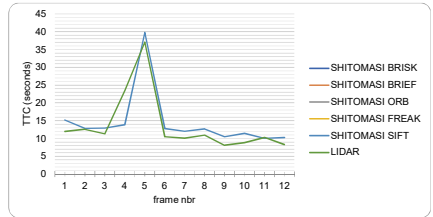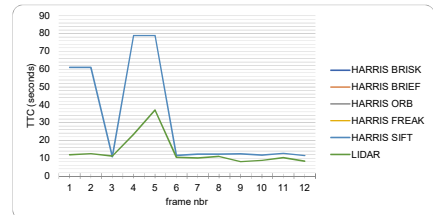| Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
SHITOMASI	BRISK	1	1759	1630	83	9.779982	14.844612	11.470868	15.19481	11.989397
SHITOMASI	BRISK	2	1806	1729	91	10.145861	15.363916	12.277738	12.853594	12.595109
SHITOMASI	BRISK	3	1894	1736	95	10.399553	16.408053	12.846285	12.925121	11.285089
SHITOMASI	BRISK	4	1889	1758	90	10.282753	14.8262	12.967078	13.893044	23.528077
SHITOMASI	BRISK	5	1874	1778	86	10.416507	14.957595	13.007331	39.75763	37.070036
SHITOMASI	BRISK	6	1912	1739	82	10.321393	15.108326	13.026529	12.776217	10.491403
SHITOMASI	BRISK	7	1930	1787	89	10.303581	15.42809	13.492995	12.023237	10.099996
SHITOMASI	BRISK	8	1886	1768	91	10.109069	15.001221	13.35018	12.703137	10.967763
SHITOMASI	BRISK	9	1957	1776	85	10.303369	15.897491	14.203233	10.500498	8.094218
SHITOMASI	BRISK	10	1888	1849	94	10.523076	14.809301	13.768909	11.454247	8.813924
SHITOMASI	BRISK	11	1919	1778	85	10.241008	16.128324	13.730552	10.062017	10.292551
SHITOMASI	BRISK	12	2055	1815	91	10.464244	17.222694	14.927143	10.300536	8.309779

Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
SHITOMASI	BRIEF	1	1759	1630	83	10.209528	14.266675	11.478288	15.19481	11.989397
SHITOMASI	BRIEF	2	1806	1729	91	10.23509	14.78727	12.712294	12.853594	12.595109
SHITOMASI	BRIEF	3	1894	1736	95	10.260321	14.783106	13.038695	12.925121	11.285089
SHITOMASI	BRIEF	4	1889	1758	90	10.232084	14.999317	13.22946	13.893044	23.528077
SHITOMASI	BRIEF	5	1874	1778	86	10.255933	15.031343	14.281048	39.75763	37.070036
SHITOMASI	BRIEF	6	1912	1739	82	10.347558	15.098062	13.336443	12.776217	10.491403
SHITOMASI	BRIEF	7	1930	1787	89	10.621014	15.727155	13.753526	12.023237	10.099996
SHITOMASI	BRIEF	8	1886	1768	91	11.519018	16.970698	14.148208	12.703137	10.967763
SHITOMASI	BRIEF	9	1957	1776	85	10.245306	15.534321	14.035644	10.500498	8.094218
SHITOMASI	BRIEF	10	1888	1849	94	10.314074	14.951843	14.036523	11.454247	8.813924
SHITOMASI	BRIEF	11	1919	1778	85	10.335328	18.5843	13.832835	10.062017	10.292551
SHITOMASI	BRIEF	12	2055	1815	91	10.346156	16.472962	16.101252	10.300536	8.309779

Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
SHITOMASI	ORB	1	1759	1630	83	10.267431	14.957631	13.060955	15.19481	11.989397
SHITOMASI	ORB	2	1806	1729	91	10.348959	15.517171	12.623536	12.853594	12.595109
SHITOMASI	ORB	3	1894	1736	95	10.498401	15.578416	13.080882	12.925121	11.285089
SHITOMASI	ORB	4	1889	1758	90	10.210409	14.904986	13.325869	13.893044	23.528077
SHITOMASI	ORB	5	1874	1778	86	11.103933	16.257533	13.452601	39.75763	37.070036
SHITOMASI	ORB	6	1912	1739	82	10.395834	16.029589	13.4557	12.776217	10.491403
SHITOMASI	ORB	7	1930	1787	89	10.416723	17.067123	16.969122	12.023237	10.099996
SHITOMASI	ORB	8	1886	1768	91	10.601269	17.372898	14.580054	12.703137	10.967763
SHITOMASI	ORB	9	1957	1776	85	10.468448	17.335455	16.315461	10.500498	8.094218
SHITOMASI	ORB	10	1888	1849	94	10.687273	14.889503	14.138602	11.454247	8.813924
SHITOMASI	ORB	11	1919	1778	85	10.726711	16.861315	13.958351	10.062017	10.292551
SHITOMASI	ORB	12	2055	1815	91	10.887736	17.023963	15.195217	10.300536	8.309779

Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
SHITOMASI	FREAK	1	1759	1630	83	10.329566	15.897604	12.044879	15.19481	11.989397
SHITOMASI	FREAK	2	1806	1729	91	10.33432	19.342882	17.342342	12.853594	12.595109
SHITOMASI	FREAK	3	1894	1736	95	12.530218	20.847327	16.819581	12.925121	11.285089
SHITOMASI	FREAK	4	1889	1758	90	12.504234	19.94893	16.978315	13.893044	23.528077
SHITOMASI	FREAK	5	1874	1778	86	10.364592	18.243843	13.321915	39.75763	37.070036
SHITOMASI	FREAK	6	1912	1739	82	10.176914	16.186289	14.721333	12.776217	10.491403
SHITOMASI	FREAK	7	1930	1787	89	10.40938	15.353848	13.681121	12.023237	10.099996
SHITOMASI	FREAK	8	1886	1768	91	10.234776	14.960663	17.993954	12.703137	10.967763
SHITOMASI	FREAK	9	1957	1776	85	10.329759	15.640543	14.073192	10.500498	8.094218
SHITOMASI	FREAK	10	1888	1849	94	10.296313	15.606432	14.113003	11.454247	8.813924
SHITOMASI	FREAK	11	1919	1778	85	10.168194	16.204713	13.808372	10.062017	10.292551
SHITOMASI	FREAK	12	2055	1815	91	10.485749	16.09487	15.140633	10.300536	8.309779

Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
SHITOMASI	SIFT	1	1759	1630	83	9.773761	14.81971	11.779564	15.19481	11.989397
SHITOMASI	SIFT	2	1806	1729	91	11.001382	16.191466	15.526823	12.853594	12.595109
SHITOMASI	SIFT	3	1894	1736	95	10.657933	16.383761	14.087174	12.925121	11.285089
SHITOMASI	SIFT	4	1889	1758	90	10.120959	15.068634	13.268505	13.893044	23.528077
SHITOMASI	SIFT	5	1874	1778	86	10.358315	14.543906	13.316018	39.75763	37.070036
SHITOMASI	SIFT	6	1912	1739	82	10.417202	15.392943	13.69824	12.776217	10.491403
SHITOMASI	SIFT	7	1930	1787	89	10.323571	15.506741	15.490453	12.023237	10.099996
SHITOMASI	SIFT	8	1886	1768	91	10.140484	14.971525	13.533076	12.703137	10.967763
SHITOMASI	SIFT	9	1957	1776	85	10.226965	16.379547	14.176714	10.500498	8.094218
SHITOMASI	SIFT	10	1888	1849	94	10.161142	16.06478	14.270869	11.454247	8.813924
SHITOMASI	SIFT	11	1919	1778	85	10.231169	15.25098	15.019716	10.062017	10.292551
SHITOMASI	SIFT	12	2055	1815	91	11.228788	16.424413	15.145334	10.300536	8.309779

Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
HARRIS	BRISK	1	820	297	28	17.434034	7.37245	1.187525	61.001474	11.989397
HARRIS	BRISK	2	820	297	56	17.434034	7.37245	1.187525	61.001474	11.989397
HARRIS	BRISK	3	913	924	93	18.89516	7.859283	3.672902	10.811122	12.595109
HARRIS	BRISK	4	677	1123	105	14.721493	5.983541	3.431271	78.965313	23.528077
HARRIS	BRISK	5	1028	362	38	21.532361	8.675806	1.706608	78.965313	37.070036
HARRIS	BRISK	6	466	1019	65	12.065136	4.423787	2.226257	11.59651	10.491403
HARRIS	BRISK	7	581	463	47	13.682612	5.88467	1.285886	12.229388	10.099996
HARRIS	BRISK	8	443	631	59	11.77344	4.248848	1.377726	12.229388	10.967763
HARRIS	BRISK	9	1082	443	47	23.397048	9.018395	2.160821	12.439358	8.094218
HARRIS	BRISK	10	817	1068	90	17.274882	7.032468	3.798892	11.698582	8.813924
HARRIS	BRISK	11	340	803	66	10.971121	3.388617	1.338662	12.733332	10.292551
HARRIS	BRISK	12	433	331	39	11.708982	4.183786	0.78621	11.521645	8.309779

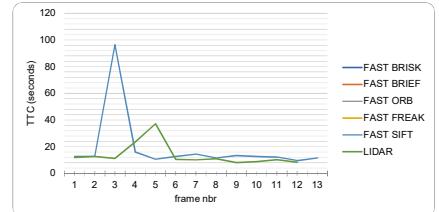| Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
HARRIS	BRIEF	1	820	297	28	17.697288	7.181449	1.188588	61.001474	11.989397
HARRIS	BRIEF	2	820	297	56	17.697288	7.181449	1.188588	61.001474	11.989397
HARRIS	BRIEF	3	913	924	93	19.81233	7.783712	3.676766	10.811122	12.595109
HARRIS	BRIEF	4	677	1123	105	14.943197	6.103607	3.397522	78.965313	23.528077
HARRIS	BRIEF	5	1028	362	38	21.713974	8.738093	1.71936	78.965313	37.070036
HARRIS	BRIEF	6	466	1019	65	12.239734	4.428068	2.222591	11.59651	10.491403
HARRIS	BRIEF	7	581	463	47	13.382999	5.32217	1.285664	12.229388	10.099996
HARRIS	BRIEF	8	443	631	59	11.888063	4.65805	2.123136	12.229388	10.967763
HARRIS	BRIEF	9	1082	443	47	22.681491	9.103965	2.170789	12.439358	8.094218
HARRIS	BRIEF	10	817	1068	90	18.14442	7.280293	3.83646	11.698582	8.813924
HARRIS	BRIEF	11	340	803	66	11.069456	3.589652	1.38385	12.733332	10.292551
HARRIS	BRIEF	12	433	331	39	11.902913	4.300091	0.779722	11.521645	8.309779

Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
HARRIS	ORB	1	820	297	28	17.112057	7.222306	1.198275	61.001474	11.989397
HARRIS	ORB	2	820	297	56	17.112057	7.222306	1.198275	61.001474	11.989397
HARRIS	ORB	3	913	924	93	8.45039	3.789385	10.811122	12.595109
HARRIS	ORB	4	677	1123	105	15.232682	6.156788	3.403639	78.965313	23.528077
HARRIS	ORB	5	1028	362	38	21.737902	8.963077	1.9432	78.965313	37.070036
HARRIS	ORB	6	466	1019	65	12.061742	4.391047	2.233058	11.59651	10.491403
HARRIS	ORB	7	581	463	47	13.654796	5.520185	1.292414	12.229388	10.099996
HARRIS	ORB	8	443	631	59	11.872197	4.193928	1.381576	12.229388	10.967763
HARRIS	ORB	9	1082	443	47	23.092652	9.238825	2.175282	12.439358	8.094218
HARRIS	ORB	10	817	1068	90	16.919393	7.00977	3.821232	11.698582	8.813924
HARRIS	ORB	11	340	803	66	10.883387	3.348864	1.346693	12.733332	10.292551
HARRIS	ORB	12	433	331	39	12.320401	4.172858	0.76693	11.521645	8.309779

Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
HARRIS	FREAK	1	820	297	28	16.984047	7.366502	1.190715	61.001474	11.989397
HARRIS	FREAK	2	820	297	56	16.984047	7.366502	1.190715	61.001474	11.989397
HARRIS	FREAK	3	913	924	93	24.026869	10.489996	4.774528	10.811122	12.595109
HARRIS	FREAK	4	677	1123	105	14.608494	6.3441	3.541274	78.965313	23.528077
HARRIS	FREAK	5	1028	362	38	21.632461	9.082862	2.032493	78.965313	37.070036
HARRIS	FREAK	6	466	1019	65	12.024666	4.395421	2.21986	11.59651	10.491403
HARRIS	FREAK	7	581	463	47	13.549229	5.307112	1.294304	12.229388	10.099996
HARRIS	FREAK	8	443	631	59	12.581885	4.456633	1.382271	12.229388	10.967763
HARRIS	FREAK	9	1082	443	47	22.601873	8.990258	2.150526	12.439358	8.094218
HARRIS	FREAK	10	817	1068	90	17.091172	7.08229	6.201625	11.698582	8.813924
HARRIS	FREAK	11	340	803	66	10.88023	3.45087	1.407011	12.733332	10.292551
HARRIS	FREAK	12	433	331	39	11.679208	4.087393	0.791422	11.521645	8.309779

Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
HARRIS	SIFT	1	820	297	28	17.150869	7.228908	1.201022	61.001474	11.989397
HARRIS	SIFT	2	820	297	56	17.150869	7.228908	1.201022	61.001474	11.989397
HARRIS	SIFT	3	913	924	93	18.97367	7.855083	4.892261	10.811122	12.595109
HARRIS	SIFT	4	677	1123	105	14.897794	6.142719	3.454992	78.965313	23.528077
HARRIS	SIFT	5	1028	362	38	21.380623	8.75231	1.728886	78.965313	37.070036
HARRIS	SIFT	6	466	1019	65	12.346741	4.726895	2.39655	11.59651	10.491403
HARRIS	SIFT	7	581	463	47	13.365486	5.346363	1.290718	12.229388	10.099996
HARRIS	SIFT	8	443	631	59	16.22793	5.77067	1.765609	12.229388	10.967763
HARRIS	SIFT	9	1082	443	47	29.518014	12.321101	2.797307	12.439358	8.094218
HARRIS	SIFT	10	817	1068	90	23.320856	9.403763	4.962704	11.698582	8.813924
HARRIS	SIFT	11	340	803	66	13.499866	4.507471	1.720783	12.733332	10.292551
HARRIS	SIFT	12	433	331	39	12.034086	4.376169	0.785107	11.521645	8.309779

