Proposed Approach:

The proposed approach is divided into 6 key steps:

Step1: Locating the vehicle positions and lane positions

In the first step, we tried to find out the lane positions in each frame (Time frame). For this purpose, we have used accumulator. We have highlighted the vehicle positions in the image by converting vehicle trajectory points to image points. The example is shown in the below image:

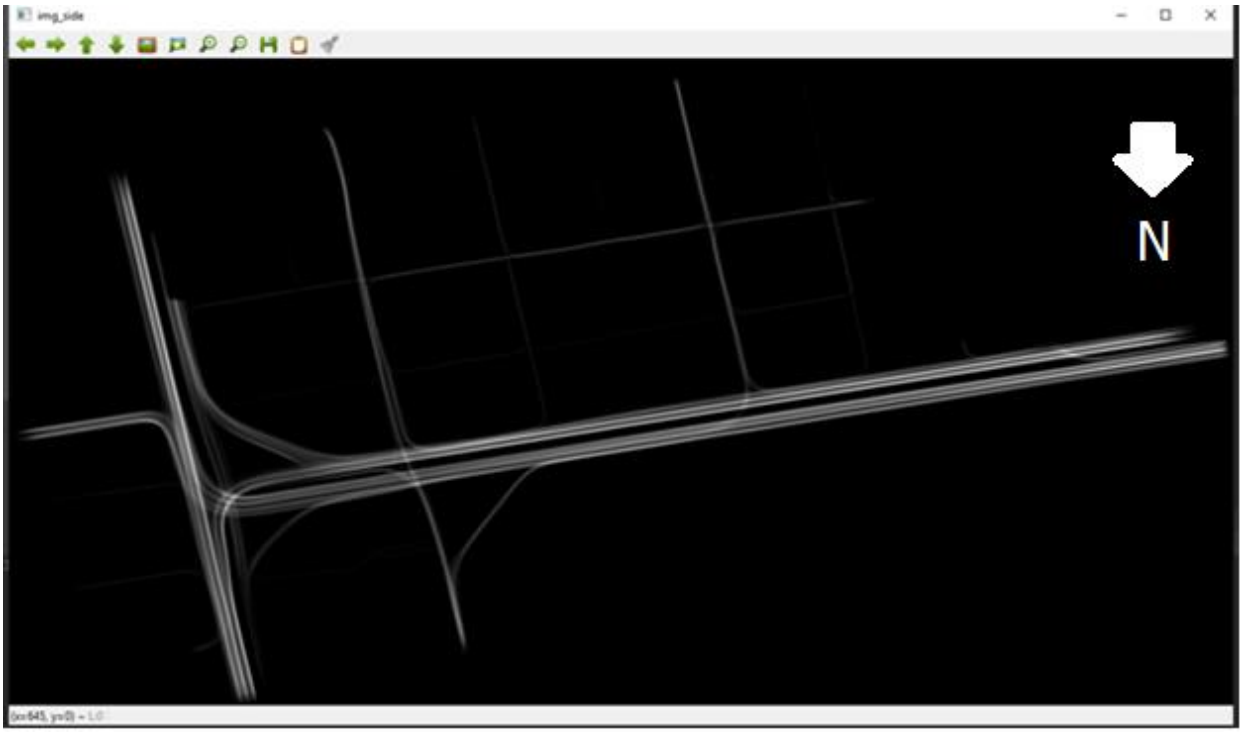

Figure 1: Accumulated vehicle trajectories.

Step2: Refining the lanes according to vehicle trajectories

We will calculate the vehicle moving directions based on the coordinates of vehicles and the route. We will take into account only those vehicle trajectories which are required to be detected. The selection is done based on the directions of the moving vehicles.

Step 3: Locating the lane area

In this step, we will locate and highlight the lane areas from the selected regions in previous step. We used anchor drawing concept to find the clear lane points. We improved already available edge drawing algorithm to anchor drawing to find line along peak points. In anchor drawing, we will draw a line passing through the maximum peak pixels. We get continuous line in anchor drawing compared to edge drawing. A polygon is drawn at each lane and on each selected route by taking the initial and end point of the lane.

