FP1. Match 3D objects

-I Implemented the function in camFusion_student.cpp; Loop through all matches and find the pair of bounding boxes that contains matched keypoints. Keep track with a table to find the best matched BB at the end

FP2. Computer Lidar-based TTC

I Used the median of the point cloud cluster to as the representation of the target vehicle in 2 consecutive frames and applied the formular for constant velocity model.

FP3. Associate keypoint correspondences with bounding boxes

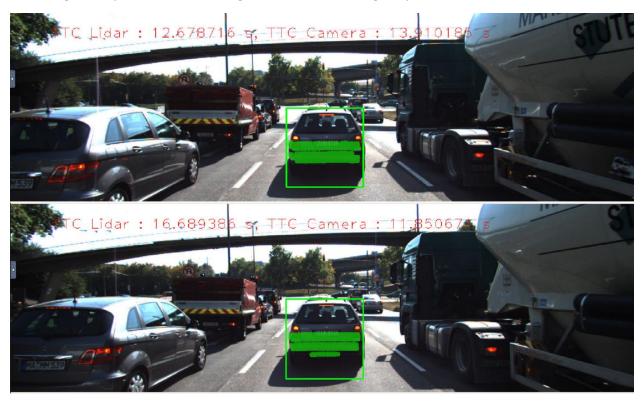
I calculated the mean of all Euclidian distance between matched keypoints and remove those have distance above the mean.

FP.4 Compute Camera-based TTC

I first implemented the function to find the matched keypoints within the ROI and then remove the outlier using the ration distance as introduced in the lesson

FP.5 Performance evaluation 1

- Erros observed in Lidar-based TCC: I notice that at frame 4 the TTC is 16 while the target car looks closer to our host vehicle and the at frame 6 the TTC go back to 12. This potential root cause might come from the way I used median (distance in X) to find the representation of the pointcloud, as the ROI changes, the points included changes and leads the change of point cloud distribution.



FP.6 Performance Evaluation 2

I summary all observation in the table below:

