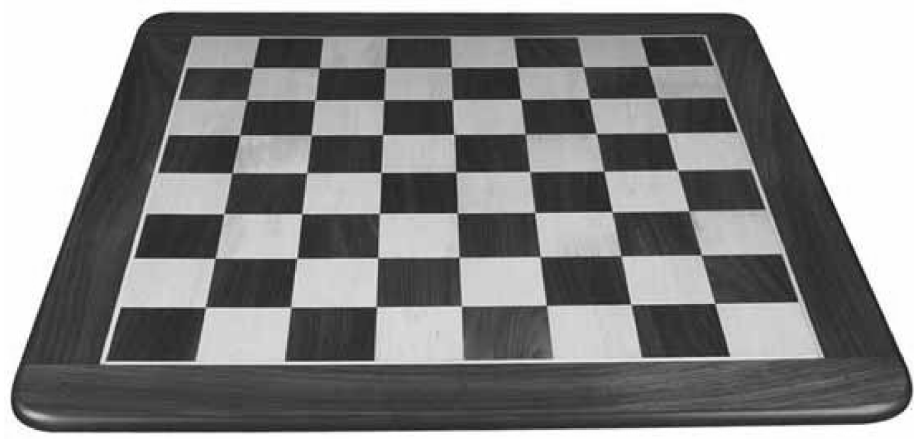
3/15/2015

HW4 ELEC345

1. "CORNERNESS" MEASURE

a) Convert the input image to gray scale.



b) Compute I_x and I_y using central difference x-gradient and y-gradient filters respectively. You had implemented these filters in Assignment 1.

I used 0.5*[-1,0,1] as central difference operater.

```
diffx = 0.5* [-1, 0, 1];
Ix = imfilter(image, diffx, 'symmetric');
```

c) Compute I_x^2, I_y^2 and I_xI_y.

Codes:

```
Ix2 = Ix.^2;
Iy2 = Iy.^2;
Ixy = Ix.*Iy;
```

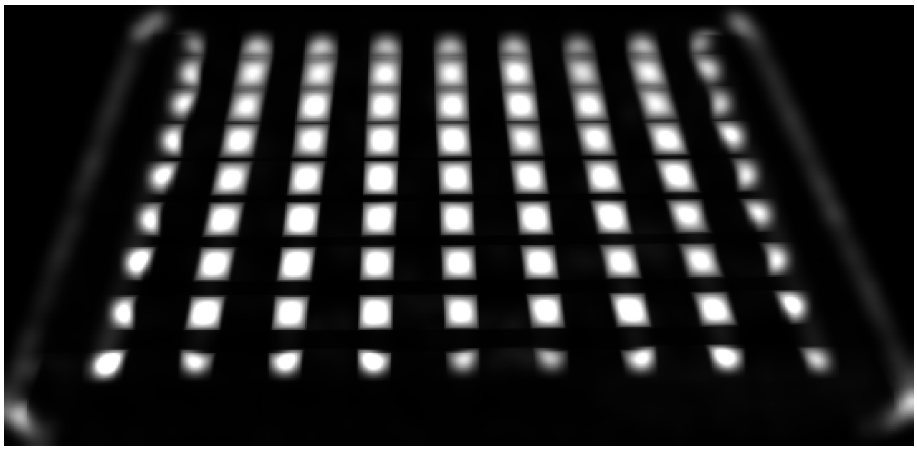
d) Create a Gaussian smoothing filter (w in Equation (1)) using fspecial with a chosen standard deviation (σ) and size 4σ.

```
gauss = fspecial('gaussian', 4*sigma, sigma);
```

e) Apply the Gaussian filter to I_x^2, I_y^2 and I_xI_y using imfilter.

```
convIx2 = imfilter(Ix2, gauss, 'symmetric');
```

f) Compute the cornerness measure M. Recall that determinant([a, b; b, c]) = $ac–b^2$ and trace([a, b; b, c]) = a + c. M should be map of cornerness, the same size as the image.



Codes:

```
detH = convIx2.*convIy2 - convIxy.*convIxy;
traceH = convIx2 + convIy2;
M = detH./traceH;
M(isnan(M)) = 0;
```

2. CORNER EXTRACTION

a) Perform non-maximal suppression on M to find local maximas. You could implement the local maxima detection by various means. A few suggested Matlab functions are: ordfilt2, imdilate, imregionalmax.

