

Homography Estimation: Correspondence Estimation

When you take a panoramic image with your camera, you end up with a sequence of images of the same scene taken from different perspectives. Each image has a slightly difference appearance but in many cases it is possible to transform them so they can be combined into a single image or panorama. In this Lab you will program automatic homography estimation between two images. Although this lab is not dependent on labs from previous weeks, it builds on concepts from Week 4.

In this lab you will (1) compute the homography between two images when correspondences are known, (2) estimate correspondences between two sets of Harris Corners using Nearest Neighbor and the ratio test and (3) use RANSAC to find the best homography estimate from the estimated correspondences from (2).

Your Script

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```
1 % get images
2 buildingDir = fullfile(toolboxdir('vision'), 'visiondata', 'building');
3 buildingScene = imageDatastore(buildingDir);
4 I1 = rgb2gray(readimage(buildingScene, 1));
5 I2 = rgb2gray(readimage(buildingScene, 2));
6
7 % get points
8 points1 = detectHarrisFeatures(I1);
9 points2 = detectHarrisFeatures(I2);
10
11 % get features
12 [features1, points1] = extractFeatures(I1, points1);
13 [features2, points2] = extractFeatures(I2, points2);
14
15 loc1 = points1.Location;
16 loc2 = points2.Location;
17
18 [match,match_fwd,match_bkwd] = match_features(double(features1.Features),double(features2.Features));
19
20 figure()
21 plot_corr(I1,I2,loc1(match_fwd(:,1),:),loc2(match_fwd(:,2),:));
22
23 figure()
24 plot_corr(I1,I2,loc1(match_bkwd(:,1),:),loc2(match_bkwd(:,2),:));
25
26 figure()
27 plot_corr(I1,I2,loc1(match(:,1),:),loc2(match(:,2),:));
28
29 function [match,match_fwd,match_bkwd] = match_features(f1,f2)
30     %% INPUT
31     %% f1,f2: [ number of points x number of features ]
32     %% OUTPUT
33     %% match, match_fwd, match_bkwd: [ indices in f1, corresponding indices in f2 ]
34
35     % get matches using pdist2 and the ratio test with threshold of 0.7
36     % fwd matching
37     match_fwd = [];
38
39     % get indices of f2 which are closest to f1
40     neighbors_wrt_first = knnsearch(f2,f1,'K',2);
41
42     number = length(neighbors_wrt_first);
43     for ind = 1:number
44         feature_1 = f1(ind,:);
45         current_pair = neighbors_wrt_first(ind,:);
46         d_1 = pdist2(feature_1, f2(current_pair(1),:) );
47         d_2 = pdist2(feature_1, f2(current_pair(2),:) );
48         d_ratio = d_1/d_2;
49         if d_ratio < .7
50             match_fwd = [match_fwd ; ind, current_pair(1)];
```

```

50     end
51 end
52
53
54 % bkwd matching
55 match_bkwd = [];
56
57 % get indices of f1 which are closest to f2
58 neighbors_wrt_first = knnsearch(f1,f2,'K',2);
59
60 number = length(neighbors_wrt_first);
61 for ind = 1:number
62     feature_2 = f2(ind,:);
63     current_pair = neighbors_wrt_first(ind,:);
64     d_1 = pdist2(f1(current_pair(1),:), feature_2 );
65     d_2 = pdist2(f1(current_pair(2),:), feature_2 );
66     d_ratio = d_1/d_2;
67     if d_ratio < .7
68         match_bkwd = [match_bkwd ; current_pair(1), ind];
69     end
70 end
71
72 % fwd bkwd consistency check
73 match = intersect(match_fwd, match_bkwd, 'rows');
74
75 end
76

```

▶ Run Script



Previous Assessment: All Tests Passed

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✔ Is match correct?

✔ Is match_fwd correct?

✔ Is match_bkwd correct?

Output

