

My solution to the image mosaic problem follows the guide set in the homework PDF going through the processes of: keypoint extraction, keypoint matching, fundamental matrix computation, homography determination, and ultimately, image mosaic creation. The process begins with key point extraction using the Scale-Invariant Feature Transform (SIFT) algorithm, a crucial step for identifying unique features that are invariant to image scale and rotation.

Keypoint matching between images is performed using the FLANN-based matcher, followed by a ratio test to filter out the bad matches based on a threshold value of 0.75. This successfully reduces false positives and is able to catch most image mismatches. Specifically, a scene is considered the same if there are more than 50 good matches and the match fractions for both images exceed 5%, or if there are over 100 good matches with a lower threshold of 2% match fraction. This dual threshold approach allows flexibility in assessing the similarity between images, accommodating variations in image quality and content.

Further analysis involves computing the fundamental matrix and using the RANSAC algorithm to identify inliers among the matched keypoints. The criteria for a successful match are more stringent now, requiring more than 25 inliers and a 60% percent match of inliers relative to the total number, or 75 inliers and a 30 percent match.

The creation of image mosaics is contingent on the successful computation of a homography matrix, with specific thresholds set for the number of inliers and their percentage, from the fundamental matrix step, to proceed with mosaic generation. These thresholds ensure that only matches with a very high degree of confidence are used, minimizing distortion in the final mosaic.

The mosaic generation itself was created by first making a canvas large enough to accommodate the two images, then applying the homography to the first image. This transforms it to the coordinates of the second image. The final step is to apply the first image to the second with an alpha blend. The alpha value I decided on, was .5 as equal balance between the images seems to be the best for determining the quality of the overlay.

The benefits of my approach mainly relate to the fact that multiple threshold options allow for images matches to be made with either a high number of matches or a high percentage of matches without necessarily needing both. Of course a drawback of this is the possibility that a mosaic looks bad and "should" have been scrapped. An example on the edge of this is the two colosseum photos. The right side is aligned well, but the left looks very messy.

All Images Statistics:

	Image Pair	Original Matches	Num Inliers	Percent Inliers	Attempt Mosaic
29	VCC1 & VCC3	78	-1	-1	-1
30	VCC1 & VCC2	894	499	55	1
31	VCC1 & Office1	42	-1	-1	-1
32	VCC1 & Office2	42	-1	-1	-1
33	VCC1 & Office3	40	-1	-1	-1
34	VCC1 & Drinks2	35	-1	-1	-1
35	VCC1 & Drinks3	44	-1	-1	-1
36	VCC1 & Drinks1	56	-1	-1	-1
37	VCC1 & Park2	20	-1	-1	-1
38	VCC1 & Tree4	42	-1	-1	-1
39	VCC1 & Park1	16	-1	-1	-1
40	VCC1 & Tree2	34	-1	-1	-1
41	VCC1 & Tree3	35	-1	-1	-1
42	VCC1 & Tree1	24	-1	-1	-1
43	VCC3 & VCC2	100	-1	-1	-1
44	VCC3 & Office1	18	-1	-1	-1
45	VCC3 & Office2	15	-1	-1	-1
46	VCC3 & Office3	10	-1	-1	-1
47	VCC3 & Drinks2	12	-1	-1	-1
48	VCC3 & Drinks3	18	-1	-1	-1
49	VCC3 & Drinks1	13	-1	-1	-1
50	VCC3 & Park2	8	-1	-1	-1
51	VCC3 & Tree4	11	-1	-1	-1
52	VCC3 & Park1	8	-1	-1	-1
53	VCC3 & Tree2	9	-1	-1	-1
54	VCC3 & Tree3	15	-1	-1	-1
55	VCC3 & Tree1	16	-1	-1	-1
56	VCC2 & Office1	81	-1	-1	-1
57	VCC2 & Office2	70	-1	-1	-1
58	VCC2 & Office3	55	-1	-1	-1
59	VCC2 & Drinks2	48	-1	-1	-1
60	VCC2 & Drinks3	58	-1	-1	-1
61	VCC2 & Drinks1	62	-1	-1	-1
62	VCC2 & Park2	35	-1	-1	-1
63	VCC2 & Tree4	46	-1	-1	-1
64	VCC2 & Park1	29	-1	-1	-1
65	VCC2 & Tree2	46	-1	-1	-1
66	VCC2 & Tree3	31	-1	-1	-1

