Assignment Project #2 Corner Detection

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Report:

1. In this project, I choose the following image as the source image to implement Harris corner point detector.

Figure 1.1

2. First, I set the threshold of R to be 50000 and set the sigma of the 2D Gaussian filter as 1. I initialize the u and v of 2D Gaussian filter by using the function meshgrid() as Figure 2.1.

```
src = imread('blocks.jpeg');

img = rgb2gray(src);

threshold = 50000; % Initialize the threshold
a = 0.04; % Initialize alpha as 0.04
sigma = 1; % Initialize sigma as 1
N = sigma * 3; % Define the Gaussian window

[u, v] = meshgrid(-N:N, -N:N);
```

Figure 2.1

3. Then I calculate the Gaussian filter as w and the first gradients of the image as X and Y. Use w, X and Y to calculate the arguments A, B, C of E(x,y) as Figure 3.1.

```
w = exp(-(u .^ 2 + v .^ 2) / (2 * sigma^2)); % Calculate the Gaussian

% Calculate the first gradients of the image
m = [-1,0,1];
tmpX = conv2(m, img);
tmpY = conv2(transpose(m), img);
X = zeros(size(img,1), size(img,2));
Y = zeros(size(img,1), size(img,2));
for i=1:size(img,1)
    for j=1:size(img,2)
        X(i,j) = tmpX(i,j+1);
        Y(i,j) = tmpY(i+1, j);
    end
end

% Calculate each argument of E(x,y)
A = conv2(w, X .^ 2);
B = conv2(w, Y .^ 2);
C = conv2(w, X .* Y);
```

Figure 3.1

4. After that, I calculate the second moment matrix M for each pixel ,use M to calculate the corresponding corner response function R and threshold R. Next, take only the points of local maxima of R as Figure 4.1 shows.

```
res = zeros(size(img,1), size(img,2));
temp = zeros(size(img,1), size(img,2));
for i=1:size(res,1)
    for j=1:size(res,2)
        % Define the matrix M around each pixel
        M = [A(i,j) C(i,j); C(i,j) B(i,j)];

        % Computer the response function R
        R = det(M) - a * (trace(M) ^ 2);
        temp(i,j) = R;
        % Threshold R
        if (R > threshold)
            res(i,j) = R;
        end
    end
end

% Find local maxima of response function
out = res > imdilate(res, [1 1 1;1 0 1;1 1 1]);
```

Figure 4.1

5. Finally, integrate the corner points with the source image and save the image as ‘result.jpg’. Figure 5.1 shows the final result. The red dot in the image means the corner points found by the Harris corner point detector.

Figure 5.1