Thresholding first:

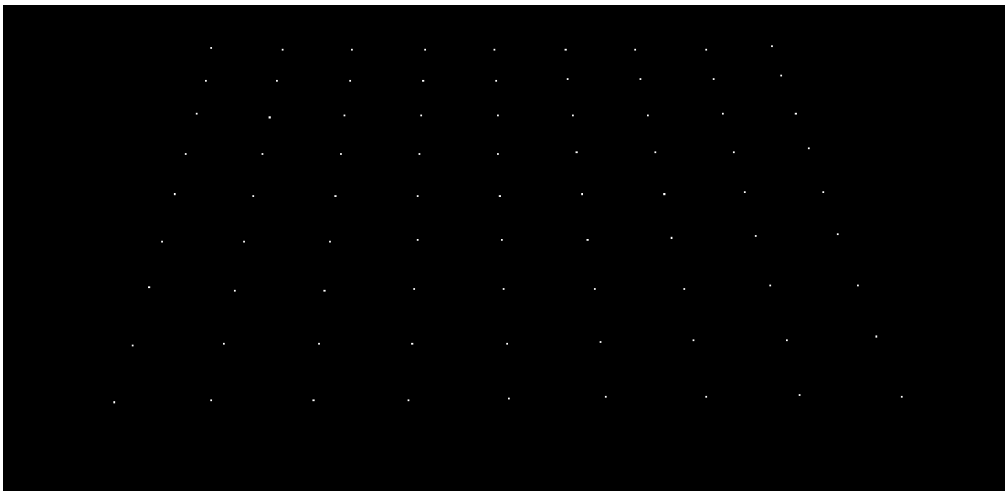
```
Threshidx = M < Threashold;
M(Threshidx)=0;
```

Use mregionalmax to get the corner points:

```
Pts = imregionalmax(M);
```

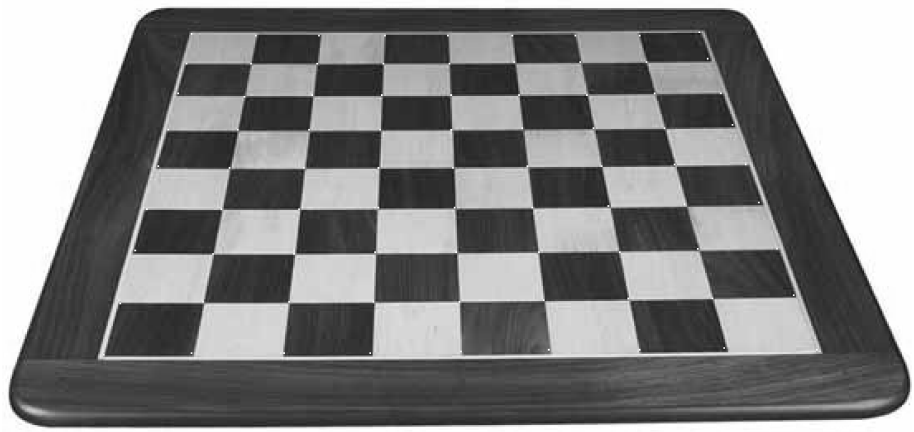
b) Find the coordinates of the corner points.

