Homework 3 solution template
CMPSCI 370 Spring 2019, UMass Amherst
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1 Image filtering [10 points]

- Why is filtering with a Gaussian kernel preferable over a box kernel for denoising an image?

  Ans: The pixels further away from the center are weighted less in the average with Gaussian kernel. This better preserves the image content and avoid producing artifacts.

- What is the effect of increasing the σ of the Gaussian kernel on the result of filtering?

  Ans: The pixels further away from the center are weighted more when σ increases. Larger σ results in smoother outputs.

- When is median filtering preferable over Gaussian kernel filtering for denoising?

  Ans: Median filtering is effective in reducing salt-and-pepper noise and better at preserving edges.

- Why is it a good idea to smooth an image before filtering with a derivative filter?

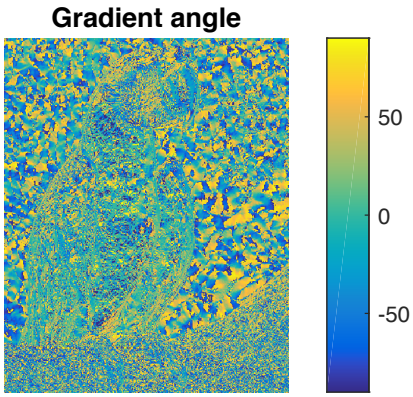
  Ans: Computing image gradients is sensitive to noise. Smoothing as preprocessing can alleviate the effect of noise.

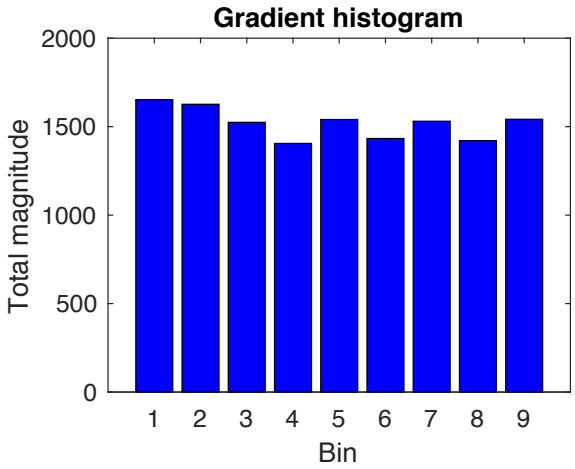
- What does filtering an image with a Laplacian of Gaussian filter do?

  Ans: Laplacian of Gaussian filter can be used as an edge detector. The edge can be identified at the pixel where the filter response is zero at the pixel while positive on one side and negative on the other side (zero crossing).

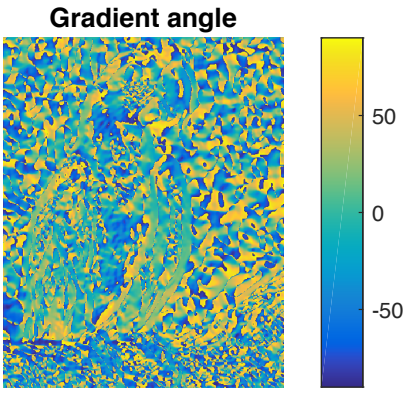
2 Image Gradient and Orientation Histogram

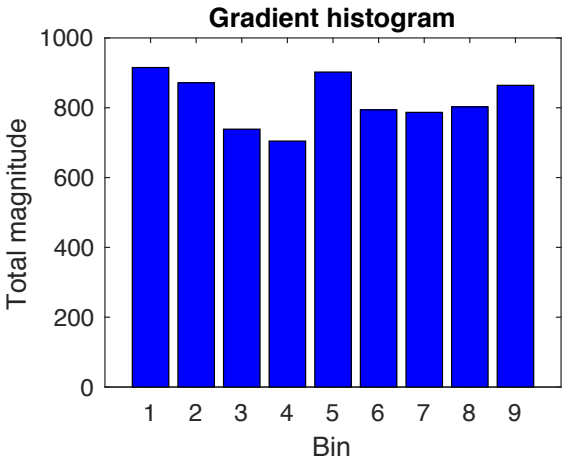
1. Visualizing gradient magnitude, angle and histogram





2. Visualizing gradient magnitude, angle and histogram for smoothed image





3 Corner detection

1. Output for the checkerboard image. When you get the correct output of corner detectors, the heatmaps of corner scores should have higher values (more yellowish) around corners and lower (more bluish) elsewhere.

