


FP.5 Performance Evaluation 1

Find examples where the TTC estimate of the Lidar sensor does not seem plausible. Describe your observations and provide a sound argumentation why you think this happened.

Results:

In the graphs below Image ID starts from 1; so, to get the corresponding image id in the tables below we need to subtract 1.

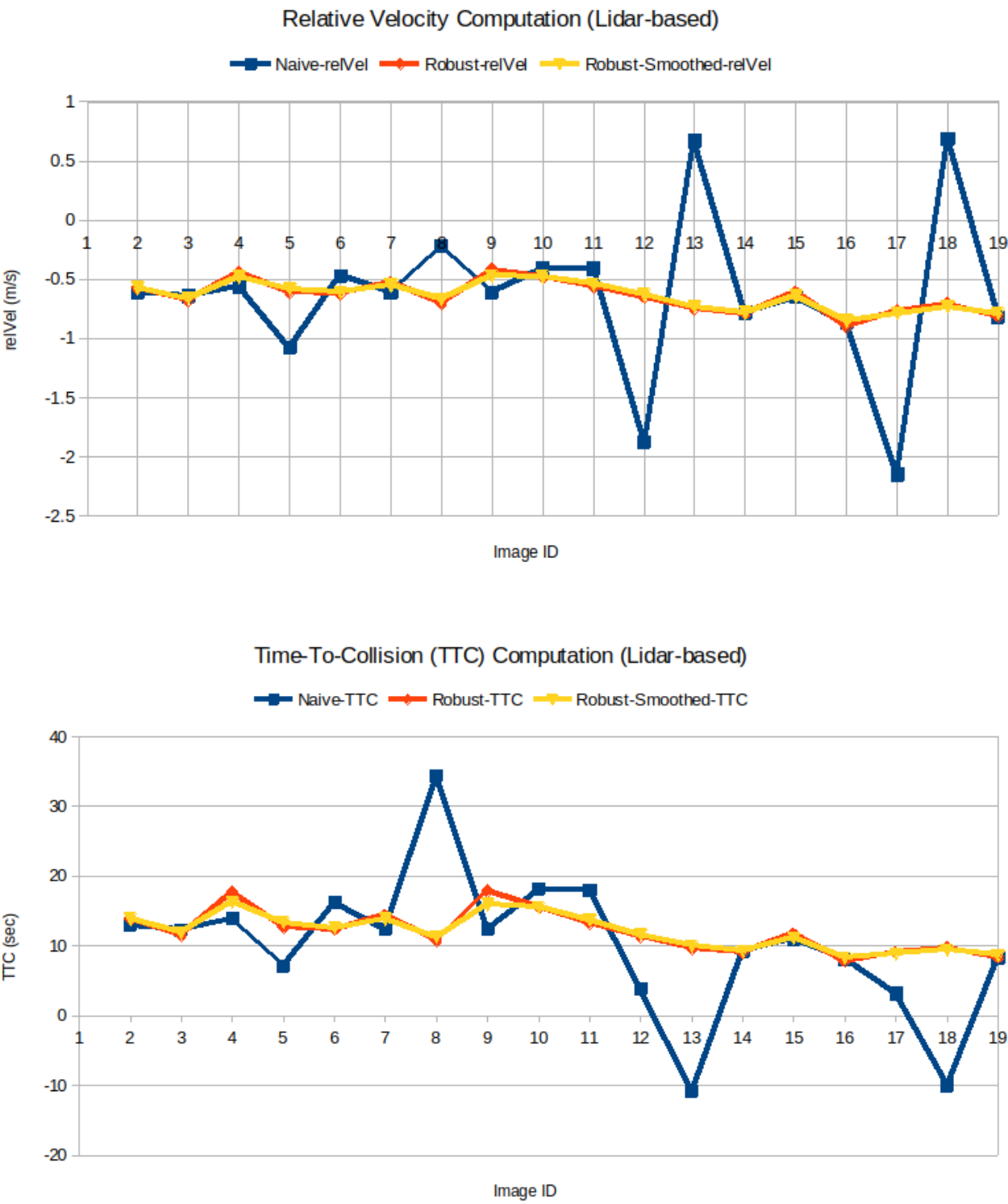


Notes:

*** In Image #6-7,** we see that the Lidar measurements are more spread out (when compared to other instances); this measurement noise can depend on the angle and distance that Lidar beams hit the vehicle in front which could also suddenly due to bumps on the road. This causes to register min point that is closer than mean is, which in the next frame when calculating `relVel = -0.22 (m/s)` , it results in a very slow speed; hence, large `TTC = 34.34 (sec.)` which is visible from the graph at Image ID 8 = 7+1 for Naive calculation of relVel. We can see that the methods used for Robust calculation of the relVel, actually able to deal with this situation and calculate a more reasonable `TTC = 10.80 (sec.)` .