Stored in Pts



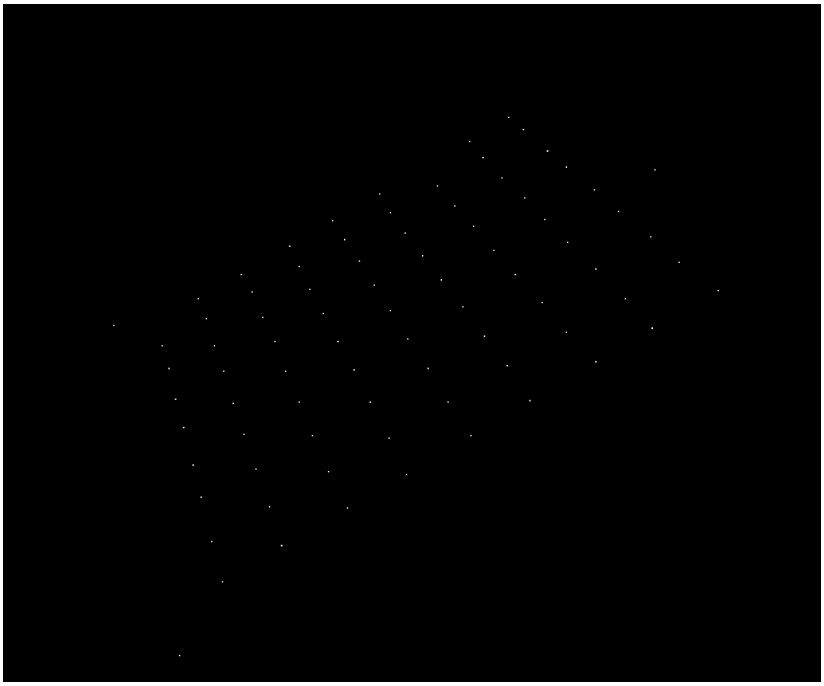
c) Display the image and superimpose the corners.

```
Mpt = double(imregionalmax(M));
imshow(uint8(Mpt*255+image));
```

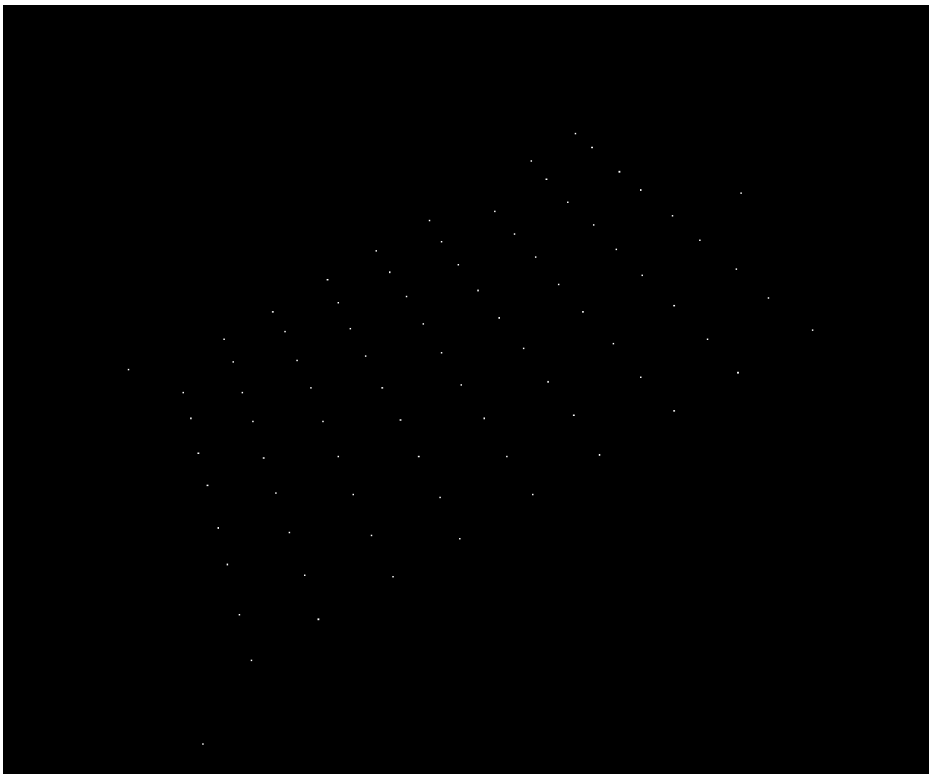


3. ROTATION AND SCALING

1. Rotate the chessboard image by 30 deg and apply your function.
I changed the extra black produced by rotation to white and applied the function. I used a larger Gaussian filter and a higher threshold. The rotated one failed to detect all the corners. Using a better defined derivative might help to improve the result.



2. Resize the chessboard image by 4 times on both axes and apply your function.
I used a much larger Gaussian filter and a really low threshold.
The size change will make Ix^2 16 times smaller than the original figure. Also, the resize smooth things out a bit, so the corner detection is still very good.



Due to resolution of screen, it is hard to see the dots, but all the dots are detected.

PS: FOR CODES, RUN HW4.M FUNCTION IS IN HARRIS.M