16-720: Assignment 5

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1.1: mygradient

Included in `code/mygradient.m` file. Results in figure 1 and 2.

1.2: hog

Included in `code/hog.m` file. Results in figure 3.

1.3: detect

Included in `code/detect.m` file. Results in figures 4 and 5.

1.4: Multiple Detections

Included in `code/detect.m` file. Results in figure 6 and 7.

2.1: select_patches

Included in script `code/select_patches.m` file. It displays multiple images. First, it displays all images with signs and then some control images without signs. The number of rectangles that can be selected per image are set in the script to 5. If there is a single traffic sign, I drew a bounding box around it multiple times so that the detector is given more examples and becomes tolerant to variances in the image and the exact position of the bounding box for the traffic signals.

2.1: tl_pos

Included in script `code/tl_pos.m` file. Gets positive templates and averages them.

2.2: tl_pos_neg

Included in script `code/tl_pos_neg.m` file. Subtracts the average of negative templates from the average of positive templates.

2.3: tl_lda

Included in script `code/tl_lda.m` file. Subtracts the average of negative templates from the average of positive templates and premultiplies with the inverse of the covariance of negative templates as indicated in the handout. $\lambda = 0.001$ was found to be robust in regularizing the low-rank or ill-conditioned nature of the covariance matrix.

2.4: multiscale_detect

Included in script `code/multiscale_detect.m` file. Coded as directed in the assignment. Results in figures 9 and 10. I found the tl_pos_neg template to work best, and therefore used it in the multiscale case.

