Detecting Harris Corners and Matching Images

Computer Vision (CS342) Mini-Project 3

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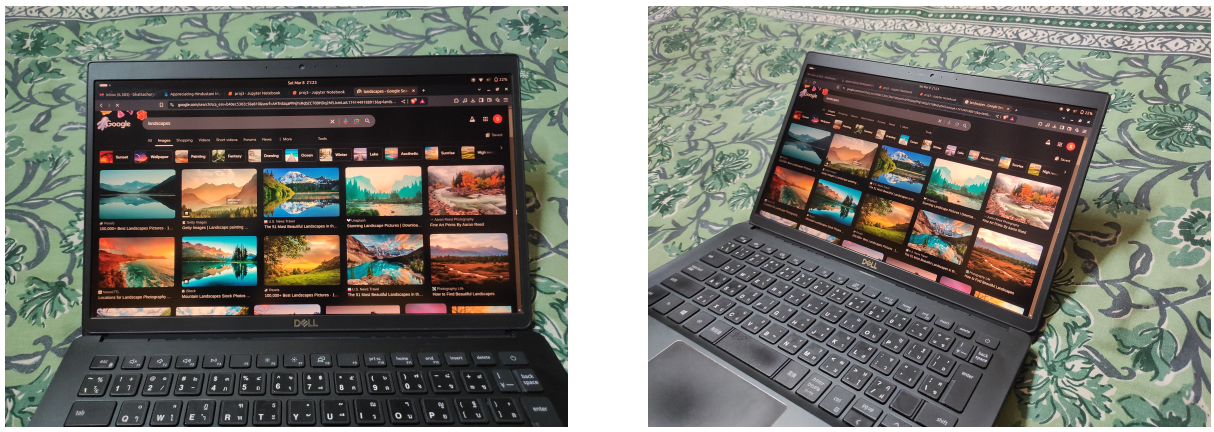
1 Introduction

In this mini-project, our goal was to take two similar original images, detect keypoints from the corners detected by Harris Corner detection method in those images, and match those keypoints. We were tasked with implementing two methods: one for finding harris corners, and another for creating key points (with gradient) from those corners.

We used the following two images for our project (those are images of Soham's laptop):



(a) Image 1 (b) Image 2

Figure 1: The images used in our project

2 Detecting Harris Corners

Firstly we converted our original image to grayscale. The we calculated the sobel derivaties, I_x and I_y of the image by taking kernel size = 3. Then we computed the I_{xx}, I_{yy} and I_{xy} matrices, which were used to compute the second-moment matrix, M. We then computed the determinant of M and trace of M, which we used to compute the corner response function, R by using the formula $R = det(M) - \alpha \cdot trace(M)^2$.

3 Keypoint Creation

We used the harris corners to generate keypoints, which we put on the original image, and then matched the best 100 keypoints.

