

## RUBRIC POINTS

### MP.1 Data Buffer Optimization

Implemented a vector for dataBuffer objects with size limit 2 elements. By pushing in new elements on one end and removing elements on the other end using indexing.

### MP.2 Keypoint Detection

Integrated detectors HARRIS, FAST, BRISK, ORB, AKAZE, and SIFT from OpenCV library and made them selectable by setting a string accordingly.

### MP.3 Keypoint Removal

Removed all keypoints outside of a pre-defined rectangle and only used the keypoints within the rectangle for further processing by duplicating a new vector of dataframes and keeping valid keypoints.

### MP.4 Keypoint Descriptors

Integrated descriptors BRIEF, ORB, FREAK, AKAZE and SIFT from OpenCV library and made them selectable by setting a string accordingly.

### MP.5 Descriptor Matching

Implemented FLANN matching as well as k-nearest neighbor selection with  $n = 2$ . Both methods are selectable using the respective strings in the main function.

### MP.6 Descriptor Distance Ratio

Used the K-Nearest-Neighbor matching in implementing the descriptor distance ratio test, by looking at the ratio of best vs. second-best match to decide whether to keep an associated pair of keypoints.

### MP.7 Performance Evaluation 1

Counted the number of keypoints on the preceding vehicle for all 10 images for all the detectors. Attached excel file consisting the results.

### MP.8 Performance Evaluation 2

Counted the number of matched keypoints for all 10 images using all possible combinations of detectors and descriptors. Attached excel file consisting the results.

### MP.9 Performance Evaluation 3

Noted the time taken for keypoint detection and descriptor extraction. Attached excel file consisting the results.

Results:

The Top 3 detector and descriptor combinations based on the results are

- FAST detector with ORB descriptor (3.5ms)
- FAST detector with BRIEF descriptor (5.5ms)
- ORB detector with ORB descriptor (13ms)

These recommendations are based on the fact the our application needs very fast processing and these combinations are very time efficient and also detecting a good number of keypoints and their matches.