Read Me 3D Final Project

The following file contains the description of the addressing of each of the given tasks.

Match 3D Objects

Here a matrix was created to store the count of matching keypoints that appear within the Region of Interest of the bounding boxes. Then a loop is performed to check all the keypoints through all the bounding boxes filling the counting matrix. At the end the bounding botches matches with the highest amount of counts are given as the resulting pairs.

TTCs Calculation

Both Camera and Lidar TTCs where calculated according the course. For the lidar, the difference in distance between the nearest points from each frame is obtained and for the camera the distance change between the previous keypoints and the new ones, obtaining the mean from all to perform the calculation.

Clustering Keypoint matches with ROI

The mean of the distances is obtained to reject the outliers and then just a check of the matching keypoints is performed to know if both appear on the Region of Interest from the bounding box. When it is so, these are added to the kptMatches from the bounding box structure.

Different Descriptors

While using different descriptors the results for the camera TTC vary strongly. For example, using BRISK delivers a TTC close to the calculated from LIDAR but with a difference of 2 meters. When using FREAK the results are much more accurate, indicating that the description creation is better done.

The worst case was using ORB as the result wasn't even logical according to the given scenario, happening the same when using ORB also as a keypoint detector. The assumption is that the detector works fast but fails when trying to be consistent through the frames creating different keypoints at each one leading to wrong measurements.

Table and Graph from TTC results

Detector	Descriptor	Frames Lidar																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
BRISK	BRISK	12,97	12,26	13,91	7,11	16,25	12,42	34,34	9,34	18,13	18,03	3,83	-10,85	9,22	10,96	8,09	3,17	-9,99	8,30

Detector	Descriptor	Frames Camera																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
BRISK	BRISK	-1,10	6,79	19,12	0,19	6,69	18,72	-5,15	4,24	1,27	9,96	2,09	0,16	-1,26	1,98	1,37	-6,90	30,19	33,88
BRISK	BRIEF	16,74	3,06	4,75	4,26	2,85	4,29	7,46	10,20	-15,67	0,74	2,46	5,07	-2,70	4,13	0,89	5,11	6,98	3,10
BRISK	ORB	-218,15	1,98	2,79	6,20	4,17	-4,04	4,58	4,02	12,13	0,18	0,92	2,50	1,49	5,33	-0,60	21,07	6,95	6,13
BRISK	FREAK	11,42	2,74	1,23	-11,54	10,07	1,99	5,83	2,60	3,90	-100,81	4,07	7,10	4,88	-4,87	4,71	7,34	1,56	-27,46
FAST	BRISK	2,10	-18,92	2,02	0,27	-0,23	297,04	2,57	0,10	1,57	8,40	2,03	10,92	0,83	5,46	-0,38	9,32	8,64	0,07
FAST	BRIEF	6,75	3,84	3,37	2,32	7,56	2,28	1,76	7,66	5,82	-25,03	5,59	1,34	43,70	3,61	1,48	8,64	684,12	3,76
FAST	ORB	9,45	1,90	2,32	5,73	5,34	2,41	1,96	6,25	3,64	5,29	7,40	19,45	2,54	14,41	2,44	-0,36	23,52	2,80
FAST	FREAK	-20,73	1,16	2,99	-0,36	2,76	0,04	-60,70	7,15	7,52	2,54	1,16	-9,45	1,46	0,41	-0,31	0,07	1,22	-0,33
ORB	BRISK	-7,53		-14,07	-2,08	21,62	0,08	0,00	-9,76	23,73	-0,72	-12,27	3,63	3,82	6,10	5,68	0,25		
ORB	BRIEF																		
ORB	ORB		1,02	0,33	2,50	0,01	3,19	-29,40	-2,55	0,31		-11,23	0,30		0,86	7,69	-0,27		
ORB	FREAK	-10,27	12,26	2,25	0,01	3,18	0,21	18,13	0,05	23,62	-2,04	0,50	0,42						
AKAZE	BRISK	17,97	2,92	6,29	-0,86	0,46	8,32	0,12	2,12	0,61	2,46	-3,01	5,05	0,14	-0,24	3,42	-10,56	-3,85	12,47
AKAZE	BRIEF	13,35	-6,23	7,43	4,28	7,83	-6,75	4,22	6,26	2,52	2,76	3,38	3,18	2,23	3,18	1,24	-10,07	-335,64	17,24
AKAZE	ORB	4,52	7,60	3,46	2,70	0,27	2,24	0,03	0,02	-0,13	3,02	1,42	4,56	-2,56	2,66	3,02	4,66	3,30	1,88
AKAZE	FREAK	4,80	3,12	2,81	-1,14	5,51	3,32	2,47	6,62	3,43	7,68	1,82	-2,39	2,41	1,95	2,45	1,37	4,18	-8,35
SIFT	BRISK		-0,60	-2,53	-0,65	0,27	0,01	0,22	3,30	0,16	0,06	0,15	-2,24	0,04		14,03	11,28	0,26	0,23
SIFT	BRIEF	0,27	-44,87	4,46	0,14		23,24	-14,78	1,37	-7,30	1,58	-1,75	0,51	-2,51	0,01	-9,53	3,72	-9,99	12,12
SIFT	ORB																		
SIFT	FREAK	0,07	6,40	0,64	19,15	1,18	0,06		0,24	-4,50	0,09	-6,84	7,04	1,61	3,98	0,09	0,17	1,07	6,79