FP.1 Match 3D Objects

A 2-D array was created to record the highest number of keypoints which are located in

bounding boxes of both previous and current frame. The map bbBestMatches was updated in

the end.

FP.2 Compute Lidar-based TTC

The equation d1\*(deltaT)/(d0-d1) was used. The solution from lesson 3 was used. Median distances instead of minimum distances were used.

FP.3 Associate Keypoint Correspondences with Bounding Boxes

Loop all kptMatches and check if the corresponding keypoint within region of interest for the

current bounding box. If within ROI, save the matches and distances. Then, used the mean of

the distances for removing outliers. In the end, the remaining keypoint matches and keypoints

are saved in the bounding box data struct.

FP.4: Computer Camera-based TTC

The equation -(deltaT)/(1-h1/h0) is used. I used the solution from less 3 “engineering a

collision System”.

FP.5 Performance Evaluation 1

See TTC calculations based on Lidar points from the following figure.

Chart, line chart

Description automatically generated

In order to check the ground truth, top views of Lidar points are plotted in below.

The distance from the rear part of the preceding vehicle gradually reduced from 8 to 7 meters between frame 0 and frame 18. If vehicle speed does not change too much, the TTC shall also gradually reduce. Lidar-based TTC is much higher in frame 4 and 5. The data noises may cause inaccuracy of TTC.

Frame 0

A picture containing chart

Description automatically generated

Frame 1

Text

Description automatically generated with medium confidence

Frame 2

Text

Description automatically generated with medium confidence

Frame 3

A picture containing chart

Description automatically generated

Frame 4

Text, letter

Description automatically generated

Frame 5

Text, letter

Description automatically generated

FP.6 Performance Evaluation 2

Detectors Shitomasi, FAST work pretty well.However, the detector Harris are really not

stable. Negative TTC exists from Harris detector.

See details in below and more \*.png files under the folder “Build”.

Detector: Shitomasi Descriptor:BRISK

Chart, line chart

Description automatically generated

Detector: Shitomasi Descriptor:ORB

Chart, line chart

Description automatically generated

Detector: Shitomasi Descriptor:BRIEF

Chart, line chart

Description automatically generated

Detector: FAST Descriptor:BRISK

Chart, line chart

Description automatically generated

Detector: FAST Descriptor:FREAK

Chart, line chart

Description automatically generated

Detector: HARRIS Descriptor:BRISK

Chart, line chart

Description automatically generated