# ECE 8410: Computer Vision

## Assignment 4

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Mark Belbin (201618477)
Raylene Mitchell (201415247)
Rodney Winsor (200433886)

# Code Explanation

To implement the Harris corner detection algorithm, first the input image was read and converted to grayscale. This image is shown in Figure 1 along with its grayscale counterpart.



*Figure 1: Grayscale original image.*

Next, the vertical and horizontal gradients were found using derivative masks and the imfilter function. A gaussian filter was then applied to each gradient matrix, as well as the element-wise multiplication of the two.

```
% Derivative Masks
dx = [-1 0 1; -1 0 1; -1 0 1];
dy = dx';

% Find x and y moments of the image
Ix = imfilter(img, dx, 'same');
Iy = imfilter(img, dy, 'same');

%perform gaussian filtering on the moments
g = fspecial('gaussian', round(6*sigma), sigma);
Ixx = conv2(Ix.^2, g);
Iyy = conv2(Iy.^2, g);
Ixy = conv2(Ix.*Iy, g);
```

Then, the harris corner measure was calculated using these gradients. The result of this measure is shown in Figure 2 plotted as a sort of heatmap. The yellow clusters signify an area of high 'corner-ness', and the local maxima of these clusters will be the resulting corner points.

```
% Harris corner measure creation
R_Harris = (Ixx.*Iyy - Ixy.^2)-alpha*((Ixx + Iyy).^2);

figure;
clims = [4500, 5000];
imagesc(R_Harris, clims);
```
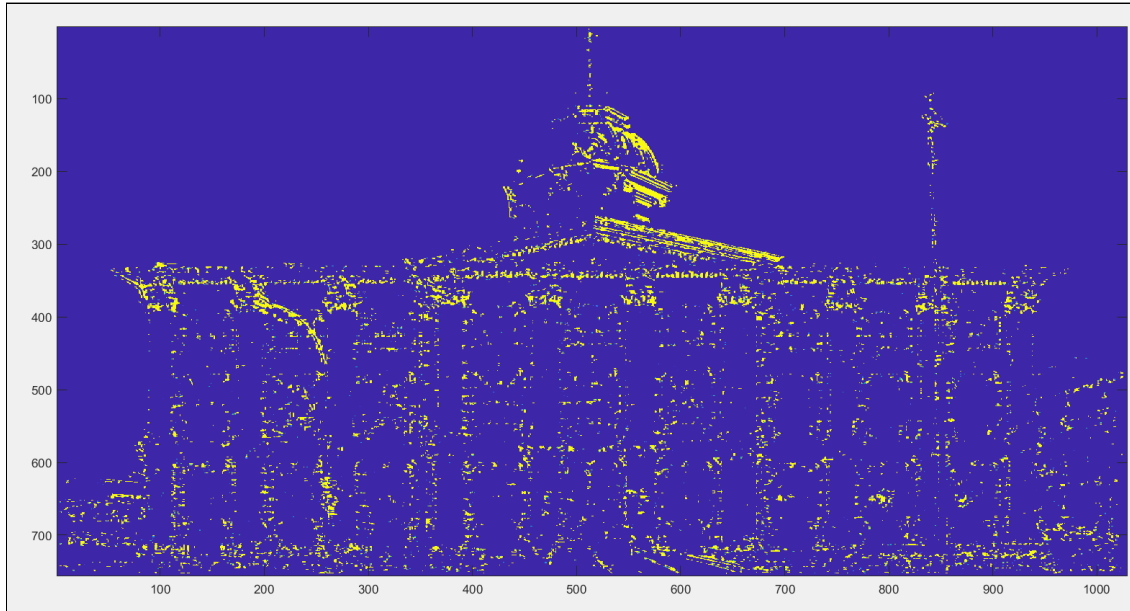


*Figure 2: Cluster areas from the Harris measure, the local maxima of these yellow clusters will be the detected corner points.*

The local maxima were then extracted from the harris measure using the following code, yielding the final harris corner points.

```
% Find local maxima from corner measure
N = 2*radius+1; % Size of mask.
mx=imdilate(R_Harris, strel('disk',N)); % Grey-scale dilate.
Lmax = (R_Harris==mx)& (R_Harris>thresh); % Find maxima.
[r,c] = find(Lmax); % Find row,col coords.
```

# Final Result

The final resulting image with detected corner points is shown in Figure 3. The detected points were tuned using the input parameters to the harris detection algorithm. Mainly, we reduced alpha to decrease the number of detected corners, and then increased the threshold to further reduce the corners to only the 'best' ones. It looks like this worked from our resulting image, as most corner points actually seem to be a real corner on the image.

```
% Harris corner detector input parameters %
sigma=1;
thresh=4500;
radius=5;
alpha=0.08;
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```



Figure 3: Final detected harris corner points plotted over the original RGB image.