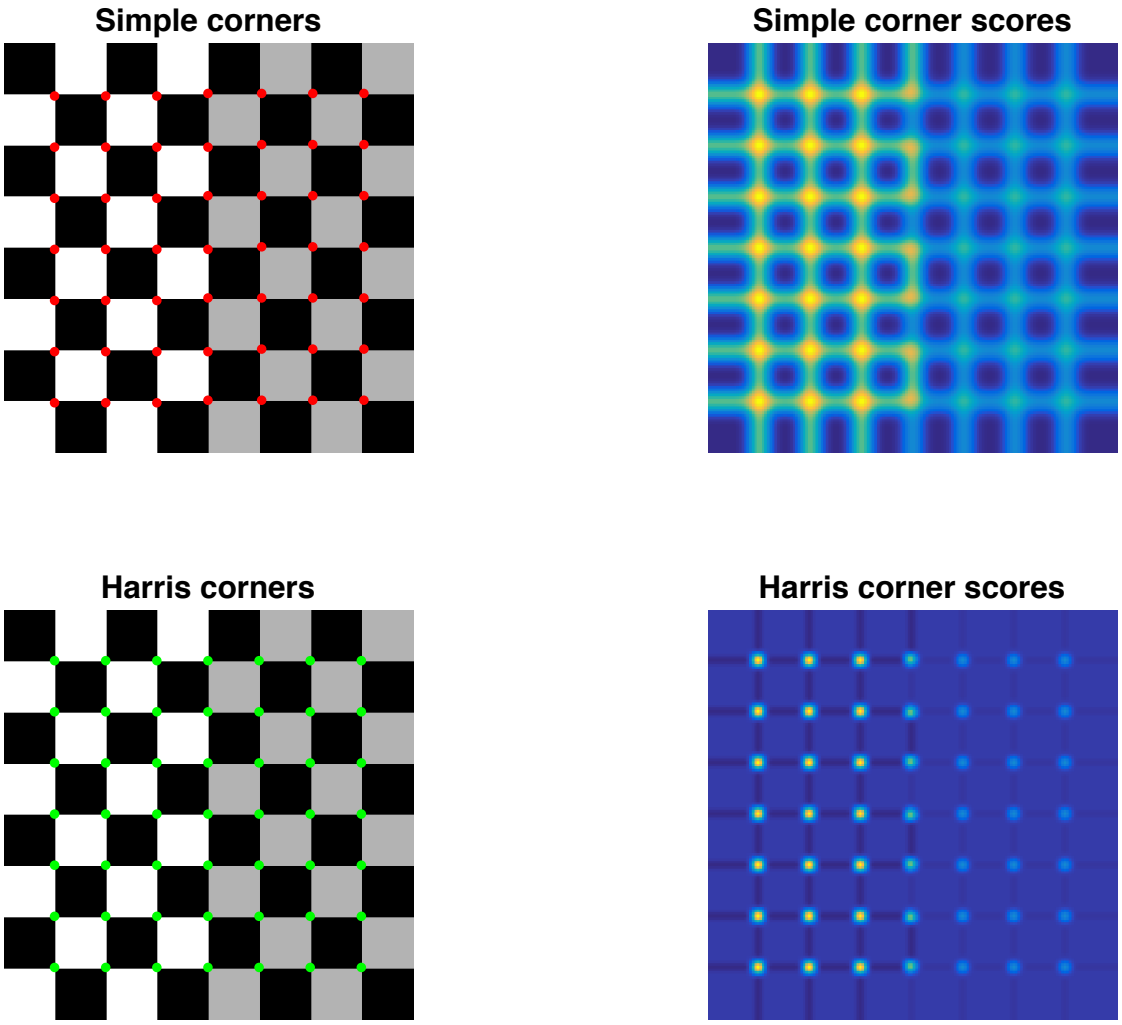


Figure 1: Results for the checkerboard image.