SHTOMASH	Detector	Descriptor	frame 1	frame 2	frame 3	frame 4	frame 5	frame 6	frame 7	frame 8	frame 9	frame 10	frame 11	frame 12	frame 13	frame 14	frame 15	frame 16	frame 17	frame 18
BRISK	SHITOMASHI		24.4928	14.528	18.3804	11.8507	14.1876	13.9102	22.3009	16.4756	11.3267	13.5138	11.5174	12.5502	12.5595	12.6567	10.5007	10.2477	9.31494	9.87553
BRISE ORB 18.847 18.64 16.91 19.949 18.647 18.647 18.647 18.6487 18.64	HARRIS	1	n/a	10.586	n/a	12.4858	n/a	13.6217	16.7724	11.2543	0.134504	n/a	11.6702	5.33701	11.9102	7.72144	n/a	7.09479	11.7964	0.350321
	FAST	1	12.5951	11.797	13.6008	12.8651	n/a	12.5645	15.6212	11.7252	13.0297	13.6593	24.3961	12.5689	12.8596	12.1132	11.8915	12.0872	7.88441	12.2182
	BRISK	BRISK	14.36	16.91	10.9949	16.9132	30.7918	18.1758	15.7748	19.7292	15.206	14.9163	12.4661	10.8666	12.5023	11.6022	12.2247	10.812	9.38048	10.4496
Sept	ORB	1	18.8847	18.6344	26.6842	19.9253	n/a	12.5033	16.4045	16.0542	12.0719	13.4335	9.78143	n/a	9.22601	9.51962	11.9076	11.8316	15.8889	25.7402
SHITOMACH HARRIS HARRIS HARRIS HARRIS HARRIS 14,000 12,000	AKAZE	1	12.2751	14.7487	13.998	14.9035	13.8194	15.3823	16.4883	14.1263	13.7881	12.0597	12.6935	11.5922	10.2771	9.84639	9.48015	10.4517	9.26131	8.94209
HARRIS FAST 10.9082 10.586 -11.4731 11.7693 13.6432 47.094 15.8978 25.116 3.30058 n/a 11.7414 5.05076 13.456 5.6061 n/a 10.9006 12.5848 n/a 12.9477 20.0678 13.8959 14.6808 15.7524 14.4533 11.7607 11.8219 12.699 17.1467 11.503 12.0299 11.0226 12.3176 11.2304 20.7636 10.4738 12.9477 20.0678 13.3699 20.0963 17.3541 16.2282 17.2164 19.3832 14.8189 12.0806 12.2549 12.4541 11.9443 10.7752 11.2997 11.0855 30.0563 11.4731 17.0008 12.2548 13.7483 13.2483 13.2484 13.248	SIFT		14.7371	15.6734	12.8992	20.6866	16.0607	10.4699	16.1066	15.4765	14.2222	10.5046	12.9654	11.3005	11.3185	11.5133	9.48497	8.72439	8.78325	8.76581
BRISK BRISK 1.0695 11.981 13.8858 14.6608 15.7524 14.4532 11.7607 11.8219 12.669 17.4667 13.7704 11.1503 12.099 11.0226 12.3176 11.2054 0.0786 10.4738 BRISK 12.9477 20.0678 13.3699 20.0963 17.541 16.2282 17.2164 19.832 14.819 12.0806 12.2549 12.4541 11.9443 10.7752 11.2997 11.4085 9.30693 11.4731 ARAZE 13.2783 16.8136 13.9164 15.1064 15.100	SHITOMASHI		14.0747	16.8411	9.93645	12.9215	13.2483	13.4042	15.2359	12.5114	11.7376	13.3275	11.4314	11.5364	11.9735	13.2126	12.0506	11.0235	10.7442	8.39865
BRISK ORB 1.9471 20.0678 13.3689 20.0963 17.3541 16.282 17.2164 19.3832 14.819 12.0806 12.2549 12.541 11.9443 10.7752 11.2997 11.4085 3.0693 11.4731	HARRIS	1	10.9082	10.586	-11.4731	11.7693	13.6432	14.7045	15.8978	25.116	3.30058	n/a	11.7414	5.05076	13.456	5.6061	n/a	10.9006	12.5848	n/a
CRE 16.921 32.5893 19.9567 30.0516 33.1788 13.4145 188.74 13.8288 13.2276 13.0367 11.7678 14.641 10.7295 9.71308 15.4581 7.85888 28.5165 14.788 13.2783 15.2783 15.2783 15.2783 15.0736 15.1064 15.1064 15.1064 15.1094 15.653 16.175 13.9668 14.1769 12.567 13.0318 11.6693 10.5753 10.8898 9.37766 9.54881 8.693 7.95904 8.61225 9.72006 7.95906	FAST	1	11.0695	11.981	13.8858	14.6808	15.7524	14.4533	11.7607	11.8219	12.699	17.1467	13.7704	11.1503	12.0299	11.0226	12.3176	11.2304	9.0786	10.4738