*** In Image #11-12,** we see a large outlier point which results in a large `relVel = -1.88 (m/s)` at current frame that results in a very low `TTC = 3.83 (sec.)` . Also in the next frame where we don't have this kind of outlier, we see the influence of the previous outlier, which now results in a positive `relVel = 0.67 (m/s)` ; which means two vehicles are getting far from each other and hence result in a negative `TTC = -10.85 (sec.)` or `NAN`

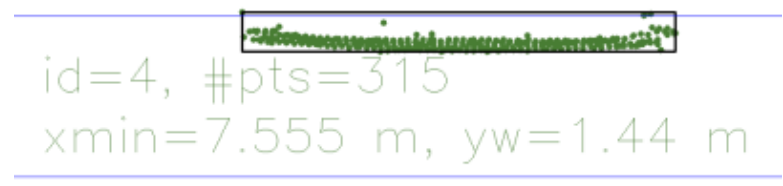
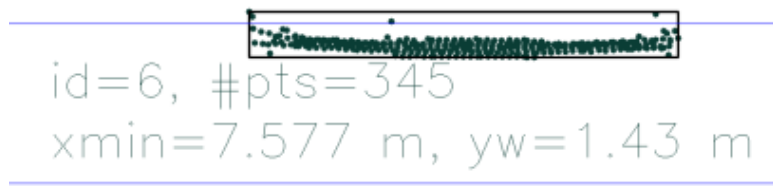
*** In Image #16-17,** the situation is exactly like then one in **Image #11-12** (above).



Effect of Outlier - Case 1:

Image #6:

Image #7:



Measurements are spread-out (noisy)

Image #6 (noisy measurements)	x-min-curr: 7.577 x-min-prev: 7.638 relVel: -0.61 Lidar-TTC: 12.42	x-min-curr: 7.631 x-min-prev: 7.684 relVel: -0.53 Lidar-TTC: 14.40 Smoothed-relVel: -0.55 Smoothed-TTC: 13.87
Image #7 (influenced by prev noise)	x-min-curr: 7.555 x-min-prev: 7.577 relVel: -0.22 Lidar-TTC: 34.34	x-min-curr: 7.561 x-min-prev: 7.631 relVel: -0.70 Lidar-TTC: 10.80 Smoothed-relVel: -0.67 Smoothed-TTC: 11.28

Effect of Outlier - Case 2:

Image #11:

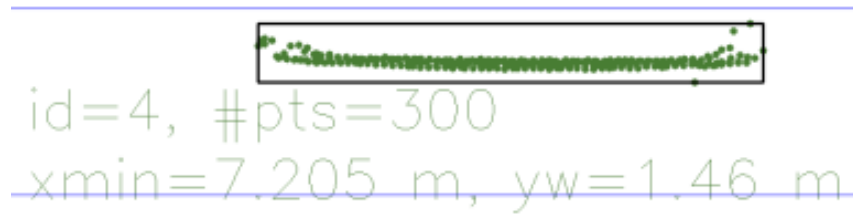
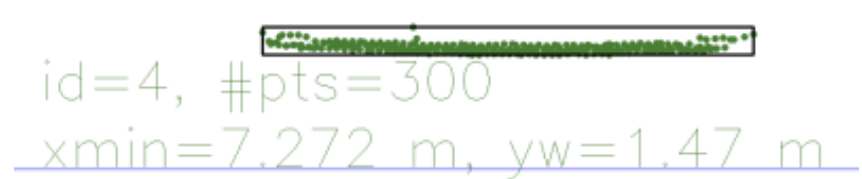


Image #12:



Large outlier!

Image #11 (large outlier)	x-min-curr: 7.205 x-min-prev: 7.393 relVel: -1.88 Lidar-TTC: 3.83	x-min-curr: 7.350 x-min-prev: 7.415 relVel: -0.65 Lidar-TTC: 11.31 Smoothed-relVel: -0.63 Smoothed-TTC: 11.67
Image #12 (influenced by prev outlier)	x-min-curr: 7.272 x-min-prev: 7.205 relVel: +0.67 Lidar-TTC: nan (or: -10.85)	x-min-curr: 7.275 x-min-prev: 7.350 relVel: -0.75 Lidar-TTC: 9.70 Smoothed-relVel: -0.73 Smoothed-TTC: 9.97

Effect of Outlier - Case 3:

Image #16:

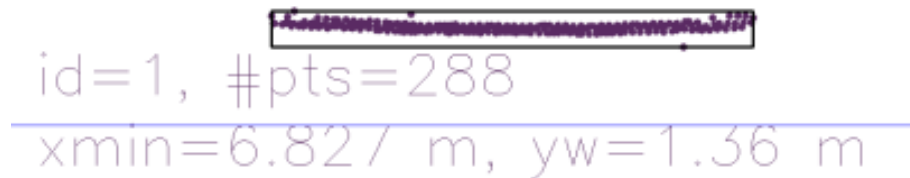
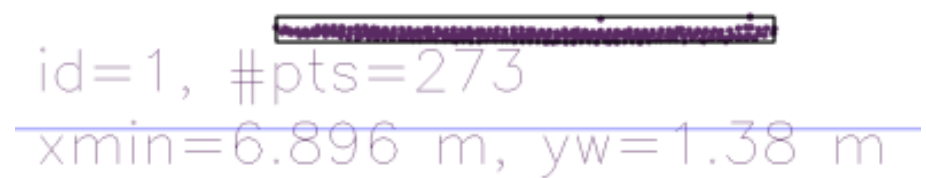


Image #17:



Large outlier!

Image #16 (large outlier)	x-min-curr: 6.827 x-min-prev: 7.042 relVel: -2.15 Lidar-TTC: 3.18	x-min-curr: 6.968 x-min-prev: 7.045 relVel: -0.77 Lidar-TTC: 9.05 Smoothed-relVel: -0.79 Smoothed-TTC: 8.82
Image #17 (influenced by prev outlier)	x-min-curr: 6.896 x-min-prev: 6.827 relVel: +0.69 Lidar-TTC: nan (or: -9.99)	x-min-curr: 6.897 x-min-prev: 6.968 relVel: -0.71 Lidar-TTC: 9.71 Smoothed-relVel: -0.73 Smoothed-TTC: 9.45