithm the closeness of the vehicles will be determined.

- If a vehicle is found to be closer to the automobile than a particular threshold on either side, the driver is warned to prevent a sudden lane change on that side.

- When at rest, the captured images will be processed to detect a close approaching vehicle. If detected, the door on that side of the automobile will be locked such that it cant be opened from inside.

5   Main challenges :

- Processing each frame from both the cameras simultaneously in real time could produce lag-induced outputs. As a result, we would have to come up with highly-efficient image processing algorithms in order to ensure that immediate responses are provided to the driver.

- In case of a road with two-way traffic the normal approach would produce wrong results, as a vehicle going in opposite direction will also produce a warning as it passes by. To overcome this, the processing algorithms should be modified such that only the vehicles approaching/following the automobile should be detected.

6   Learning Objectives :

- Image Processing Concepts like:
  - Image Interest Points Detection
  - Image manipulation like cropping ROI, enhancement, drawings etc.
- Machine Learning concepts like:
  - Training Haar-Cascades (classifiers) using given training data and corresponding known outputs.
  - Accurately classifying testing data using self-trained Haar-Cascades.