69	VCC2 & Tree1	33	-1	-1	-1	-1
70	Office1 & Office2	229	162	70	1	1
71	Office1 & Office3	128	54	42	1	1
72	Office1 & Drinks2	15	-1	-1	-1	-1
73	Office1 & Drinks3	20	-1	-1	-1	-1
74	Office1 & Drinks1	15	-1	-1	-1	-1
75	Office1 & Park2	11	-1	-1	-1	-1
76	Office1 & Tree4	50	-1	-1	-1	-1
77	Office1 & Park1	11	-1	-1	-1	-1
78	Office1 & Tree2	38	-1	-1	-1	-1
79	Office1 & Tree3	47	-1	-1	-1	-1
80	Office1 & Tree1	30	-1	-1	-1	-1
81	Office2 & Office3	97	45	46	1	1
82	Office2 & Drinks2	11	-1	-1	-1	-1
83	Office2 & Drinks3	13	-1	-1	-1	-1
84	Office2 & Drinks1	15	-1	-1	-1	-1
85	Office2 & Park2	13	-1	-1	-1	-1
86	Office2 & Tree4	39	-1	-1	-1	-1
87	Office2 & Park1	10	-1	-1	-1	-1
88	Office2 & Tree2	26	-1	-1	-1	-1
89	Office2 & Tree3	46	-1	-1	-1	-1
90	Office2 & Tree1	36	-1	-1	-1	-1
91	Office3 & Drinks2	19	-1	-1	-1	-1
92	Office3 & Drinks3	19	-1	-1	-1	-1
93	Office3 & Drinks1	22	-1	-1	-1	-1
94	Office3 & Park2	7	-1	-1	-1	-1
95	Office3 & Tree4	29	-1	-1	-1	-1
96	Office3 & Park1	11	-1	-1	-1	-1
97	Office3 & Tree2	11	-1	-1	-1	-1
98	Office3 & Tree3	26	-1	-1	-1	-1
99	Office3 & Tree1	22	-1	-1	-1	-1
100	Drinks2 & Drinks3	280	73	26	1	1
101	Drinks2 & Drinks1	327	51	15	1	1
102	Drinks2 & Park2	30	-1	-1	-1	-1
103	Drinks2 & Tree4	48	-1	-1	-1	-1
104	Drinks2 & Park1	73	-1	-1	-1	-1
105	Drinks2 & Tree2	62	-1	-1	-1	-1
106	Drinks2 & Tree3	75	-1	-1	-1	-1
107	Drinks2 & Tree1	36	-1	-1	-1	-1

108	Drinks3 & Drinks1 100		-1	-1	-1	
109	Drinks3 & Park2 24		-1	-1	-1	
110	Drinks3 & Tree4 50		-1	-1	-1	
111	Drinks3 & Park1 75		-1	-1	-1	
112	Drinks3 & Tree2 60		-1	-1	-1	
113	Drinks3 & Tree3 74		-1	-1	-1	
114	Drinks3 & Tree1 53		-1	-1	-1	
115	Drinks1 & Park2 38		-1	-1	-1	
116	Drinks1 & Tree4 46		-1	-1	-1	
117	Drinks1 & Park1 51		-1	-1	-1	
118	Drinks1 & Tree2 42		-1	-1	-1	
119	Drinks1 & Tree3 57		-1	-1	-1	
120	Drinks1 & Tree1 43		-1	-1	-1	
121	Park2 & Tree4 3		-1	-1	-1	
122	Park2 & Park1 151		148	98	1	
123	Park2 & Tree2 5		-1	-1	-1	
124	Park2 & Tree3 5		-1	-1	-1	
125	Park2 & Tree1 1		-1	-1	-1	
126	Tree4 & Park1 33		-1	-1	-1	
127	Tree4 & Tree2 207		87	42	1	
128	Tree4 & Tree3 616		455	73	1	
129	Tree4 & Tree1 99		-1	-1	-1	
130	Park1 & Tree2 5		-1	-1	-1	
131	Park1 & Tree3 5		-1	-1	-1	
132	Park1 & Tree1 6		-1	-1	-1	
133	Tree2 & Tree3 1121		876	78	1	
134	Tree2 & Tree1 1427		1236	86	1	
135	Tree3 & Tree1 425		200	47	1	
136						

Custom Images (Discussed in writeup):