SIFT	BRISK	BRIEF	12.9477	20.0678	13.3699	20.0963	17.3541	16.2282	17.2164	19.3832	14.819	12.0806	12.2549	12.4541	11.9443	10.7752	11.2997	11.4085	9.30693	11.4731
SHTOMASHI 11.8355 14.8188 15.3418 21.8725 14.7482 10.7532 15.8379 18.1733 13.2843 13.0845 12.0832 9.84375 10.4468 9.88427 8.8317 7.97504 8.61235 9.25026 15.0756 12.1711 12.095 13.3448 12.7989 12.7984 14.6234 12.9181 13.9358 12.0292 11.5554 11.8595 9.89389 13.1503 8.66612 8.14662 14.8678 14.8678 12.0717 12.3776 12.7705 13.6805 43.2173 n/a 11.3027 10.7352 12.3241 13.8902 14.8673 13.301 12.0131 11.3079 10.9223 12.3456 9.9881 10.2184 18.8505 16.7888 15.6438 19.8978 20.1027 31.4115 17.7808 9.8851 10.8951 14.8673 13.301 12.0131 13.3079 10.9223 12.3456 9.9881 10.2184 12.9182 15.0455 14.1216 14.3807 15.5799 13.8902 13.8952 13.8932 13.691 12.1246 12.2719 11.6155 10.6776 11.6641 11.3596 10.5992 9.06497 8.9387 15.731 13.8922 13.6914 12.2461 13.802 14.6662 13.9556 13.8952 13.8924 12.4668 13.06 12.2719 13.6555 12.7251 14.3328 8.89827 11.1301 12.9182 15.0455 14.1216 14.3807 15.5799 13.7591 15.733 13.8922 13.691 12.1246 12.2719 11.6155 10.6776 11.6641 11.3596 10.5992 9.06497 8.9387 14.4761 14	ORB		16.921	32.5893	19.9567	30.0516	33.1788	13.4145	188.74	13.8288	13.2276	13.0367	11.7678	14.641	10.7295	9.71308	15.4581	7.85888	28.5165	14.788
SHITOMASHI HARRIS RANGE 15.0726 12.171 12.095 13.3448 12.7989 12.7954 14.6347 12.5114 10.9913 13 9.33785 12.0292 11.5554 11.8595 9.8359 13.1503 8.66612 8.14662 14.881815 52.7952 n/a 11.7693 35.3833 13.6217 14.2744 13.5704 3.79517 n/a 11.1552 11.1055 n/a 5.66097 n/a 7.21241 n/a 3.42677 12.7017 12.7017 12.7017 12.7017 12.7017 12.7017 12.7017 12.7017 12.7017 12.7017 12.7017 12.7017 12.7017 12.7017 12.7017 12.7017 12.7017 12.7017 13.6007	AKAZE		13.2783	16.8136	13.9164	15.1064	15.1909	13.5663	16.0175	13.9668	14.1769	12.567	13.0318	11.0693	10.5753	10.8589	9.37766	9.91621	9.54581	8.693
HARRIS FAST 12.0717 12.3776 12.7705 13.6805 43.2173 17.891 13.027 13.9757 12.3241 13.8902 14.8673 13.301 12.0131 11.3079 10.7325 12.3241 13.8902 14.8673 13.301 12.0131 11.3079 10.9223 12.3436 9.49881 10.2184 10.2184 10.2184 12.9181 12.9181 13.6558 12.7251 14.3328 8.89827 11.301 12.0131 13.079 10.7325 13.9357 14.2995 13.894 12.4668 13.106 12.2247 13.6558 12.7251 14.3328 8.89827 11.301 12.0181 12.9181 13.6558 12.7251 14.3328 8.89827 11.301 12.0181 12.9182 15.0455 14.1216 14.3807 15.5579 13.7591 15.723 13.8922 13.691 12.1246 12.2719 11.6155 10.6776 11.6641 11.3596 10.5992 0.6497 8.9387 14.1216 14.3807 15.5579 13.7591 15.723 13.8922 13.691 12.1246 12.2719 11.6155 10.6776 11.6641 11.3596 10.5992 0.6497 8.9387 12.9184 13.8926 14.6463 11.9751 12.2613 