ISYE 8803 Exam 2 Problem 3

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1 Problem 1

In this problem, I analyze a remote sensing image and use robust principal component analysis (RPCA) to remove noise and artifacts. I then complete edge detection on the grayscale version of the image and background matrix and compute the MSE and correlation between the two edge-detected images.

1.1 RPCA

The original satellite image being analyzed here is show in Figure 1 and Figure 2 shows the grayscale version of the image.

Figure 1: Original image.

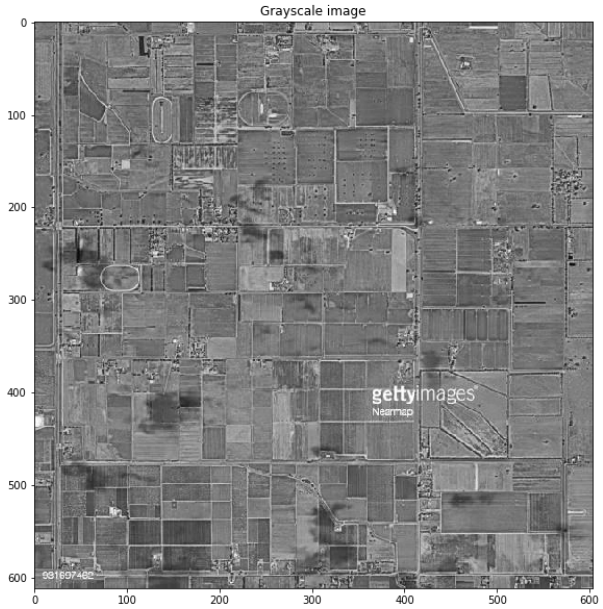

Figure 2: Original image in grayscale.

I implement RPCA on the grayscale image to extract the background (low-rank matrix) image as well as the noise (sparse matrix) image. These images can be seen in Figures 3 and 4 respectively. Finally, I use this result to reconstruct the original image with the artifacts removed and this results is shown in Figure 5. It is clear that RPCA allows for the extraction of the letters in the original image.

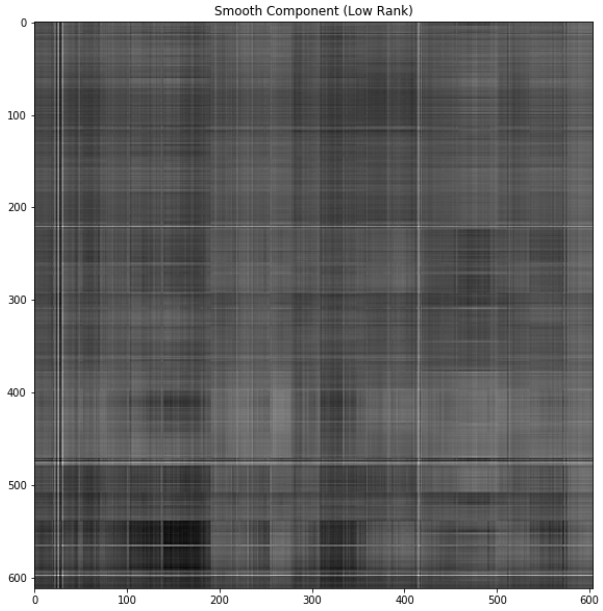

Figure 3: Smooth component of the image.

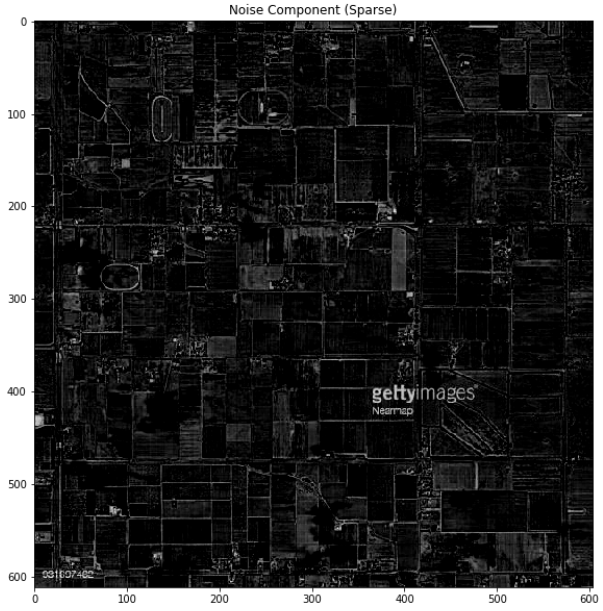

Figure 4: Noise component of the image.