2. Output for the `'polymer-science-umass.jpg'` image

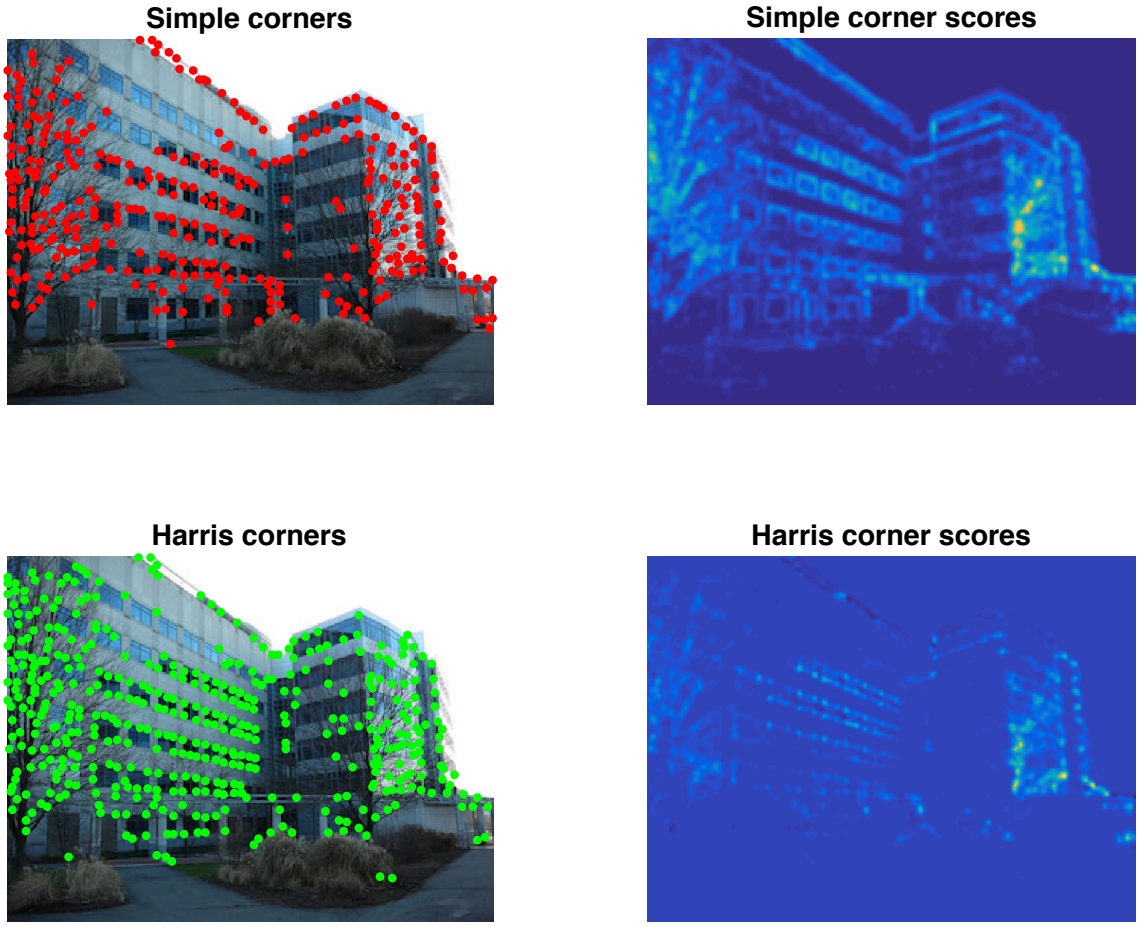


Figure 2: Results for the `'polymer-science-umass.jpg'` image.

3. Output for the image of your own choice

4 Solution code

Include the source code for your solutions as seen below (only the files you implemented are necessary). In latex the command `verbatiminput{alignChannels.m}` allows you to include the code verbatim as seen below. Regardless of how you do this the main requirement is that the included code is readable (use proper formatting, variable names, etc.) A screenshot of your code works to provided you include a link to source files.

4.a detectCorners.m

4.b imageGradient.m