12.0556 15.3888 15.1847 13.7284 13.0174 14.1512 11.9428 13.2407 13.0002 17.8084 11.8818 12.6526 12.9845 8.02811 19.9082 17.9081 13.313 13.6893 23.4576 13.5516 16.5212 10.9512 12.9992 11.8127 12.0992 12.3456 14.14079 12.9458 11.9088 19.9082 14.7623 15.6243 9.38588 33.3573 17.8082 12.9992 11.2271 12.0961 27.8084 11.4079 12.1987 7.86218 11.9088 10.948	SIFT		11.8355	14.8188	15.3418	21.8725	14.7482	10.7532	15.8379	18.1733	13.2843	13.0845	12.0832	9.84375	10.4468	9.88427	8.8317	7.97504	8.61235	9.25026
FAST BRISK ORB 12.0717 12.3776 12.7705 13.6805 43.2173 n/a 11.3027 10.7352 12.3241 13.8902 14.8673 13.301 12.0131 11.3079 10.9223 12.3436 9.49881 10.2184	SHITOMASHI		15.0726	12.1711	12.095	13.3448	12.7989	12.7954	14.6347	12.5114	10.9913	13	9.33785	12.0292	11.5554	11.8595	9.98359	13.1503	8.66612	8.14662
BRISK ORB 16.7888 15.6438 19.8978 20.1027 31.4115 17.7808 19.8573 19.9357 14.2959 13.894 12.4668 13.106 12.2247 13.5655 12.7251 14.3328 8.89827 11.301	HARRIS		8.81335	52.7952	n/a	11.7693	35.3833	13.6217	14.2744	13.5704	3.97517	n/a	11.1552	11.1055	n/a	5.66097	n/a	7.21241	n/a	3.42677
CARDED C	FAST	1	12.0717	12.3776	12.7705	13.6805	43.2173	n/a	11.3027	10.7352	12.3241	13.8902	14.8673	13.301	12.0131	11.3079	10.9223	12.3436	9.49881	10.2184
AKAZE 12.9182 15.0455 14.1216 14.3807 15.5759 13.7591 15.723 13.8922 13.691 12.1246 12.2719 11.6155 10.6776 11.6641 11.3596 10.5992 9.06497 8.9387	BRISK	ORB	16.7888	15.6438	19.8978	20.1027	31.4115	17.7808	19.8573	19.9357	14.2959	13.894	12.4668	13.106	12.2247	13.5655	12.7251	14.3328	8.89827	11.1301
SHT N/a	ORB		22.07	10.918	18.5308	29.9201	n/a	13.2729	15.3801	10.8951	30.4129	23.5366	9.35938	21.9028	10.2757	10.8872	13.6989	10.9958	40.195	14.5414
SHITOMASHI HARRIS FREAK 13.8926	AKAZE		12.9182	15.0455	14.1216	14.3807	15.5579	13.7591	15.723	13.8922	13.691	12.1246	12.2719	11.6155	10.6776	11.6641	11.3596	10.5992	9.06497	8.9387
HARRIS FAST FIREM 10.9082 N/a 1.53607 12.5101 N/a 15.2483 13.6036 10.7335 N/a 10.2931 11.8135 11.8228 13.456 6.06984 N/a 6.71705 12.5848 N/a 12.0961 12.78033 14.313 13.2689 12.4876 13.314 15.311 15.2681 16.5212 11.6952 11.6951 11.2281 11.6952 11.8213 12.9881 11.8272 12.0496 12.3436 11.4079 12.1387 13.9778 7.6218 11.9962 11.8213 11.9962 11.8213 11.8228 13.456 10.943 12.3466 11.4079 12.1387 13.9778 11.997 12.1387 11.997 13.2987 11.997 13.2987 11.8313 11.8228 13.456 10.6984 N/a 12.3466 11.4079 12.3466 11.4079 12.3467 13.9778 11.997 13.9778 11.997 13.9778 11.997 13.9778 14.8423 14.0821 11.9986 13.3578 14.3581 13.978 13.2466 13.5203 14.1623 14	SIFT		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
FAST 12.0961 27.8033 14.313 13.2689 23.4576 13.5266 16.5212 11.6952 12.0693 17.9109 12.9992 11.8227 12.0496 12.3436 11.4079 12.1987 7.86218 11.9008	SHITOMASHI		13.8926	14.6463	11.9751	12.2613	12.0556	15.3888	15.1847	13.7284	13.0174	14.1512	11.9428	13.2407	13.0002	17.8084	11.8818	12.6526	12.9845	8.02811