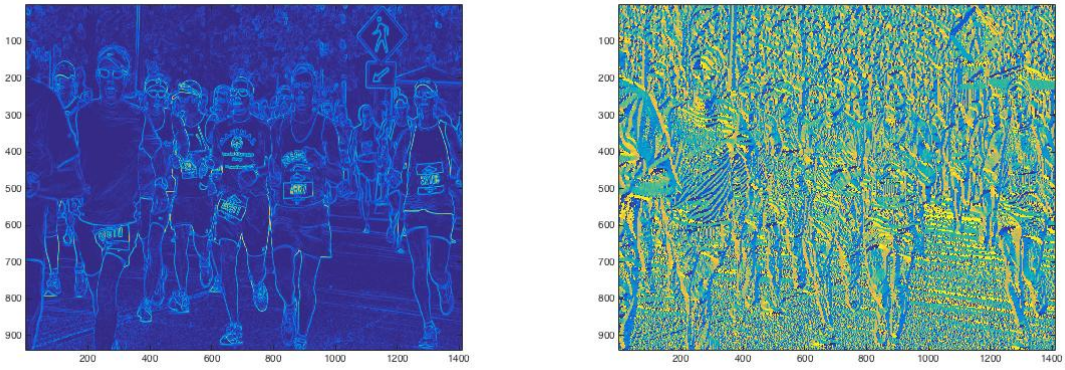

Figure 1: Magnitude and Orientation of Gradient on test0.jpg

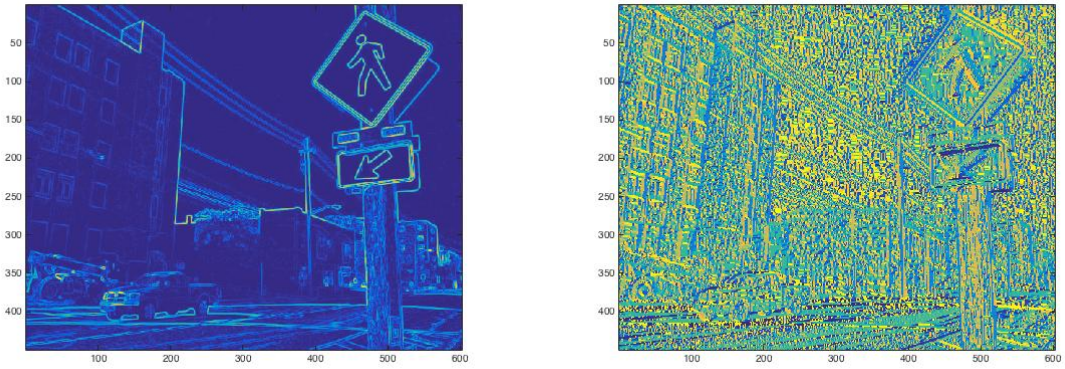

Figure 2: Magnitude and Orientation of Gradient on test1.jpg

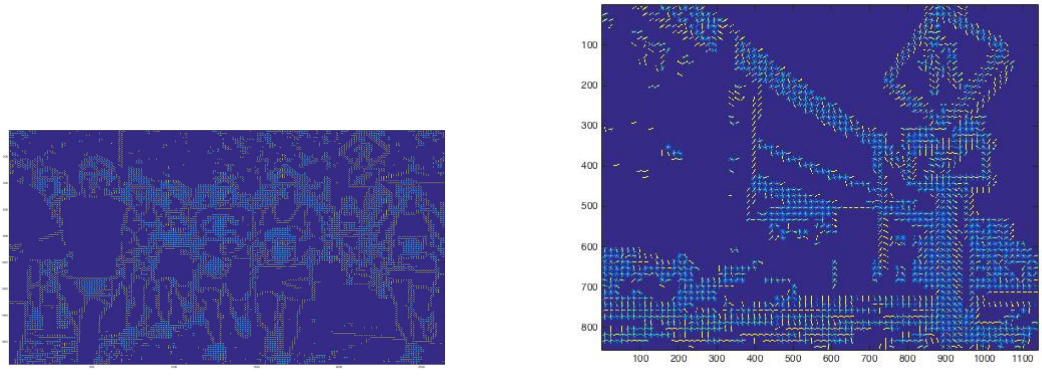

Figure 3: HOG Visualizations on test0.jpg and test1.jpg

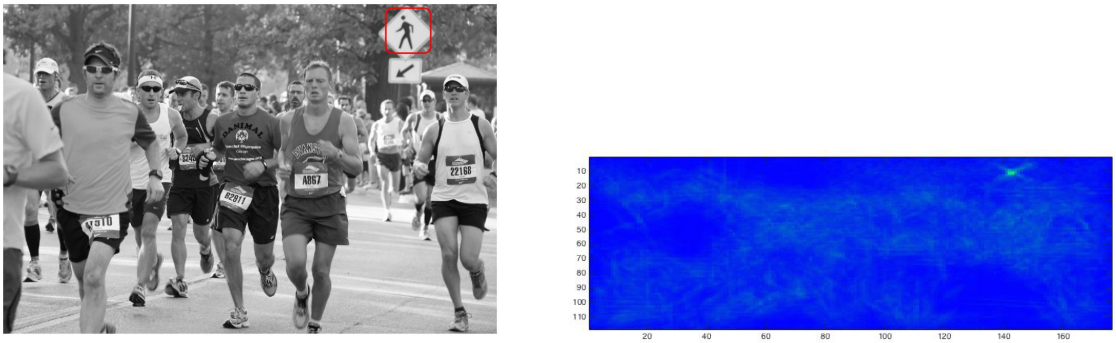

Figure 4: Cross-correlation and Detection on test0.jpg

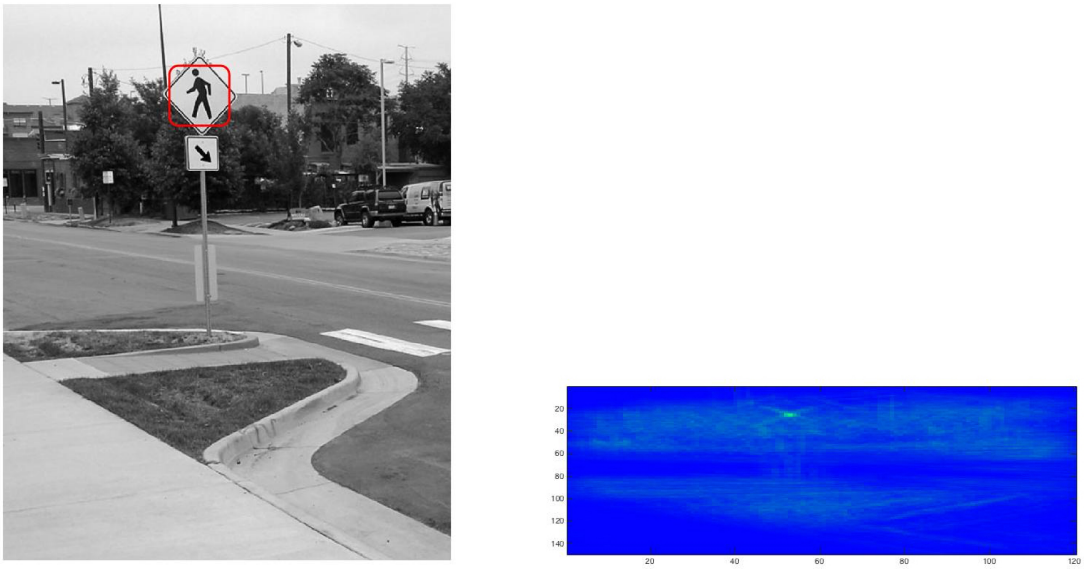

Figure 5: Cross-correlation and Detection on test4.jpg