4 Images generated

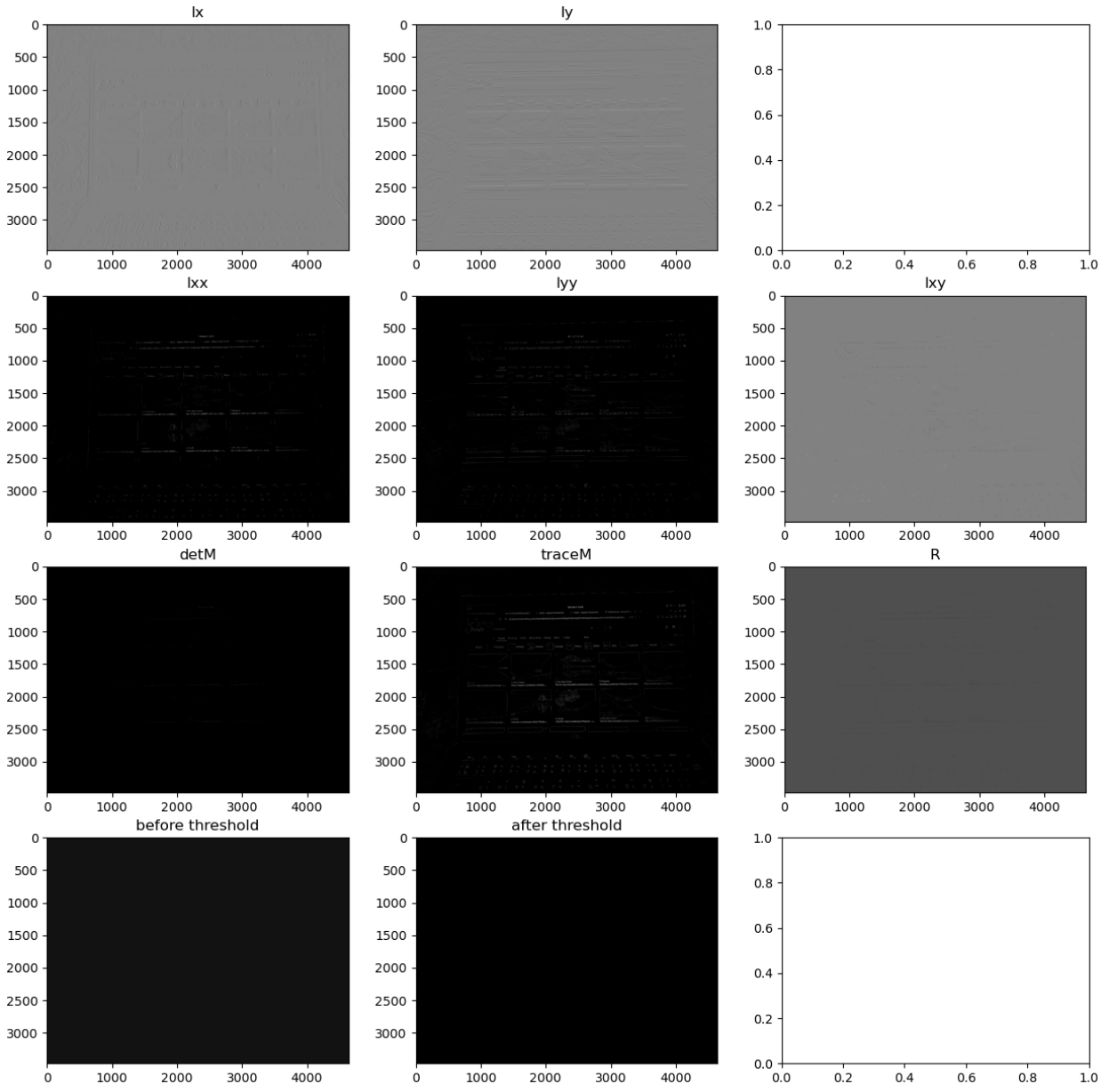


Figure 2: Sobel derviatives of both images

Figure 3: Keypoints detected on image 1

Figure 4: Keypoints detected on image 2

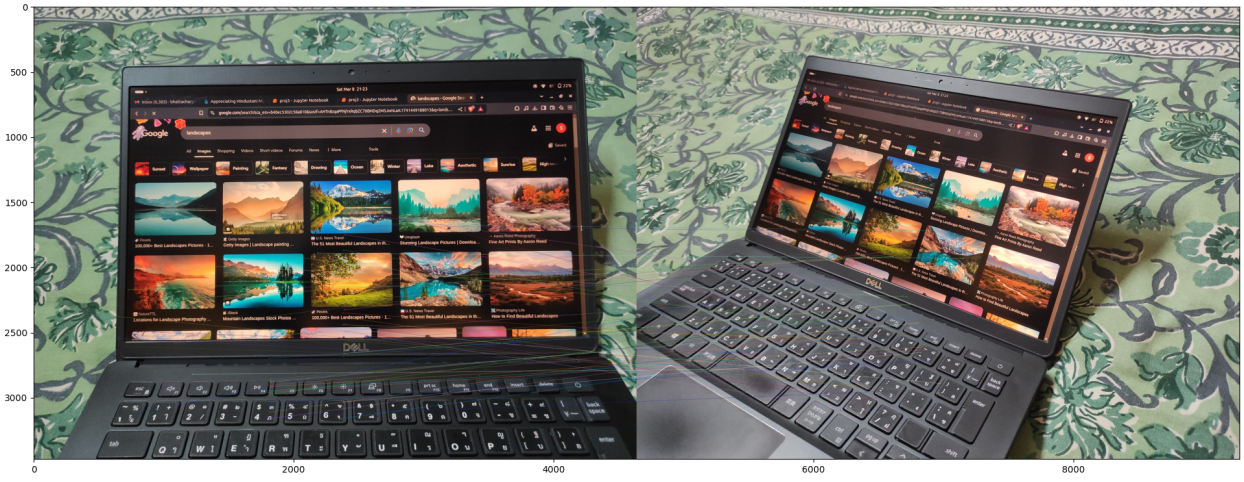


Figure 5: Matched keypoints

5 Some remarks

Although it was not asked, we kept the images of the sobel derivatives, their combinations, and the corner response function in our output. We did so because besides debugging, it also helped us to visualize the outputs better.
We also increased the number of matched keypoints to 100 from 10 due to the huge size of our images. Additionally, it is to be noted that in the combined image, although the matched keypoints aren't very clearly visible, they do exist and can be viewed by close observation. (It is a little harder to view at first glance because of the small size of the keypoints, which we could not find a way to modify without tampering with the output). We also made a few adjustments to the jupyter notebook file, primarily to debug, but kept the changes as it aided us in visualizing the output.