BRISK FREAK 12.188 16.995 14.1325 15.2391 24.8776 13.3114 15.4119 16.9052 17.6251 12.5337 14.8692 12.0228 12.6791 11.197 13.9176 8.76213 9.27288 11.0962 10.943 23.3622 12.6911 11.2087 59.0092 14.7623 156.243 9.38588 33.3573 n/a 6.46748 n/a 6.98176 21237.2 8.68208 8.25347 32.1974 24.1855 14.7996 13.3585 13.3988 16.3518 16.8318 10.9177 16.5944 14.8423 14.0282 11.2396 10.6571 10.6904 11.2158 10.2517 9.66809 9.8641 8.46464 8.96286 AKAZE 21.5965 14.4355 13.0048 14.397 15.1878 13.2446 15.8094 14.1623 14.1482 11.6422 12.0663 10.8931 10.8519 10.533 10.7295 9.76202 9.02322 9.08333 10.8788 10.9488 11.773 11.1126 12.7502 11.2131 13.2783 13.2285 12.332 13.5257 12.1891 11.5712 11.2894 11.8681 11.1123 7.48485 11.6818 16.8418 10.9177 16.5944 14.623 14.6422 14.6422 14.6422 14.6423 14.6424 14.6424 14.6424 14.6424 14.6424 14.6424 14.6444	HARRIS		10.9082	n/a	1.53607	12.5101	n/a	15.2483	13.6036	10.7335	n/a	10.2931	11.8135	11.8228	13.456	6.06984	n/a	6.71705	12.5848	n/a
DRB 10.943 23.3622 12.6911 11.2087 59.0092 14.7623 156.243 9.38588 33.3573 n/a 6.46748 n/a 6.98176 21237.2 8.68208 8.25347 32.1974 24.1855 10.943 23.3622 12.6911 11.2087 59.0092 14.7623 156.243 9.38588 33.3573 n/a 6.46748 n/a 6.98176 21237.2 8.68208 8.25347 32.1974 24.1855 14.7996 13.3585 13.3988 16.3518 16.8318 10.9177 16.5944 14.8423 14.0282 11.2396 10.6571 10.6904 11.2158 10.2517 9.68690 9.8618 8.4548 8.46248 8.96286 AKAZE AKAZE 12.5965 14.4355 13.0048 14.397 15.1878 13.2446 15.8094 14.1623 14.1482 11.6422 12.0663 10.8931 10.8519 10.533 10.7295 9.76202 9.20222 9.08333 14.0894 11.7773 11.1126 12.7502 11.9213 13.2703 13.2947 13.2285 12.332 13.5257 12.1981 11.5712 11.2894 11.8681 11.1123 7.48435 11.6681 8.26497 10.9082 n/a n/a 11.0967 n/a 11.0967 n/a 13.456 6.66097 n/a 8.66241 12.5848 3.98535 12.6702 10.7403 14.1559 14.1341 19.0545 13.6069 13.5023 14.1139 13.1594 14.6889 18.3879 11.7475 12.5276 11.6113 11.232 11.3076 7.78691 12.2465 13.6432 12.5488 13.6432 12.5484 13.8661 14.0078 11.994 13.8559 12.5727 10.6113 13.586 10.2772 11.1837 13.2776 13.4448	FAST		12.0961	27.8033	14.313	13.2689	23.4576	13.5266	16.5212	11.6952	12.0693	17.9109	12.9992	11.8227	12.0496	12.3436	11.4079	12.1987	7.86218	11.9008
AKAZE 10.943 23.3622 12.6911 11.2087 59.0092 14.7623 156.243 9.38588 33.3573 n/a 6.46748 n/a 6.98176 21237.2 8.68208 8.25347 32.1974 24.1855 51FT 14.7996 13.3585 13.3988 16.3518 16.8318 10.9177 16.5944 14.8423 14.0282 11.2396 10.6571 10.6904 11.2158 10.2517 9.66809 9.8641 8.46464 8.96286 8.10831 10.831	BRISK	FREAK	12.188	16.995	14.1325	15.2391	24.8776	13.3114	15.4119	16.9052	17.6251	12.5337	14.8692	12.0228	12.6791	11.1997	13.9176	8.76213	9.27288	11.0962