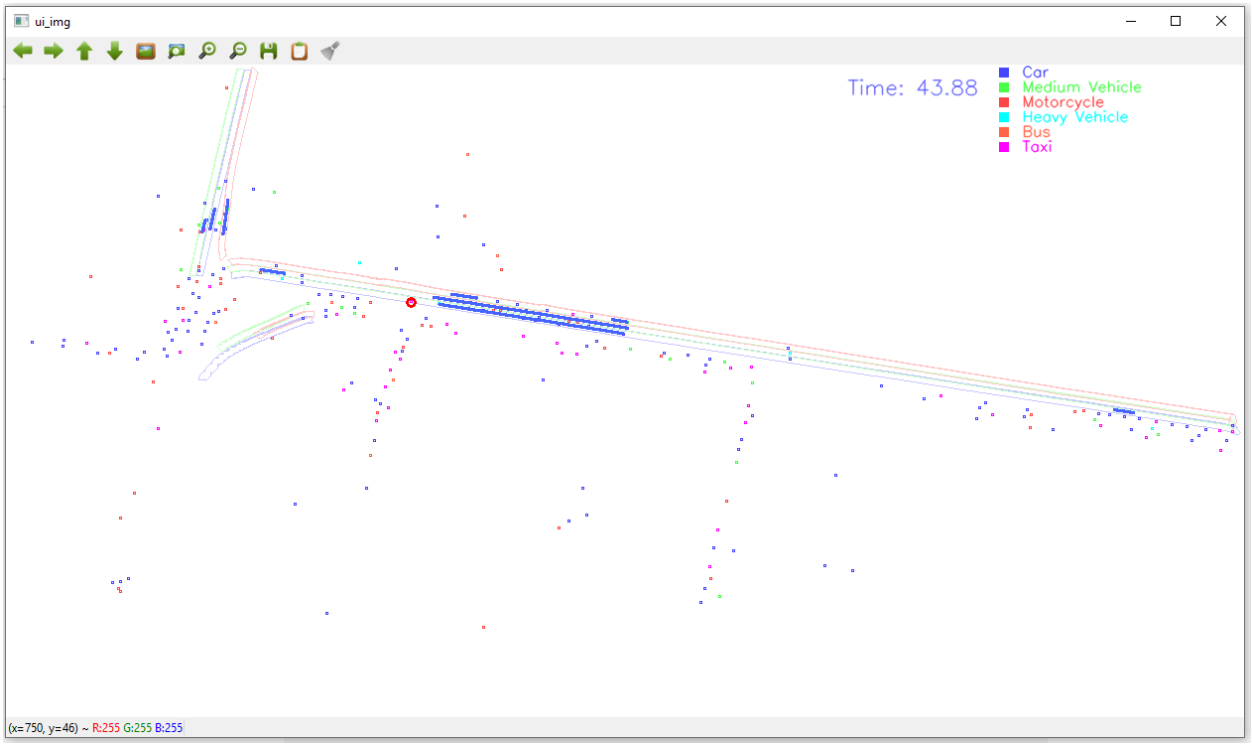

Figure 2: Trajectory view. Blue line indicates queues in each lane, Red circle indicated spillback vehicle

Step 4: Locating the lane of the vehicles

The corresponding lane of the vehicles is determined by the intersection between vehicles position and lane area determined in step 3.

Step 5: Determining Maximum length of queue

The maximum length of queue is determined by selecting the vehicles which are moving with the speed less than certain threshold (mostly stationary vehicles. Considered threshold speed 7km/h) and analyzing the length of the lane in such scenarios.

Step 6: Determining Spillback Positions

To find the spillback position, we have used the temporal information of the time frames. We have selected the traffic queues in the previous steps. If any new vehicle id is appearing in front of queue then its is considered as spillback position. The track of current vehicle ids over the time are saved in order to find the spillback position.

Software/Language used:

- jetbrains pycharm community edition 2019.1.2
- Python 3.7

Libraries/packages used:

1. OpenCV 4.4.0
2. Numpy 1.18.5
3. shapely 1.7.0
4. json
5. csv

Flags:

- DISP : 1 for display trajectory view along with queues, spillbacks.