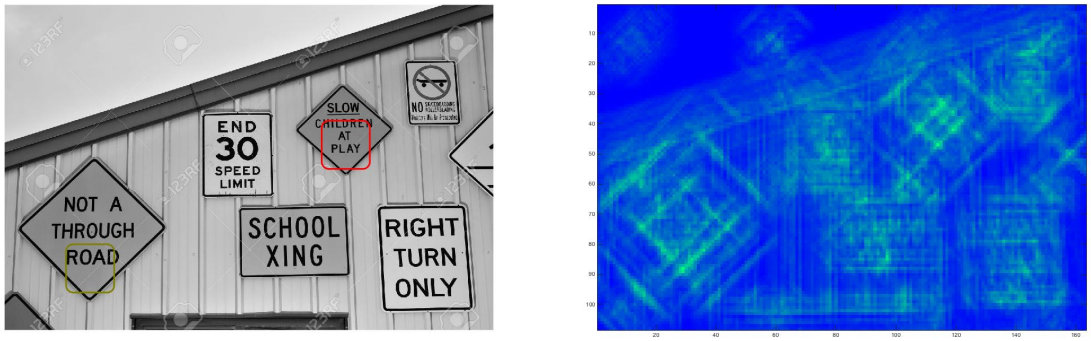

Figure 6: Cross-correlation and Detection on multiple-detections.jpg

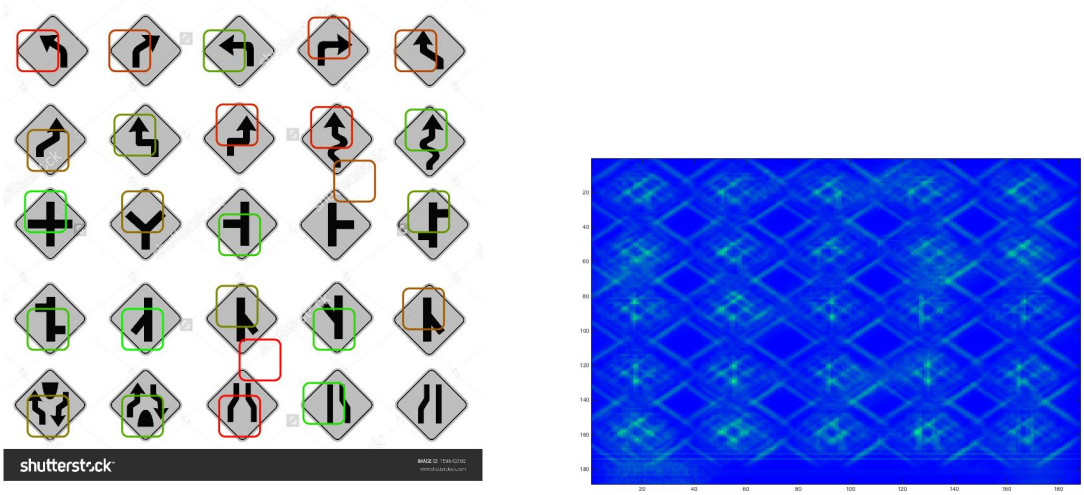

Figure 7: Cross-correlation and Detection on multiple-detections-extreme.jpg

Figure 8: Detections on Test Images Provided

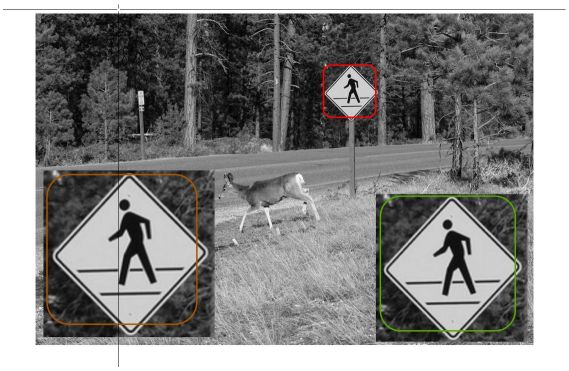

Figure 9: Multiple Detections at Different Scales

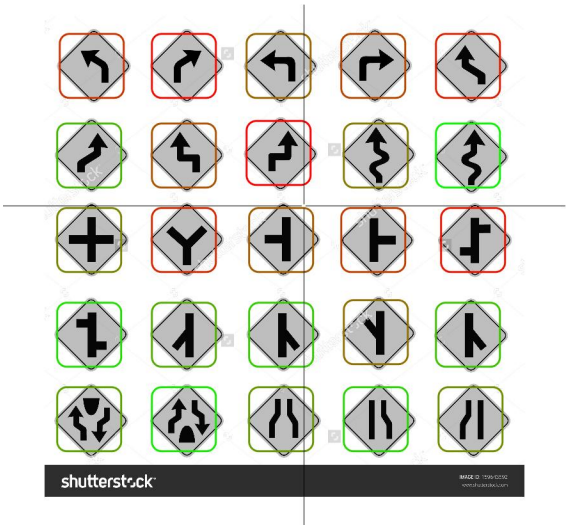

Figure 10: Multiple Detections of Traffic Signs at Same Scale

Figure 11: Positive Examples