SIFT 14.7996 13.3585 13.3988 16.3518 16.8318 10.9177 16.5944 14.8423 14.0282 11.2396 10.6571 10.6904 11.2158 10.2517 9.66809 9.8641 8.46464 8.96286 AKAZE AKAZE 12.5965 14.4355 13.0048 14.397 15.1878 13.2446 15.8094 14.1623 14.1482 11.6422 12.0663 10.8931 10.8519 10.533 10.7295 9.76202 9.02322 9.08333 SHTOMASHI 14.0894 11.7773 11.1126 12.7502 11.213 13.2273 13.2947 13.2285 12.332 13.5257 12.1981 11.5712 11.2894 11.8681 11.1123 7.48485 11.6818 16.6497 HARRIS 10.9082 n/a n/a 11.0145 13.6432 27.8744 13.9875 25.116 n/a n/a 11.0967 n/a 13.456 5.66097 n/a 8.86241 12.5848 3.98535 FAST 12.6702 10.7403 14.1559 14.1341 29.0545 13.6669 13.5023 14.1139 13.1594 14.6889 18.3879 11.7475 12.5276 11.6137 11.232 11.3076 7.78691 12.2465 DRB 14.4842 11.0165 22.5752 n/a 70.6497 12.5581 44.1797 10.6807 11.924 12.6395 9.62025 n/a 9.65265 15.2678 16.9683 10.5643 18.734 18.5157 AKAZE 12.649 14.6108 13.2831 14.1509 17.4249 13.8406 15.6829 14.063 14.2546 11.7404 12.8073 11.4842 11.027 10.4792 9.94151 10.1631 9.52286 8.86387 SIFT frame 1 frame 2 frame 3 frame 4 frame 5 frame 6 frame 7 frame 8 frame 9 frame 10 frame 11 frame 12 frame 13 frame 14 frame 15 frame 16 frame 17 frame 18	ORB		10.943	23.3622	12.6911	11.2087	59.0092	14.7623	156.243	9.38588	33.3573	n/a	6.46748	n/a	6.98176	21237.2	8.68208	8.25347	32.1974	24.1855
AKAZE AKAZE 12.5965 14.4355 13.0048 14.397 15.1878 13.2446 15.8094 14.1623 14.1482 11.6422 12.0663 10.8931 10.8519 10.533 10.7295 9.76202 9.2022 9.08333 10.000 14.	AKAZE		10.943	23.3622	12.6911	11.2087	59.0092	14.7623	156.243	9.38588	33.3573	n/a	6.46748	n/a	6.98176	21237.2	8.68208	8.25347	32.1974	24.1855
SHITOMASHI 14.0894 11.7773 11.1126 12.7502 11.9213 13.2703 13.2947 13.2285 12.332 13.5257 12.1981 11.5712 11.2894 11.8681 11.1123 7.48435 11.1681 8.26497	SIFT		14.7996	13.3585	13.3988	16.3518	16.8318	10.9177	16.5944	14.8423	14.0282	11.2396	10.6571	10.6904	11.2158	10.2517	9.66809	9.8641	8.46464	8.96286
HARRIS 10.9082 n/a n/a 11.0145 13.6432 27.8744 13.9875 25.116 n/a n/a 11.0967 n/a 13.456 5.66097 n/a 8.86241 12.5848 3.98535 FAST 12.6702 10.7403 14.1559 14.1341 29.0545 13.0669 13.9023 14.1139 13.1594 14.6889 18.3879 11.7475 12.5276 11.6137 11.232 11.3076 7.76691 12.2465 RISK SIFT 14.68 14.8942 17.9725 18.4394 36.8012 16.5939 17.7167 15.5108 14.2078 11.994 13.1859 12.7527 10.6113 13.8363 10.2772 11.1837 13.2776 ORB 19.4124 11.0165 22.5752 n/a 70.6497 12.5581 44.1797 10.6807 11.924 12.6395 9.62025 n/a 9.65265 15.2678 16.9683 10.5643 18.7334 18.5157 AKAZE 12.649 14.6108 13.2831 14.1509 17.4249 13.8406 15.6829 14.063 14.2546 11.7404 12.8073 11.4842 11.027 10.4792 9.94151 10.1631 9.52286 8.86837 SIFT 12.0662 13.9837 12.7056 19.1004 15.275 12.5168 14.5659 18.4685 14.5452 10.7818 11.9401 11.7433 11.0237 12.9064 9.78012 9.39131 8.9451 9.24051 Frame 1 Frame 2 Frame 3 Frame 4 Frame 5 Frame 6 Frame 7 Frame 8 Frame 9 Frame 10 Frame 11 Frame 12 Frame 13 Frame 14 Frame 15 Frame 16 Frame 17 Frame 18	AKAZE	AKAZE	12.5965	14.4355	13.0048	14.397	15.1878	13.2446	15.8094	14.1623	14.1482	11.6422	12.0663	10.8931	10.8519	10.533	10.7295	9.76202	9.20222	9.08333
