Report 2D Feature Tracking

Andrea Bennati

Detector Analysis

Table 1 shows the results of the different detectors both on number of keypoints found and time required to find them.

Detector	Total keypoints over 10 imgs	Total time (ms) over 10 imgs
ShiTomasi	13423	90.0273
Harris	3706	106.749
Fast	17874	5.75944
Brisk	17625	102.106
Orb	5000	152.504
Akaze	13430	360.369
Sift	13861	518.254

Table 1: Detector comparison

As we can see the Fast detector finds the maximum number of points with the minimum time required.

Descriptor Analysis

As we can see from Table 2 Brief and Brisk are the fastest descriptor

Descriptor	Total time (ms) over 10 imgs
Brisk	11.6504
Brief	5.08152
Orb	21.9589
Freak	165.864
Akaze	330.245
Sift	-

Table 2: Descriptor comparison

Detector / Descriptor Combinations

From the previous results we have that Fast and Brief are the fastest detector and descriptor respectively. As we expected the best combination is given by Fast/Brief, followed by Fast/Brisk and Fast/Orb.

I have trouble with the Sift descriptor and with the Akaze descriptor that works only with the Akaze detector

Combination (det/des)	Total matches over 10 imgs	Total matching time (ms) over 10 imgs	Total time
ShiTomasi/Brisk	771	3.37707	108.043
ShiTomasi/Brief	953	1.48291	91.9205
ShiTomasi/Orb	914	0.962225	105.938
ShiTomasi/Freak	768	0.98705	230.675
ShiTomasi/Akaze	-	-	-
ShiTomasi/Sift	-	-	-
Harris/Brisk	245	3.39334	119.861
Harris/Brief	283	0.54881	107.185
Harris/Orb	276	0.551065	146.156
Harris/Freak	239	0.581883	253.109
Harris/Akaze	-	-	-
Harris/Sift	-	-	-
Fast/Brisk	904	1.53635	20.3641
Fast/Brief	1106	1.96541	13.0383
Fast/Orb	1090	1.30008	30.6538
Fast/Freak	887	1.30999	201.469
Fast/Akaze	-	-	-
Fast/Sift	-	-	-
Brisk/Brisk	1039	1.30842	114.996
Brisk/Brief	1122	1.3661	107.517
Brisk/Orb	999	1.30174	134.112
Brisk/Freak	-	-	-
Brisk/Akaze	-	-	-
Brisk/Sift	-	-	-
Orb/Brisk	744	3.10874	228.326
Orb/Brief	540	2.7521	165.673
Orb/Orb	754	0.877233	233.904
Orb/Freak	-	-	-

Orb/Akaze	-	-	-
Orb/Sift	-	-	-
Akaze/Brisk	1204	1.56115	386.103
Akaze/Brief	1257	2.09491	348.191
Akaze/Orb	1177	1.61876	441.06
Akaze/Freak	-	-	-
Akaze/Akaze	1249	1.28648	746.269
Akaze/Sift			
Sift/Brisk	586	1.3077	556.598
Sift/Brief	693	1.02987	529.915
Sift/Orb	-	-	-
Sift/Freak	-	-	-
Sift/Akaze	-	-	-
Sift/Sift	-	-	-

Table 3: Combinations comparison

Conclusions

Given the results in the previous tables and due to the time constraint that this system requires my first choice would be the Fast/Brief combination, followed by the Fast/Brisk and Fast/Orb. From an analysis on the keypoints on the images I can observe that the fast detector focus more on the lights of the car and on other points than on the license plate.
The ShiTomasi detector, second one for time required, instead focus more on the license plate. If the Fast detector is not reliable enough I would try the ShiTomasi.