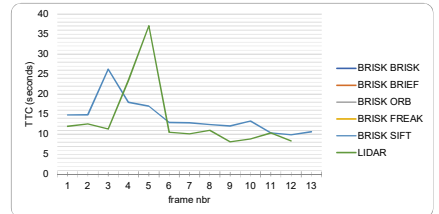| Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
FAST	BRISK	1	1898	1806	78	1.046582	15.555066	14.389214	12.750266	11.989397
FAST	BRISK	2	1898	1806	156	1.046582	15.555066	14.389214	12.734918	11.989397
FAST	BRISK	3	1876	1819	98	1.018503	15.113605	14.236318	96.298459	12.595109
FAST	BRISK	4	1829	1788	108	1.175764	16.867503	13.741209	15.988134	11.285089
FAST	BRISK	5	1843	1772	102	1.074131	14.889409	13.617446	10.621905	23.528077
FAST	BRISK	6	1879	1737	96	1.095648	15.059944	13.43552	12.668408	37.070036
FAST	BRISK	7	1849	1798	89	1.098708	15.34816	14.062596	14.442054	10.491403
FAST	BRISK	8	1826	1796	115	1.050762	14.779913	14.62861	11.476595	10.099996
FAST	BRISK	9	1833	1787	116	1.079438	14.957081	13.766501	13.288496	10.967763
FAST	BRISK	10	1921	1773	103	0.743344	15.807554	14.22129	12.542484	8.094218
FAST	BRISK	11	1934	1871	108	0.760264	15.700702	15.745319	12.19959	8.813924
FAST	BRISK	12	1946	1877	112	1.396715	15.474866	15.134207	9.593879	10.292551
FAST	BRISK	13	1961	1872	109	1.077849	15.771402	15.205756	11.611777	8.309779

Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
FAST	BRIEF	1	1898	1806	78	1.033707	15.234245	14.425821	12.750266	11.989397
FAST	BRIEF	2	1898	1806	156	1.033707	15.234245	14.425821	12.734918	11.989397
FAST	BRIEF	3	1876	1819	98	0.734761	15.659538	14.344812	96.298459	12.595109
FAST	BRIEF	4	1829	1788	108	1.061204	14.865315	13.616083	15.988134	11.285089
FAST	BRIEF	5	1843	1772	102	1.078204	14.730421	13.671856	10.621905	23.528077
FAST	BRIEF	6	1879	1737	96	1.414146	14.958148	14.846992	12.668408	37.070036
FAST	BRIEF	7	1849	1798	89	1.414146	20.129698	17.704271	14.442054	10.491403
FAST	BRIEF	8	1826	1796	115	1.382662	19.966637	17.602047	11.476595	10.099996
FAST	BRIEF	9	1833	1787	116	1.391493	19.899109	17.442009	13.288496	10.967763
FAST	BRIEF	10	1921	1773	103	1.083459	15.481018	14.339398	12.542484	8.094218
FAST	BRIEF	11	1934	1871	108	1.085937	15.49086	17.065553	12.19959	8.813924
FAST	BRIEF	12	1946	1877	112	1.092367	15.387917	15.138854	9.593879	10.292551
FAST	BRIEF	13	1961	1872	109	1.090689	16.407384	15.288637	11.611777	8.309779

FAST TTC chart — legend: FAST BRISK, FAST BRIEF, FAST ORB, FAST FREAK, FAST SIFT, LIDAR; y-axis: TTC (seconds); x-axis: frame nbr

Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
FAST	ORB	1	1898	1806	78	1.40308	20.68463	18.253471	12.750266	11.989397
FAST	ORB	2	1898	1806	156	1.40308	20.68463	18.253471	12.734918	11.989397
FAST	ORB	3	1876	1819	98	1.372893	15.26845	14.441883	96.298459	12.595109
FAST	ORB	4	1829	1788	108	1.071972	15.019521	13.735359	15.988134	11.285089
FAST	ORB	5	1843	1772	102	1.088838	14.944099	14.29055	10.621905	23.528077
FAST	ORB	6	1879	1737	96	1.047227	15.64225	13.473262	12.668408	37.070036
FAST	ORB	7	1849	1798	89	1.026211	15.018821	14.191984	14.442054	10.491403
FAST	ORB	8	1826	1796	115	1.056261	14.587873	13.747486	11.476595	10.099996
FAST	ORB	9	1833	1787	116	1.426042	20.098047	17.440305	13.288496	10.967763
FAST	ORB	10	1921	1773	103	1.43613	21.030889	18.167672	12.542484	8.094218
FAST	ORB	11	1934	1871	108	1.451822	21.022506	19.559442	12.19959	8.813924
FAST	ORB	12	1946	1877	112	1.114364	15.407563	16.223742	9.593879	10.292551
FAST	ORB	13	1961	1872	109	1.181738	15.658494	15.167149	11.611777	8.309779

Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
FAST	FREAK	1	1898	1806	78	1.082622	15.335613	14.50512	12.750266	11.989397
FAST	FREAK	2	1898	1806	156	1.082622	15.335613	14.50512	12.734918	11.989397
FAST	FREAK	3	1876	1819	98	1.060887	14.960281	14.240561	96.298459	12.595109
FAST	FREAK	4	1829	1788	108	1.078332	14.976092	13.680176	15.988134	11.285089
FAST	FREAK	5	1843	1772	102	1.064458	14.967781	14.902599	10.621905	23.528077
FAST	FREAK	6	1879	1737	96	0.784395	15.507387	13.68817	12.668408	37.070036
FAST	FREAK	7	1849	1798	89	1.093386	16.2625	15.690426	14.442054	10.491403
FAST	FREAK	8	1826	1796	115	1.065108	14.707404	13.634045	11.476595	10.099996
FAST	FREAK	9	1833	1787	116	1.081232	15.03446	13.621463	13.288496	10.967763
FAST	FREAK	10	1921	1773	103	0.74939	15.912641	14.235878	12.542484	8.094218
FAST	FREAK	11	1934	1871	108	1.09557	16.579612	16.298206	12.19959	8.813924
FAST	FREAK	12	1946	1877	112	1.390484	15.600325	15.104431	9.593879	10.292551
FAST	FREAK	13	1961	1872	109	1.108403	15.972382	15.272977	11.611777	8.309779

Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
FAST	SIFT	1	1898	1806	78	1.10116	15.426088	14.337299	12.750266	11.989397
FAST	SIFT	2	1898	1806	156	1.10116	15.426088	14.337299	12.734918	11.989397
FAST	SIFT	3	1876	1819	98	1.093725	20.447956	18.144192	96.298459	12.595109
FAST	SIFT	4	1829	1788	108	1.443429	20.172777	17.348617	15.988134	11.285089
FAST	SIFT	5	1843	1772	102	1.383831	20.092517	17.600221	10.621905	23.528077
FAST	SIFT	6	1879	1737	96	1.081942	15.033339	15.219944	12.668408	37.070036
FAST	SIFT	7	1849	1798	89	1.070098	14.917532	15.2939	14.442054	10.491403
FAST	SIFT	8	1826	1796	115	1.071568	14.651976	13.592936	11.476595	10.099996
FAST	SIFT	9	1833	1787	116	1.092105	14.746506	13.61248	13.288496	10.967763
FAST	SIFT	10	1921	1773	103	1.114432	15.6523	15.376264	12.542484	8.094218
FAST	SIFT	11	1934	1871	108	1.088056	15.445294	15.049845	12.19959	8.813924
FAST	SIFT	12	1946	1877	112	0.761463	15.714434	15.136717	9.593879	10.292551
FAST	SIFT	13	1961	1872	109	0.778849	16.012486	16.02245	11.611777	8.309779

Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
BRISK	BRISK	1	3000	2896	141	301.055748	25.140977	37.092553	14.804349	11.989397
BRISK	BRISK	2	3000	2896	282	301.055748	25.140977	37.092553	14.870257	11.989397
BRISK	BRISK	3	2906	2855	145	296.384963	25.591623	35.353606	26.233313	12.595109
BRISK	BRISK	4	2886	2886	166	301.01369	23.925509	35.908112	17.956767	11.285089
BRISK	BRISK	5	2893	2886	168	297.471704	24.091955	35.911256	16.988562	23.528077
BRISK	BRISK	6	3022	2930	177	298.452566	25.044952	39.192151	12.943978	37.070036
BRISK	BRISK	7	3013	3022	167	300.789487	25.099363	39.006222	12.843391	10.491403
BRISK	BRISK	8	2949	3013	195	296.895199	24.511445	38.266041	12.417154	10.099996
BRISK	BRISK	9	3026	3012	180	301.071751	24.765188	39.268615	12.041057	10.967763
BRISK	BRISK	10	3074	3026	190	298.585125	26.065518	40.967396	13.27909	8.094218
BRISK	BRISK	11	3131	3074	189	300.71034	25.990854	41.491815	10.347077	8.813924
BRISK	BRISK	12	3135	3131	209	303.628569	26.189654	42.964194	9.839529	10.292551
BRISK	BRISK	13	3146	3135	216	299.730492	35.276453	42.166091	10.605638	8.309779

Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
BRISK	BRIEF	1	3000	2896	141	299.264623	25.97413	37.090423	14.804349	11.989397
BRISK	BRIEF	2	3000	2896	282	299.264623	25.97413	37.090423	14.870257	11.989397
BRISK	BRIEF	3	2906	2855	145	297.000082	24.284511	35.584625	26.233313	12.595109
BRISK	BRIEF	4	2886	2886	166	295.936684	23.954988	35.868136	17.956767	11.285089
BRISK	BRIEF	5	2893	2886	168	295.323248	23.831666	37.108539	16.988562	23.528077
BRISK	BRIEF	6	3022	2930	177	300.291708	25.433925	38.94597	12.943978	37.070036
BRISK	BRIEF	7	3013	3022	167	300.079917	27.819866	39.288613	12.843391	10.491403
BRISK	BRIEF	8	2949	3013	195	295.16831	24.633355	38.019568	12.417154	10.099996
BRISK	BRIEF	9	3026	3012	180	297.084245	25.032048	39.31292	12.041057	10.967763
BRISK	BRIEF	10	3074	3026	190	297.30452	25.492849	40.017651	13.27909	8.094218
BRISK	BRIEF	11	3131	3074	189	299.903241	26.027342	41.629678	10.347077	8.813924
BRISK	BRIEF	12	3135	3131	209	299.681466	26.456745	43.511665	9.839529	10.292551
BRISK	BRIEF	13	3146	3135	216	300.260932	27.769678	42.30627	10.605638	8.309779

BRISK TTC chart — legend: BRISK BRISK, BRISK BRIEF, BRISK ORB, BRISK FREAK, BRISK SIFT, LIDAR; y-axis: TTC (seconds); x-axis: frame nbr
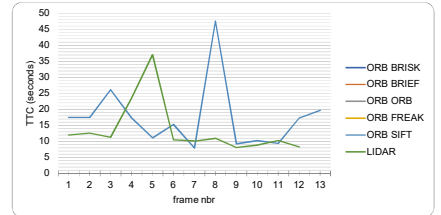
Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
BRISK	ORB	1	3000	2896	141	299.061088	24.875102	38.371225	14.804349	11.989397
BRISK	ORB	2	3000	2896	282	299.061088	24.875102	38.371225	14.870257	11.989397
BRISK	ORB	3	2906	2855	145	298.605432	26.03936	35.645758	26.233313	12.595109
BRISK	ORB	4	2886	2886	166	297.214211	24.397859	36.772083	17.956767	11.285089
BRISK	ORB	5	2893	2886	168	297.122749	24.414029	36.713742	16.988562	23.528077
BRISK	ORB	6	3022	2930	177	297.081565	25.233239	37.957983	12.943978	37.070036
BRISK	ORB	7	3013	3022	167	299.472447	25.124413	38.935745	12.843391	10.491403
BRISK	ORB	8	2949	3013	195	298.352666	25.048665	38.134386	12.417154	10.099996
BRISK	ORB	9	3026	3012	180	300.131985	24.879549	39.082265	12.041057	10.967763
BRISK	ORB	10	3074	3026	190	297.916528	25.467394	39.887781	13.27909	8.094218
BRISK	ORB	11	3131	3074	189	299.26184	25.223448	41.42127	10.347077	8.813924
BRISK	ORB	12	3135	3131	209	302.18699	26.442412	42.044767	9.839529	10.292551
BRISK	ORB	13	3146	3135	216	301.678179	26.193149	42.286683	10.605638	8.309779

Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
BRISK	FREAK	1	3000	2896	141	296.671836	26.028548	37.245685	14.804349	11.989397
BRISK	FREAK	2	3000	2896	282	296.671836	26.028548	37.245685	14.870257	11.989397
BRISK	FREAK	3	2906	2855	145	298.667353	24.082153	35.243452	26.233313	12.595109
BRISK	FREAK	4	2886	2886	166	297.401378	24.121491	36.693133	17.956767	11.285089
BRISK	FREAK	5	2893	2886	168	297.102363	23.839159	35.956588	16.988562	23.528077
BRISK	FREAK	6	3022	2930	177	299.08609	25.248702	37.809893	12.943978	37.070036
BRISK	FREAK	7	3013	3022	167	297.645865	25.268071	38.849696	12.843391	10.491403
BRISK	FREAK	8	2949	3013	195	296.323954	25.181686	37.8431	12.417154	10.099996
BRISK	FREAK	9	3026	3012	180	298.428382	26.117466	38.87398	12.041057	10.967763
BRISK	FREAK	10	3074	3026	190	298.20424	27.070732	39.805066	13.27909	8.094218
BRISK	FREAK	11	3131	3074	189	301.350724	27.553538	41.121099	10.347077	8.813924
BRISK	FREAK	12	3135	3131	209	300.396643	26.384936	41.948426	9.839529	10.292551
BRISK	FREAK	13	3146	3135	216	302.790624	27.396873	42.184051	10.605638	8.309779

Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
BRISK	SIFT	1	3000	2896	141	300.252438	24.950551	38.06697	14.804349	11.989397
BRISK	SIFT	2	3000	2896	282	300.252438	24.950551	38.06697	14.870257	11.989397
BRISK	SIFT	3	2906	2855	145	295.664573	25.809861	35.65035	26.233313	12.595109
BRISK	SIFT	4	2886	2886	166	297.517929	24.227215	36.349046	17.956767	11.285089
BRISK	SIFT	5	2893	2886	168	297.041657	23.923725	36.797816	16.988562	23.528077
BRISK	SIFT	6	3022	2930	177	298.628169	25.341784	38.19296	12.943978	37.070036
BRISK	SIFT	7	3013	3022	167	298.201208	25.243193	39.215888	12.843391	10.491403
BRISK	SIFT	8	2949	3013	195	298.663061	24.911627	38.026108	12.417154	10.099996
BRISK	SIFT	9	3026	3012	180	297.875766	24.86092	38.993768	12.041057	10.967763
BRISK	SIFT	10	3074	3026	190	298.832617	25.785013	39.7723	13.27909	8.094218
BRISK	SIFT	11	3131	3074	189	300.231955	26.334954	41.217015	10.347077	8.813924
BRISK	SIFT	12	3135	3131	209	300.74863	26.159229	42.342437	9.839529	10.292551
BRISK	SIFT	13	3146	3135	216	298.312459	26.309944	42.66885	10.605638	8.309779

Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
ORB	BRISK	1	500	391	48	9.422601	4.527518	0.851327	17.48358	11.989397
ORB	BRISK	2	500	391	96	9.422601	4.527518	0.851327	17.48358	11.989397
ORB	BRISK	3	500	398	60	9.509553	4.398678	0.868961	26.152662	12.595109
ORB	BRISK	4	500	410	72	9.591235	5.074735	0.908034	17.359982	11.285089
ORB	BRISK	5	500	413	62	9.765111	4.700821	1.014461	11.100027	23.528077
ORB	BRISK	6	500	405	65	9.913404	4.742245	0.881656	15.280831	37.070036
ORB	BRISK	7	500	404	53	9.76265	4.648256	0.879387	7.957948	10.491403
ORB	BRISK	8	500	403	53	9.692893	4.552102	0.953082	47.565583	10.099996
ORB	BRISK	9	500	394	58	9.713051	4.366792	0.901988	9.260129	10.967763
ORB	BRISK	10	500	400	45	9.833742	4.709687	0.860237	10.266625	8.094218
ORB	BRISK	11	500	405	65	10.03872	4.246025	0.879926	9.370819	8.813924
ORB	BRISK	12	500	414	59	9.917951	4.489052	0.909587	17.29561	10.292551
ORB	BRISK	13	500	422	58	8.79485	4.45226	0.957394	19.67156	8.309779

Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
ORB	BRIEF	1	500	391	48	6.696937	4.300844	0.829523	17.48358	11.989397
ORB	BRIEF	2	500	391	96	6.696937	4.300844	0.829523	17.48358	11.989397
ORB	BRIEF	3	500	398	60	6.674776	4.269159	0.839355	26.152662	12.595109
ORB	BRIEF	4	500	410	72	6.89884	4.831562	1.705796	17.359982	11.285089
ORB	BRIEF	5	500	413	62	6.910776	4.509318	0.889601	11.100027	23.528077
ORB	BRIEF	6	500	405	65	7.055501	4.577028	0.867708	15.280831	37.070036
ORB	BRIEF	7	500	404	53	7.61948	4.470201	0.863946	7.957948	10.491403
ORB	BRIEF	8	500	403	53	6.891314	4.836686	0.92725	47.565583	10.099996
ORB	BRIEF	9	500	394	58	6.807787	4.521688	0.849709	9.260129	10.967763
ORB	BRIEF	10	500	400	45	6.928688	5.035771	0.862875	10.266625	8.094218
ORB	BRIEF	11	500	405	65	6.994331	4.47777	0.891169	9.370819	8.813924
ORB	BRIEF	12	500	414	59	7.013668	4.367021	0.928047	17.29561	10.292551
ORB	BRIEF	13	500	422	58	6.900455	4.518208	0.944121	19.67156	8.309779

Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
ORB	ORB	1	500	391	48	6.891349	4.16949	0.841288	17.48358	11.989397
ORB	ORB	2	500	391	96	6.891349	4.16949	0.841288	17.48358	11.989397
ORB	ORB	3	500	398	60	6.724947	4.185297	0.855778	26.152662	12.595109
ORB	ORB	4	500	410	72	6.804826	4.279804	0.892282	17.359982	11.285089
ORB	ORB	5	500	413	62	6.775703	4.221821	0.87226	11.100027	23.528077
ORB	ORB	6	500	405	65	7.058675	4.713726	1.795581	15.280831	37.070036
ORB	ORB	7	500	404	53	6.896333	4.593543	0.864213	7.957948	10.491403
ORB	ORB	8	500	403	53	6.876894	4.537199	0.864742	47.565583	10.099996
ORB	ORB	9	500	394	58	6.810935	4.443503	0.839024	9.260129	10.967763
ORB	ORB	10	500	400	45	6.997537	4.295088	0.84589	10.266625	8.094218
ORB	ORB	11	500	405	65	5.966616	4.476685	0.881602	9.370819	8.813924
ORB	ORB	12	500	414	59	7.502563	4.399341	0.90897	17.29561	10.292551
ORB	ORB	13	500	422	58	6.868714	4.887327	0.94014	19.67156	8.309779

Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
ORB	FREAK	1	500	391	48	6.747274	4.808855	0.861761	17.48358	11.989397
ORB	FREAK	2	500	391	96	6.747274	4.808855	0.861761	17.48358	11.989397
ORB	FREAK	3	500	398	60	8.985693	5.734823	1.076847	26.152662	12.595109
ORB	FREAK	4	500	410	72	9.691586	5.897882	1.24863	17.359982	11.285089
ORB	FREAK	5	500	413	62	6.753304	4.824191	0.960999	11.100027	23.528077
ORB	FREAK	6	500	405	65	7.095818	4.1946	0.866068	15.280831	37.070036
ORB	FREAK	7	500	404	53	6.850377	5.052116	0.903335	7.957948	10.491403
ORB	FREAK	8	500	403	53	6.989207	4.636717	0.864739	47.565583	10.099996
ORB	FREAK	9	500	394	58	9.058521	5.494733	1.059456	9.260129	10.967763
ORB	FREAK	10	500	400	45	9.321213	6.116458	1.100209	10.266625	8.094218
ORB	FREAK	11	500	405	65	9.248992	5.820216	1.114901	9.370819	8.813924
ORB	FREAK	12	500	414	59	6.89896	4.484223	0.919866	17.29561	10.292551
ORB	FREAK	13	500	422	58	6.997036	4.516313	0.941	19.67156	8.309779