FAST 12.6702 10.7403 14.1559 14.1341 29.0545 13.0669 13.5023 14.1139 13.1594 14.6889 18.3879 11.7475 12.5276 11.6137 11.232 11.3076 7.78691 12.2465	SHITOMASHI		14.0894	11.7773	11.1126	12.7502	11.9213	13.2703	13.2947	13.2285	12.332	13.5257	12.1981	11.5712	11.2894	11.8681	11.1123	7.48435	11.1681	8.26497
BRISK SIFT 14.68 14.8942 17.9752 18.4394 36.8012 16.5901 16.3978 17.7167 15.5108 14.2078 11.994 13.1859 12.7527 10.6113 13.5836 10.2772 11.1837 13.2776 19.4124 11.0165 22.5752 n/a 70.6497 12.5581 44.1797 10.6807 11.924 12.6395 9.62025 n/a 9.65265 15.2678 16.9683 10.5643 18.5157 12.649 14.6108 13.2831 14.1509 17.4249 13.8406 15.6829 14.063 14.2546 11.7404 12.8073 11.4842 11.027 10.4792 9.94151 10.1631 9.52286 8.86837 12.0662 13.9837 12.7056 19.1004 15.275 12.5168 14.5569 18.4685 14.5452 10.7818 11.9401 11.7433 11.0237 12.9064 9.78012 9.39131 8.9451 9.24051	HARRIS	SIFT	10.9082	n/a	n/a	11.0145	13.6432	27.8744	13.9875	25.116	n/a	n/a	11.0967	n/a	13.456	5.66097	n/a	8.86241	12.5848	3.98535
ORB 19.4124 11.0165 22.5752 n/a 70.6497 12.5581 44.1797 10.6807 11.924 12.6395 9.62025 n/a 9.65265 15.2678 16.9683 10.5643 18.7334 18.5157	FAST		12.6702	10.7403	14.1559	14.1341	29.0545	13.0669	13.5023	14.1139	13.1594	14.6889	18.3879	11.7475	12.5276	11.6137	11.232	11.3076	7.78691	12.2465
AKAZE 12.649 14.6108 13.2831 14.1509 17.4249 13.8406 15.6829 14.063 14.2546 11.7404 12.8073 11.4842 11.027 10.4792 9.94151 10.1631 9.52286 8.86837 12.0662 13.9837 12.7056 19.1004 15.275 12.5168 14.5659 18.4685 14.5452 10.7818 11.9401 11.7433 11.0237 12.9064 9.78012 9.39131 8.9451 9.24051	BRISK		14.68	14.8942	17.9752	18.4394	36.8012	16.5901	16.3978	17.7167	15.5108	14.2078	11.994	13.1859	12.7527	10.6113	13.5836	10.2772	11.1837	13.2776
SIFT 12.0662 13.9837 12.7056 19.1004 15.275 12.5168 14.5659 18.4685 14.5452 10.7818 11.9401 11.7433 11.0237 12.9064 9.78012 9.39131 8.9451 9.24051	ORB		19.4124	11.0165	22.5752	n/a	70.6497	12.5581	44.1797	10.6807	11.924	12.6395	9.62025	n/a	9.65265	15.2678	16.9683	10.5643	18.7334	18.5157
frame 1 frame 2 frame 3 frame 4 frame 5 frame 6 frame 7 frame 8 frame 9 frame 10 frame 11 frame 12 frame 13 frame 14 frame 15 frame 16 frame 17 frame 18	AKAZE		12.649	14.6108	13.2831	14.1509	17.4249	13.8406	15.6829	14.063	14.2546	11.7404	12.8073	11.4842	11.027	10.4792	9.94151	10.1631	9.52286	8.86837
	SIFT		12.0662	13.9837	12.7056	19.1004	15.275	12.5168	14.5659	18.4685	14.5452	10.7818	11.9401	11.7433	11.0237	12.9064	9.78012	9.39131	8.9451	9.24051
	-																			
			frame 1	frame ?	frame 3	frame 4	frame 5	frame 6	frame 7	frame 8	frame 9	frame 10	frame 11	frame 12	frame 13	frame 14	frame 15	frame 16	frame 17	frame 18
	Lidar																			

The combination of **Shi Tomashi + SIFT** appear to have the most consistent performance (smallest standard deviation). Also, its results are closed to the results we got from Lidar based method.