FP.0 Final Report

- This report below addressing the whole rubric points.

FP.1 Match 3D Objects

- Function "*matchBoundingBoxes*" is implemented at camFusion_Student.cpp (Lines 401:459).
- There's also alternative implementation giving the exact results at camFusion_Student.cpp (Lines 336:399).

FP.2 Compute Lidar-based TTC

- Function "*computeTTCLidar*" is implemented at camFusion_Student.cpp (Lines 256:333).
- Stray outliers are dealt with through trying both "Average" and "Median" X values instead of "Minimum".
- "Median" is proved to be way better and the TTC values are obtained while "option" is set to it.

FP.3 Associate Keypoint Correspondences with Bounding Boxes

- Function "*clusterKptMatchesWithROI*" is implemented at camFusion_Student.cpp (Lines 136:201).
- Only the matches with Euclidean distance between (mio - sigma) and (mio + sigma) i.e not far from the median (On a Normal Distribution Curve) were selected to be used later in Camera TTC calculations.

FP.4 Compute Camera-based TTC

- Function "*computeTTCCamera*" is implemented at camFusion_Student.cpp (Lines 205:262).
- Outliers are dealt with through calculation the median distance ratio and using it in TTC calculation equation.

FP.5 Performance Evaluation 1

- Observation: -
    - In general, ideally the TTC LiDAR shall decrease from image to image as the preceding vehicle is approaching. Yet this is not the case.
    - Image_3 and 4 in the attached folder "*Final Results Images*" are examples of "Off TTC". And I assume this jump is either: -
        - Because of the sun reflections from side windows of the vehicle crossing the scene at the intersection
        - Or maybe lights reflections from the side mirrors of the preceding vehicle.

    These reflections degrade the LiDAR operation which is mainly based on light.

    - There is also slight increase in TTC between image_16 and 17.
        - This can be seen also in the relevant top view images 16, 17 in the attached folder "*show3DObjects Output*" where xmin increases from 6.83 to 6.90 m.

FP.6 Performance Evaluation 2

- All detector / descriptor combinations implemented in previous chapters have been compared with regard to the TTC estimate on a frame-by-frame basis.
    - See “Camera_Final_Project_Statistics.xlsx”, “Statistics” and “Graph” tabs.
- Detectors “Harris” and “ORB” give implausible TTC values with all descriptors combinations. They were not considered in the graph accordingly.
    - See “Camera_Final_Project_Statistics.xlsx”, “Statistics” tab, the cell highlighted in red.
- Best detector / descriptor combination was chosen to be “FAST / Brief” based on the previous analysis in Camera MidTerm Project.
- Deviations in TTC Camera may result from bad matches that were not filtered out even from (mio - sigma) and (mio + sigma) range.
- Bad matches may result from the shadow of preceding vehicle along with the shadow of the truck on the right which degrade the Camera operation.