MP.1 DATA BUFFER

For not overloading the memory, the buffer holds only few number of images (2 in this project). After the second image is loaded, the first image will be deleted and the following image will be placed in the end of the buffer.

dataBufferSize (in line 26 in MidTermProject_Camera_Student.cpp) changes the buffer size.

MP.2 Keypoint Detection

The string dt (in line 26 in matching2D_Student.cpp) changes the detector used. This project implements the following detectors SHITOMASI, Harris, FAST, BRISK, ORB, AKAZE and SIFT.

MP.3 Keypoint Removal

A bounding box around the opposite car is used to discard the irrelevant keypoints. The car dimensions are given in the project.

MP.4 Keypoint Descriptors

The string dest (in line 27 in MidTermProject_Camera_Student.cpp) changes the descriptor. This project implements the following descriptors BRISK, BRIEF, ORB, FREAK, AKAZE and SIFT.

MP.5 Descriptor Matching

The strings matcherType, decriptorType and selectorType (lines 167,168 and 169 respectively in MidTermProject_Camera_Student.cpp) are used for descriptor matching.

MP.6 Descriptor Distance Ratio

To reduse number of false positives, Lowe's distance ratio filter is implemented. The threshold is changed be int k in line 49 in matching2D_Student.cpp

MP.7 Performance Evaluation 1

The next table show number of keypoints in each frame

	Number of key points						
frame	SHI-TOMASI	harris	fast	brisk	orb	ankaze	sift
1	1370	115	1824	2757	500	1351	1438
2	1301	98	1832	2777	500	1327	1371
3	1361	113	1810	2741	500	1311	1380
4	1358	121	1817	2735	500	1351	1335
5	1333	160	1793	2757	500	1360	1305
6	1284	383	1796	2695	500	1347	1370
7	1322	85	1788	2715	500	1363	1396
8	1366	210	1695	2628	500	1331	1382
9	1389	171	1749	2639	500	1357	1463
10	1339	281	1770	2672	500	1331	1422

MP.8 Performance Evaluation 2

The following table shows the average number of matched points for each Detector/ Descriptor combination.

	Average number of matched points						
	SHI-TOMASI	harris	fast	brisk	orb	sift	AKAZE
BRISK	85.22222222	15.77777778	242.5555556	174.4444444	83.44444444	65.77777778	X
BRIEF	104.8888889	19.22222222	314.5555556	189.3333333	60.55555556	82	X
ORB	100.8888889	18	307.5555556	168.2222222	84.77777778	X	X
FREAK	85.33333333	16	248.1111111	189.5555556	44.66666667	66.88888889	X
SIFT	100.8888889	18.11111111	309.1111111	182.8888889	84.77777778	88.88888889	X
AKAZE	X	X	X	X	X	X	139.8888889

MP.9 Performance Evaluation

The following table shows the time needed for detection and descriptors

	Time for detector/ descriptor													
	SHI-TOMASI		harris		fast		brisk		orb		sift		AKAZE	
	detctor	descriptor	detctor	descriptor	detctor	descriptor	detctor	descriptor	detctor	descriptor	detctor	descriptor	detctor	descriptor
BRISK	0.180922	3.17825	0.203028	3.80437	0.0220933	3.73854	4.15863	3.70429	0.09308	3.77183	1.45124	3.49569	X	X
BRIEF	0.170303	0.0134636	0.199552	0.0121437	0.0206633	0.0194775	4.22336	0.0139394	0.08813	0.0084227	1.74444	0.0082237	X	X
ORB	0.194387	0.012295	0.200855	0.0101035	0.0217955	0.0181852	4.42174	0.0608446	0.09308	0.0582174	Out of memeory		X	X
FREAK	0.139226	0.459527	0.164411	0.455164	0.0203451	0.492676	4.13956	0.478786	0.09017	0.474685	1.66448	0.468786	X	X
SIFT	0.151796	0.216113	0.200604	0.234776	0.022665	0.56891	4.17786	0.687645	0.08461	0.0817163	1.44553	0.961349	X	X
AKAZE	X	X	X	X	X	X	X	X	X	X	X	X	1.11271	0.940627

The best detector/ descriptor combinations are

1 FAST/ORB

2 FAST/BRIEF

3 FAST/FREAK

This is based on the very high speed and very high number matched points. ORB detector is also very fast but has a small number of matched points.

*the full data is available in the excel sheet