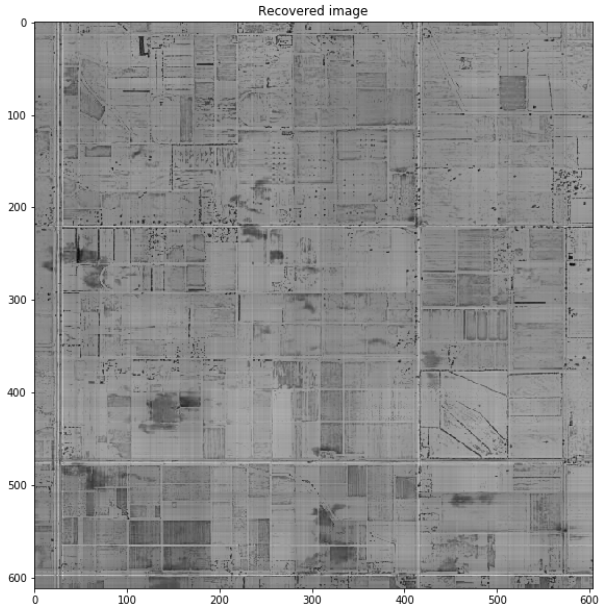

Figure 5: Recovered image.

Lastly, I conduct edge detection using the Canny algorithm on the image and background image and compute the MSE and average correlation between the images. These values were determined to be .2085 for MSE and .4754 for the correlation. Figures 6 and 7 show the edge detections.

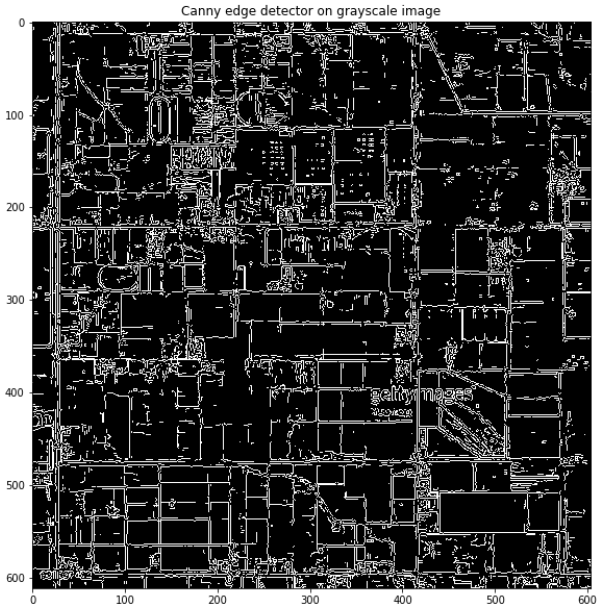

Figure 6: Edge detection of image.

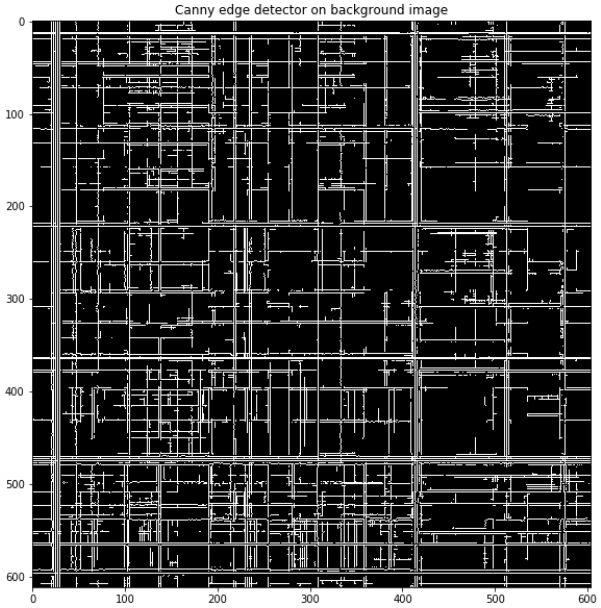

Figure 7: Edge detection of background.