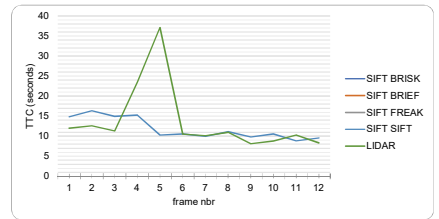| Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
ORB	SIFT	1	500	391	48	6.778188	4.146301	1.605795	17.48358	11.989397
ORB	SIFT	2	500	391	96	6.778188	4.146301	1.605795	17.48358	11.989397
ORB	SIFT	3	500	398	60	9.04757	5.525766	1.084549	26.152662	12.595109
ORB	SIFT	4	500	410	72	6.788211	4.312225	0.883145	17.359982	11.285089
ORB	SIFT	5	500	413	62	6.867893	4.465138	0.885237	11.100027	23.528077
ORB	SIFT	6	500	405	65	6.877245	4.499998	0.868592	15.280831	37.070036
ORB	SIFT	7	500	404	53	6.897723	4.267666	0.8664	7.957948	10.491403
ORB	SIFT	8	500	403	53	6.827733	4.563372	0.864119	47.565583	10.099996
ORB	SIFT	9	500	394	58	6.785162	4.129869	0.837666	9.260129	10.967763
ORB	SIFT	10	500	400	45	6.843701	4.617574	0.87506	10.266625	8.094218
ORB	SIFT	11	500	405	65	6.967131	4.812465	0.884435	9.370819	8.813924
ORB	SIFT	12	500	414	59	6.826461	4.40966	0.903498	17.29561	10.292551
ORB	SIFT	13	500	422	58	6.955881	4.412603	0.944337	19.67156	8.309779

Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
AKAZE	BRISK	1	1541	1513	104	44.791073	12.662271	11.924693	12.540301	11.989397
AKAZE	BRISK	2	1541	1513	208	44.791073	12.662271	11.924693	12.532159	11.989397
AKAZE	BRISK	3	1526	1545	111	46.319521	12.662662	10.484629	13.826702	12.595109
AKAZE	BRISK	4	1529	1566	130	43.353508	12.823104	10.282574	16.304346	11.285089
AKAZE	BRISK	5	1547	1529	125	42.952759	13.001024	10.211848	14.376728	23.528077
AKAZE	BRISK	6	1567	1572	136	42.998005	12.904755	10.533531	11.501471	37.070036
AKAZE	BRISK	7	1538	1567	124	43.263045	12.641327	10.332004	12.298349	10.491403
AKAZE	BRISK	8	1513	1538	135	43.70879	12.645106	10.030145	11.382012	10.099996
AKAZE	BRISK	9	1555	1538	118	43.000042	12.720371	10.354402	10.56759	10.967763
AKAZE	BRISK	10	1544	1555	122	43.971191	12.902675	10.339662	9.951239	8.094218
AKAZE	BRISK	11	1563	1544	119	43.124617	12.820363	10.322161	9.984855	8.813924
AKAZE	BRISK	12	1561	1563	124	42.786036	12.73017	10.520608	9.573528	10.292551
AKAZE	BRISK	13	1569	1561	120	43.41681	12.886518	10.544768	8.913093	8.309779

Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
AKAZE	BRIEF	1	1541	1513	104	43.578726	12.995677	10.457653	12.540301	11.989397
AKAZE	BRIEF	2	1541	1513	208	43.578726	12.995677	10.457653	12.532159	11.989397
AKAZE	BRIEF	3	1526	1545	111	50.529447	16.949354	13.087866	13.826702	12.595109
AKAZE	BRIEF	4	1529	1566	130	43.107464	12.571537	10.346272	16.304346	11.285089
AKAZE	BRIEF	5	1547	1529	125	43.84693	12.847672	10.214762	14.376728	23.528077
AKAZE	BRIEF	6	1567	1572	136	44.133159	13.08828	10.613417	11.501471	37.070036
AKAZE	BRIEF	7	1538	1567	124	43.315449	12.751576	10.384884	12.298349	10.491403
AKAZE	BRIEF	8	1513	1538	135	42.538738	12.42356	10.000785	11.382012	10.099996
AKAZE	BRIEF	9	1555	1538	118	42.35344	12.960361	10.358542	10.56759	10.967763
AKAZE	BRIEF	10	1544	1555	122	43.671213	13.075999	10.435214	9.951239	8.094218
AKAZE	BRIEF	11	1563	1544	119	44.434237	13.347392	10.427303	9.984855	8.813924
AKAZE	BRIEF	12	1561	1563	124	43.762529	12.89753	11.749506	9.573528	10.292551
AKAZE	BRIEF	13	1569	1561	120	43.031434	12.912077	10.558209	8.913093	8.309779

Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
AKAZE	ORB	1	1541	1513	104	45.613424	15.606479	10.190841	12.540301	11.989397
AKAZE	ORB	2	1541	1513	208	45.613424	15.606479	10.190841	12.532159	11.989397
AKAZE	ORB	3	1526	1545	111	44.092489	13.008938	10.226765	13.826702	12.595109
AKAZE	ORB	4	1529	1566	130	44.26761	13.346767	10.400419	16.304346	11.285089
AKAZE	ORB	5	1547	1529	125	42.858163	13.163277	10.259312	14.376728	23.528077
AKAZE	ORB	6	1567	1572	136	51.451059	17.745102	13.958354	11.501471	37.070036
AKAZE	ORB	7	1538	1567	124	50.818114	17.437935	13.680948	12.298349	10.491403
AKAZE	ORB	8	1513	1538	135	53.045144	17.612635	13.040844	11.382012	10.099996
AKAZE	ORB	9	1555	1538	118	44.012981	13.289232	10.403605	10.56759	10.967763
AKAZE	ORB	10	1544	1555	122	44.24872	13.021877	10.424229	9.951239	8.094218
AKAZE	ORB	11	1563	1544	119	44.821994	13.02464	10.417375	9.984855	8.813924
AKAZE	ORB	12	1561	1563	124	45.180281	13.128958	10.887821	9.573528	10.292551
AKAZE	ORB	13	1569	1561	120	43.982979	13.28097	10.62349	8.913093	8.309779

Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
AKAZE	FREAK	1	1541	1513	104	47.117774	13.05805	11.876333	12.540301	11.989397
AKAZE	FREAK	2	1541	1513	208	47.117774	13.05805	11.876333	12.532159	11.989397
AKAZE	FREAK	3	1526	1545	111	43.687826	13.404017	13.345055	13.826702	12.595109
AKAZE	FREAK	4	1529	1566	130	55.907811	20.366269	17.917481	16.304346	11.285089
AKAZE	FREAK	5	1547	1529	125	59.402328	20.073579	15.673889	14.376728	23.528077
AKAZE	FREAK	6	1567	1572	136	43.579427	13.222095	10.569315	11.501471	37.070036
AKAZE	FREAK	7	1538	1567	124	43.076741	12.860561	10.511506	12.298349	10.491403
AKAZE	FREAK	8	1513	1538	135	43.149854	12.682198	10.148842	11.382012	10.099996
AKAZE	FREAK	9	1555	1538	118	43.436543	12.911275	10.433086	10.56759	10.967763
AKAZE	FREAK	10	1544	1555	122	43.179918	13.202174	10.474785	9.951239	8.094218
AKAZE	FREAK	11	1563	1544	119	44.220375	13.408662	10.566507	9.984855	8.813924
AKAZE	FREAK	12	1561	1563	124	44.666301	13.275368	10.683883	9.573528	10.292551
AKAZE	FREAK	13	1569	1561	120	43.877436	17.549936	13.668945	8.913093	8.309779

Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
AKAZE	AKAZE	1	1541	1513	104	52.337052	17.489505	12.930896	12.540301	11.989397
AKAZE	AKAZE	2	1541	1513	208	52.337052	17.489505	12.930896	12.532159	11.989397
AKAZE	AKAZE	3	1526	1545	111	44.64725	12.843096	10.396836	13.826702	12.595109
AKAZE	AKAZE	4	1529	1566	130	51.998529	17.027403	13.216746	16.304346	11.285089
AKAZE	AKAZE	5	1547	1529	125	51.429348	17.074223	13.053783	14.376728	23.528077
AKAZE	AKAZE	6	1567	1572	136	50.467902	17.736199	13.599471	11.501471	37.070036
AKAZE	AKAZE	7	1538	1567	124	43.356191	12.630851	10.375753	12.298349	10.491403
AKAZE	AKAZE	8	1513	1538	135	43.70298	12.872316	10.038283	11.382012	10.099996
AKAZE	AKAZE	9	1555	1538	118	43.893694	13.194156	10.313351	10.56759	10.967763
AKAZE	AKAZE	10	1544	1555	122	45.692269	12.933008	10.34233	9.951239	8.094218
AKAZE	AKAZE	11	1563	1544	119	43.685304	12.969824	10.413498	9.984855	8.813924
AKAZE	AKAZE	12	1561	1563	124	44.618701	12.764201	10.483574	9.573528	10.292551
AKAZE	AKAZE	13	1569	1561	120	44.245416	13.2985	10.973892	8.913093	8.309779

| Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
AKAZE	SIFT	1	1541	1513	104	52.551031	17.226372	12.928081	12.540301	11.989397
AKAZE	SIFT	2	1541	1513	208	52.551031	17.226372	12.928081	12.532159	11.989397
AKAZE	SIFT	3	1526	1545	111	45.051706	13.093849	10.23703	13.826702	12.595109
AKAZE	SIFT	4	1529	1566	130	43.29592	13.164691	10.381479	16.304346	11.285089
AKAZE	SIFT	5	1547	1529	125	43.76546	13.005125	10.181933	14.376728	23.528077
AKAZE	SIFT	6	1567	1572	136	44.255364	13.553047	10.957321	11.501471	37.070036
AKAZE	SIFT	7	1538	1567	124	44.437764	12.919265	10.704643	12.298349	10.491403
AKAZE	SIFT	8	1513	1538	135	48.809138	12.944447	10.269419	11.382012	10.099996
AKAZE	SIFT	9	1555	1538	118	47.664274	13.114427	10.825543	10.56759	10.967763
AKAZE	SIFT	10	1544	1555	122	43.356855	12.9837	10.354376	9.951239	8.094218
AKAZE	SIFT	11	1563	1544	119	43.057143	13.475438	10.434868	9.984855	8.813924
AKAZE	SIFT	12	1561	1563	124	41.462908	13.290548	10.534972	9.573528	10.292551
AKAZE	SIFT	13	1569	1561	120	43.889131	13.167556	10.548113	8.913093	8.309779

Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
SIFT	BRISK	1	1915	1819	104	72.098212	15.624591	14.31285	14.842712	11.989397
SIFT	BRISK	2	1875	1746	113	71.431116	14.867353	13.356225	16.338638	12.595109
SIFT	BRISK	3	1963	1814	138	72.576315	15.326049	14.488206	14.918438	11.285089
SIFT	BRISK	4	1954	1854	130	71.916526	16.17814	14.876057	15.234578	23.528077
SIFT	BRISK	5	2043	1872	108	72.954661	15.823809	15.908859	10.234646	37.070036
SIFT	BRISK	6	2065	1900	105	71.873811	16.272579	16.002988	10.505042	10.491403
SIFT	BRISK	7	2007	1960	116	70.75294	16.0274	16.140467	9.929227	10.099996
SIFT	BRISK	8	2048	1943	110	74.479873	21.926536	20.785113	11.084934	10.967763
SIFT	BRISK	9	2044	1961	102	87.458095	21.680849	20.960399	9.78012	8.094218
SIFT	BRISK	10	2086	1965	113	86.099085	22.240183	21.717925	10.554878	8.813924
SIFT	BRISK	11	2093	1991	93	82.999711	25.163865	22.705756	8.829045	10.292551
SIFT	BRISK	12	2159	1990	105	72.659983	16.989525	19.120732	9.526181	8.309779

Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
SIFT	BRIEF	1	1915	1819	104	71.544296	15.255721	14.310909	14.842712	11.989397
SIFT	BRIEF	2	1875	1746	113	72.603422	15.050699	13.329969	16.338638	12.595109
SIFT	BRIEF	3	1963	1814	138	73.106292	15.28078	14.430097	14.918438	11.285089
SIFT	BRIEF	4	1954	1854	130	73.592938	15.407869	14.858204	15.234578	23.528077
SIFT	BRIEF	5	2043	1872	108	71.731619	15.91709	15.30041	10.234646	37.070036
SIFT	BRIEF	6	2065	1900	105	71.966679	16.35611	16.23552	10.505042	10.491403
SIFT	BRIEF	7	2007	1960	116	71.500337	16.035551	16.116038	9.929227	10.099996
SIFT	BRIEF	8	2048	1943	110	73.461503	16.002527	16.644696	11.084934	10.967763
SIFT	BRIEF	9	2044	1961	102	72.079815	21.960635	21.068856	9.78012	8.094218
SIFT	BRIEF	10	2086	1965	113	84.742041	22.260188	21.420392	10.554878	8.813924
SIFT	BRIEF	11	2093	1991	93	86.622436	22.170661	21.70727	8.829045	10.292551
SIFT	BRIEF	12	2159	1990	105	87.24081	23.761818	23.305401	9.526181	8.309779

Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
SIFT	FREAK	1	1915	1819	104	72.005748	15.104483	14.221314	14.842712	11.989397
SIFT	FREAK	2	1875	1746	113	71.926097	14.965728	13.351589	16.338638	12.595109
SIFT	FREAK	3	1963	1814	138	72.212561	15.878094	14.44857	14.918438	11.285089
SIFT	FREAK	4	1954	1854	130	71.776825	15.808012	14.808866	15.234578	23.528077
SIFT	FREAK	5	2043	1872	108	72.842195	16.102938	15.265564	10.234646	37.070036
SIFT	FREAK	6	2065	1900	105	73.685613	16.815393	17.783894	10.505042	10.491403
SIFT	FREAK	7	2007	1960	116	71.701219	15.920223	15.932846	9.929227	10.099996
SIFT	FREAK	8	2048	1943	110	72.205854	16.549037	16.792935	11.084934	10.967763
SIFT	FREAK	9	2044	1961	102	71.932878	15.928908	16.621271	9.78012	8.094218
SIFT	FREAK	10	2086	1965	113	85.958825	22.290882	21.490087	10.554878	8.813924
SIFT	FREAK	11	2093	1991	93	84.603135	22.368294	21.623092	8.829045	10.292551
SIFT	FREAK	12	2159	1990	105	86.491	23.029693	22.775483	9.526181	8.309779

Detector Type	Descriptor Type	Frame#	#KeyPointsPerFrame	#MatchedPoints	#KeyPointsOnROI	DetectorTime(ms)	DescriptorTime(ms)	MatchingTime(ms)	ttc_camera	ttc_lidar
SIFT	SIFT	1	1915	1819	104	71.99931	15.816036	14.19957	14.842712	11.989397
SIFT	SIFT	2	1875	1746	113	72.170492	15.046866	13.336181	16.338638	12.595109
SIFT	SIFT	3	1963	1814	138	72.153785	15.253257	14.485736	14.918438	11.285089
SIFT	SIFT	4	1954	1854	130	71.638535	15.524091	14.78802	15.234578	23.528077
SIFT	SIFT	5	2043	1872	108	71.455031	15.664193	15.42904	10.234646	37.070036
SIFT	SIFT	6	2065	1900	105	71.851122	16.205937	15.969729	10.505042	10.491403
SIFT	SIFT	7	2007	1960	116	72.86215	16.611928	16.064543	9.929227	10.099996
SIFT	SIFT	8	2048	1943	110	72.888956	15.957046	16.368206	11.084934	10.967763
SIFT	SIFT	9	2044	1961	102	72.380817	16.989611	16.59788	9.78012	8.094218
SIFT	SIFT	10	2086	1965	113	71.876568	16.314965	16.79851	10.554878	8.813924
SIFT	SIFT	11	2093	1991	93	71.668494	16.740701	17.07333	8.829045	10.292551
SIFT	SIFT	12	2159	1990	105	70.710813	16.817924	17.671517	9.526181	8.309779

We can see that the descriptor type does not influence the results, here there is a figure showing the TTC for every detector (no matter the descriptor)
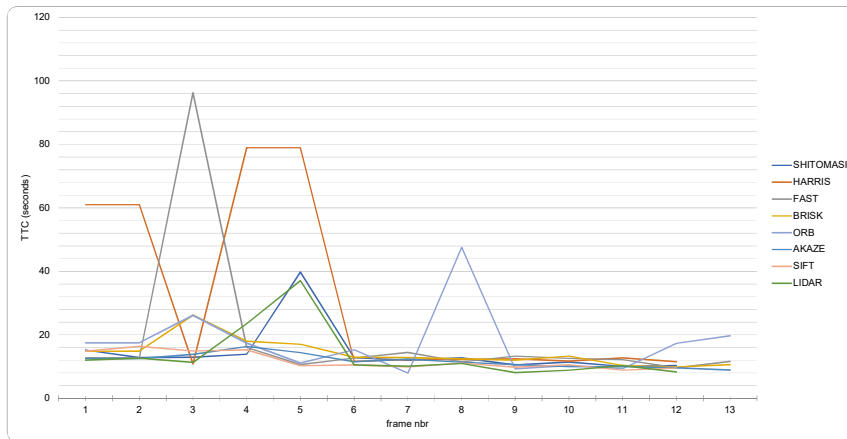
Performance evaluation 1:

According to the results of TTC based on Lidar points, We can see that TTC seems to be incorrect on figures 1 and 2 and correct in figures 3 and 4. The difference between the 2 group of pictures is that lidar points distribution tends to approximate more a straight line (or vertical plane in 3D) on correct pictures than on incorrect pictures.
This is because I am using RANSAC algorithm to find a vertical plane that represents the tail of the preceding car. When there is too much points forming a curve the plane gets slightly shifted far from the lidar sensor which cause innacuracy.
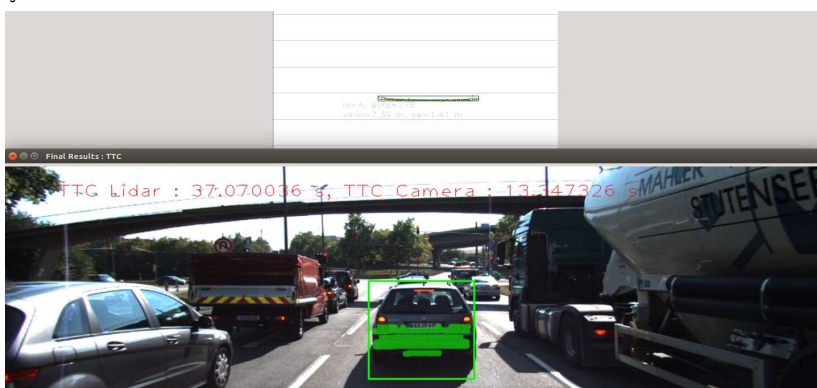
Fig. 1
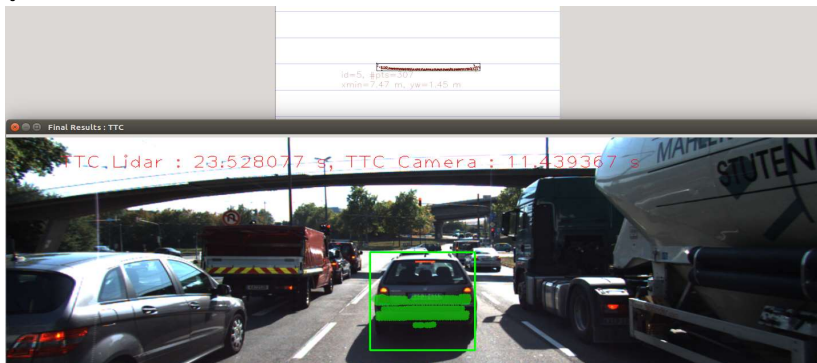
Fig. 2

Fig. 3

Fig. 3

Performance evaluation 2:

From this data, we can see that SIFT and AKAZE yield a more stable and coherent result but they are slow.
FAST detector is the fastest but it shows an incoherent result.

FAST detector is the fastest but it shows an incoherent result for frame 3 (96.29 s). Analyzing the following figures (fig 5 and 6) we can see that there are several keypoint that are outside the ROI on the previous picture. I tried by adding an additionnal condition to ensure that keypoints must belong also to the ROI of previous bounding box but it does not solve totally the problem because there are some matched keypoints on the car and truck on the right lane.

To remove the points on another vechicles or road I tried cropping the bounding box but this is not a stable solution because by doing this I removed also several keypoints that have a valid distance (>100) that are supposed to be used to calculate the distance ratio. This solution works for some frames but not for all.

Fig 5: FAST strange result:

Fig 6: ORB strange result: