

ME 425 HW 4
Image Processing and Corner Detection On
Various Images In MATLAB

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1 Introduction

In the HW4 of ME425, corner detection on several images were applied by using different detection methods such as Harris Features or minimum eigenvalue. Also, a gaussian filter was applied to the images to smooth them and compare the result of corner detection for the filtered and unfiltered images.

2 Procedure

In total, 4 different images were used to test corner detection:

1. The first one is an image of a kitchen:



2. The second one is a image of a House



3. The third one is a image of a Table



4. The fourth one is an image of a Farm



5. The fifth one is an image of a classroom in Sabanci



The following procedure was followed for each image when applying corner detection on them:

First, the images were read into the MATLAB environment by using the `imread` function. Then, they were converted to grayscale for corner detection by using

the `rgb2gray` function. Then, a gaussian filter of size 15×15 with a σ value of 12.5 was created. This filter was then applied to the image. Then, the corner function was called both with Harris corners and minimum eigenvalue methods to apply corner detection on both the original image and the filtered image. Then, the received results were plotted as 3×2 subplots on a single figure.

3 Results

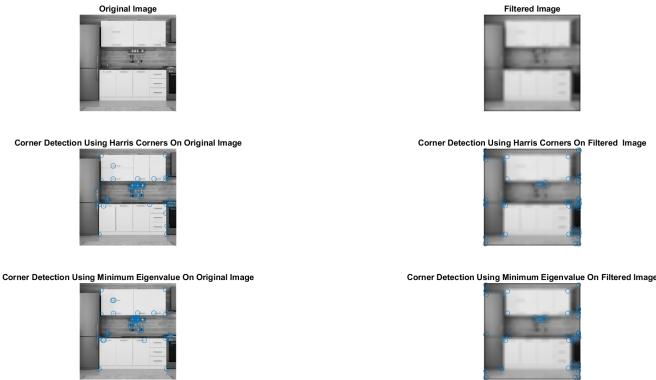


Figure 1: The Filtered and Unfiltered Results For Image 1

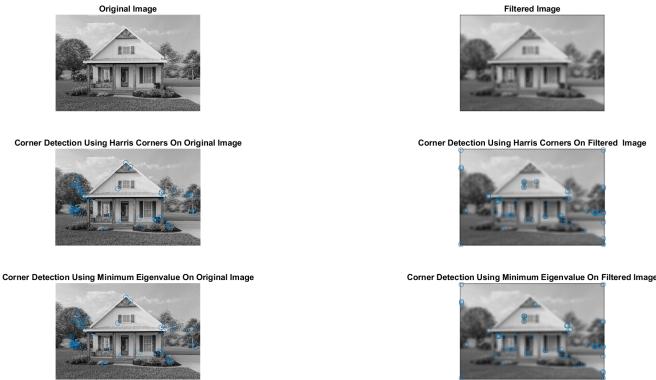


Figure 2: The Filtered and Unfiltered Results For Image 2

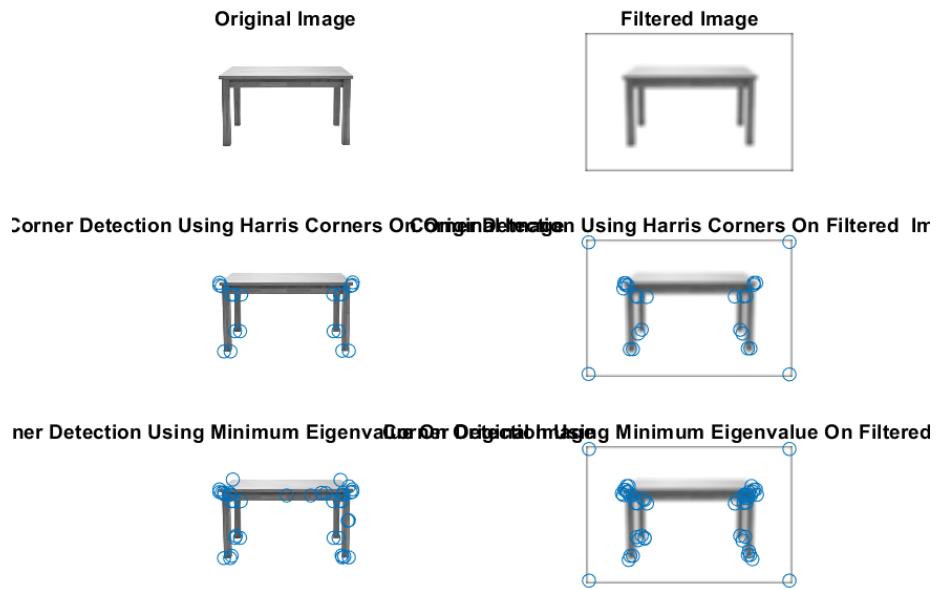


Figure 3: The Filtered and Unfiltered Results For Image 3

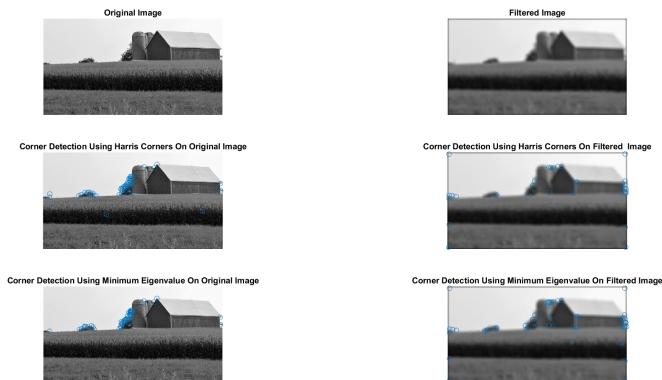


Figure 4: The Filtered and Unfiltered Results For Image 4

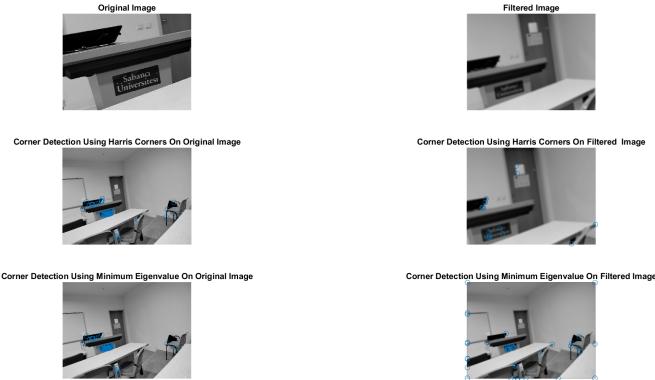


Figure 5: The Filtered and Unfiltered Results For Image 5

4 Discussion

For both detection methods, applying Gaussian filtering generally improved the robustness of corner detection. In the filtered images, the algorithms were able to detect corners that were missed in the original, noisier images, especially in regions with fine texture or low contrast. This can be seen quite clearly in the more complex pictures, such as the farm or the house image. The difference is less noticeable on simpler images such as the one of the table. However, in some cases the smoothing also caused spurious responses near the image boundaries, leading to the detection of “corners” that do not correspond to meaningful geometric features in the scene.

Comparing the Harris and Minimum Eigenvalue methods, Harris corners typically detected a larger number of meaningful corners, particularly in fine-textured regions and at less sharp junctions. The Minimum Eigenvalue method tended to be more conservative, often missing weaker or less distinct corners that Harris was still able to localize.

5 Appendix

The images that are used in this assignment will also be provided along with the MATLAB script in the submission for reproducibility of the results.

Listing 1: ME425HW4.m. Reads the images into the MATLAB workspace and applies gaussian filtering and cornere detection functions to it. Analyzes a total of 4 different images.

```

1 clc; clear; close all;
2 h = fspecial('gaussian', [13 13], 1);

```

```

3
4 %% Image 1
5 imgKitchen = imread("IMG1Kitchen.jpg");
6 imgKitchen = rgb2gray(imgKitchen);
7 figure;
8 subplot(3,2,1),
9 imshow(imgKitchen);
10 title("Original Image");
11
12 imgKitchenFiltered = imfilter(imgKitchen,h);
13 subplot(3,2,2);
14 imshow(imgKitchenFiltered);
15 title("Filtered Image");
16
17 subplot(3,2,3);
18 C = corner(imgKitchen,"Harris", 25);
19 imshow(imgKitchen);
20 hold on;
21 plot(C(:,1), C(:,2), "o");
22 title("Corner Detection Using Harris Corners On Original Image");
23
24 subplot(3,2,4);
25 CFiltered = corner(imgKitchenFiltered, "Harris", 25);
26 imshow(imgKitchenFiltered);
27 hold on;
28 plot(CFiltered(:,1), CFiltered(:,2), "o");
29 title("Corner Detection Using Harris Corners On Filtered Image");
30
31 subplot(3,2,5);
32 C = corner(imgKitchen, "MinimumEigenvalue",25);
33 imshow(imgKitchen);
34 hold on;
35 plot(C(:,1), C(:,2), "o");
36 title("Corner Detection Using Minimum Eigenvalue On Original Image
      ");
37
38 subplot(3,2,6);
39 CFiltered = corner(imgKitchenFiltered, "MinimumEigenvalue", 25);
40 imshow(imgKitchenFiltered);
41 hold on;
42 plot(CFiltered(:,1), CFiltered(:,2), "o");
43 title("Corner Detection Using Minimum Eigenvalue On Filtered Image
      ");
44
45 %% Image 2
46 imgHouse = imread("IMG2House.jpg");
47 imgHouse = rgb2gray(imgHouse);
48 figure;
49 subplot(3,2,1),
50 imshow(imgHouse);
51 title("Original Image");
52
53 imgHouseFiltered = imfilter(imgHouse,h);
54 subplot(3,2,2);
55 imshow(imgHouseFiltered);
56 title("Filtered Image");
57

```

```

58 subplot(3,2,3);
59 C = corner(imgHouse, "Harris",25);
60 imshow(imgHouse);
61 hold on;
62 plot(C(:,1), C(:,2), "o");
63 title("Corner Detection Using Harris Corners On Original Image");
64
65 subplot(3,2,4);
66 CFiltered = corner(imgHouseFiltered, "Harris", 25);
67 imshow(imgHouseFiltered);
68 hold on;
69 plot(CFiltered(:,1), CFiltered(:,2), "o");
70 title("Corner Detection Using Harris Corners On Filtered Image");
71
72 subplot(3,2,5);
73 C = corner(imgHouse, "MinimumEigenvalue",25);
74 imshow(imgHouse);
75 hold on;
76 plot(C(:,1), C(:,2), "o");
77 title("Corner Detection Using Minimum Eigenvalue On Original Image
    ");
78
79 subplot(3,2,6);
80 CFiltered = corner(imgHouseFiltered, "MinimumEigenvalue", 25);
81 imshow(imgHouseFiltered);
82 hold on;
83 plot(CFiltered(:,1), CFiltered(:,2), "o");
84 title("Corner Detection Using Minimum Eigenvalue On Filtered Image
    ");
85
86 %% Image 3
87 imgTable = imread("Table.jpg");
88 imgTable = rgb2gray(imgTable);
89 figure;
90 subplot(3,2,1),
91 imshow(imgTable);
92 title("Original Image");
93
94 imgTableFiltered = imfilter(imgTable,h);
95 subplot(3,2,2);
96 imshow(imgTableFiltered);
97 title("Filtered Image");
98
99 subplot(3,2,3);
100 C = corner(imgTable, "Harris",25);
101 imshow(imgTable);
102 hold on;
103 plot(C(:,1), C(:,2), "o");
104 title("Corner Detection Using Harris Corners On Original Image");
105
106 subplot(3,2,4);
107 CFiltered = corner(imgTableFiltered, "Harris", 25);
108 imshow(imgTableFiltered);
109 hold on;
110 plot(CFiltered(:,1), CFiltered(:,2), "o");
111 title("Corner Detection Using Harris Corners On Filtered Image");
112

```

```

113 subplot(3,2,5);
114 C = corner(imgTable, "MinimumEigenvalue",25);
115 imshow(imgTable);
116 hold on;
117 plot(C(:,1), C(:,2), "o");
118 title("Corner Detection Using Minimum Eigenvalue On Original Image
      ");
119
120 subplot(3,2,6);
121 CFiltered = corner(imgTableFiltered, "MinimumEigenvalue", 25);
122 imshow(imgTableFiltered);
123 hold on;
124 plot(CFiltered(:,1), CFiltered(:,2), "o");
125 title("Corner Detection Using Minimum Eigenvalue On Filtered Image
      ");
126
127 %% Image 4
128 imgFarm = imread("Farm.jpeg");
129 imgFarm = rgb2gray(imgFarm);
130 figure;
131 subplot(3,2,1),
132 imshow(imgFarm);
133 title("Original Image");
134
135 imgFarmFiltered = imfilter(imgFarm,h);
136 subplot(3,2,2);
137 imshow(imgFarmFiltered);
138 title("Filtered Image");
139
140 subplot(3,2,3);
141 C = corner(imgFarm, "Harris",25);
142 imshow(imgFarm);
143 hold on;
144 plot(C(:,1), C(:,2), "o");
145 title("Corner Detection Using Harris Corners On Original Image");
146
147 subplot(3,2,4);
148 CFiltered = corner(imgFarmFiltered, "Harris", 25);
149 imshow(imgFarmFiltered);
150 hold on;
151 plot(CFiltered(:,1), CFiltered(:,2), "o");
152 title("Corner Detection Using Harris Corners On Filtered Image");
153
154 subplot(3,2,5);
155 C = corner(imgFarm, "MinimumEigenvalue",25);
156 imshow(imgFarm);
157 hold on;
158 plot(C(:,1), C(:,2), "o");
159 title("Corner Detection Using Minimum Eigenvalue On Original Image
      ");
160
161 subplot(3,2,6);
162 CFiltered = corner(imgFarmFiltered, "MinimumEigenvalue", 25);
163 imshow(imgFarmFiltered);
164 hold on;
165 plot(CFiltered(:,1), CFiltered(:,2), "o");
166 title("Corner Detection Using Minimum Eigenvalue On Filtered Image
      ");

```

") ;