Instruction

- This homework is due at 11:59:59 p.m. on ** June 13th, 2022.

- The write-up must be a soft copy `.pdf` file edited by LaTeX.

- The overall submission should be a `.zip` file named by xxx(student id)-xxx(name)-Assignment3.zip

Python Environment. We are using Python 3.7 for this course. We will use the following packages in this course: Numpy, OpenCV-python, Matplotlib, Pytorch.

Q1. Image Compression
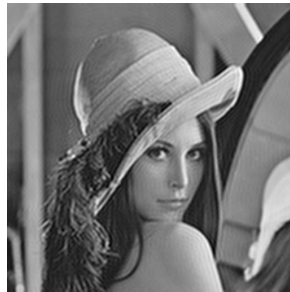

(a) Recovered globally   (b) Recovered in patches

(c) Compressed by 1/4   (d) Compressed by 1/16   (e) Compressed by 1/16 in patches

Figure 1: Compression on lena.jpg

The recovered images from inverse DCT transformation are exactly the same as the original lena.jpg. Compressing by 1/4 does not seem to change a lot, while compressing by 1/16 is more obvious. Globally compressed images are more continuous, and compression in patches makes the images look dissolved in blocks.
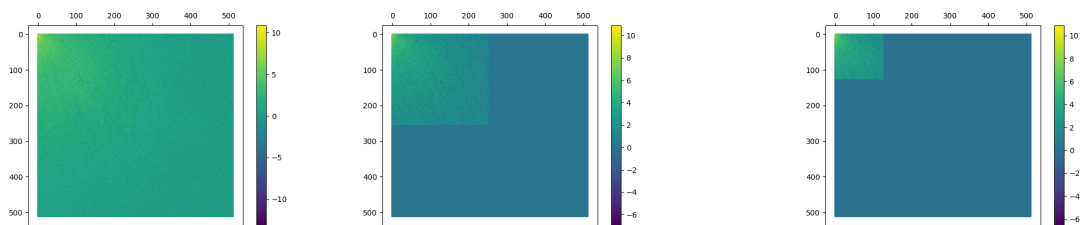
(a) Log map of in frequency domain   (b) Log map of 1/4 compressed   (c) Log map of 1/16 compressed

Figure 2: Log maps

Q3. Edge Detection

(a) Denoise   (b) Intensity gradient   (c) Non-maximum suppression filter   (d) Edges
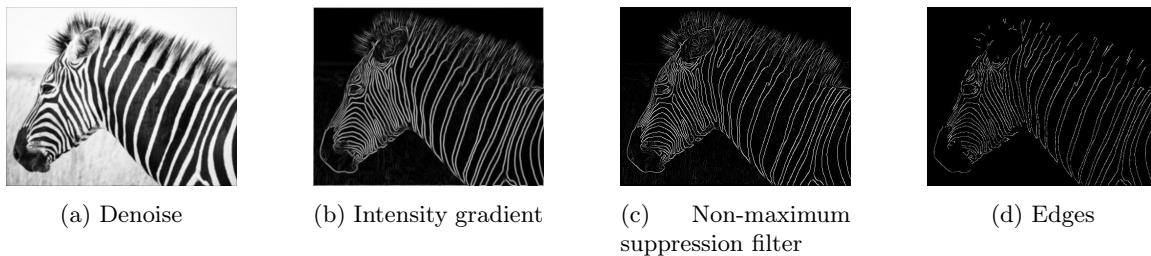
Figure 3: Edge Detection of zebra.jpg

The edges detected are not very perfect. The stripes are correctly figured out, but the back hair is also counted as edges, which is not expected. Even by increasing the threshold, the hair still passes the detection.
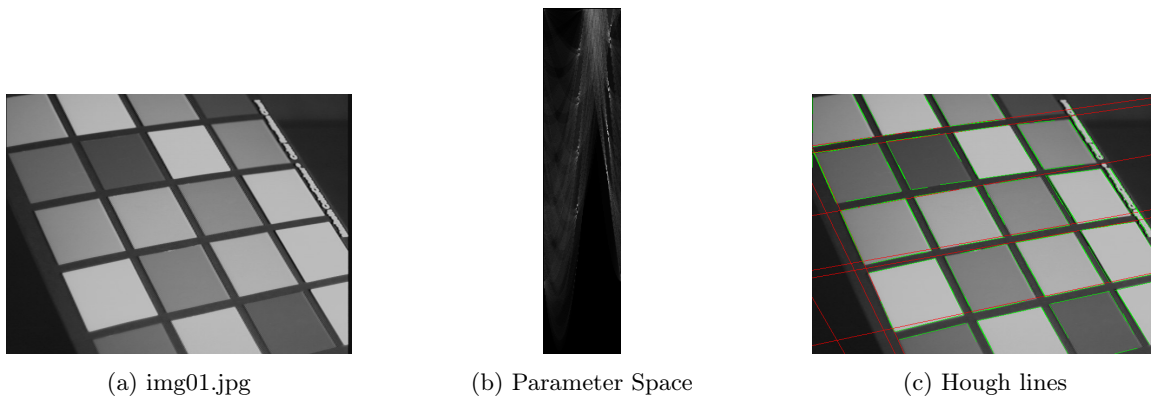
Q4. Line Detection

(a) img01.jpg   (b) Parameter Space   (c) Hough lines

Figure 4: Hough Transform of img01.jpg

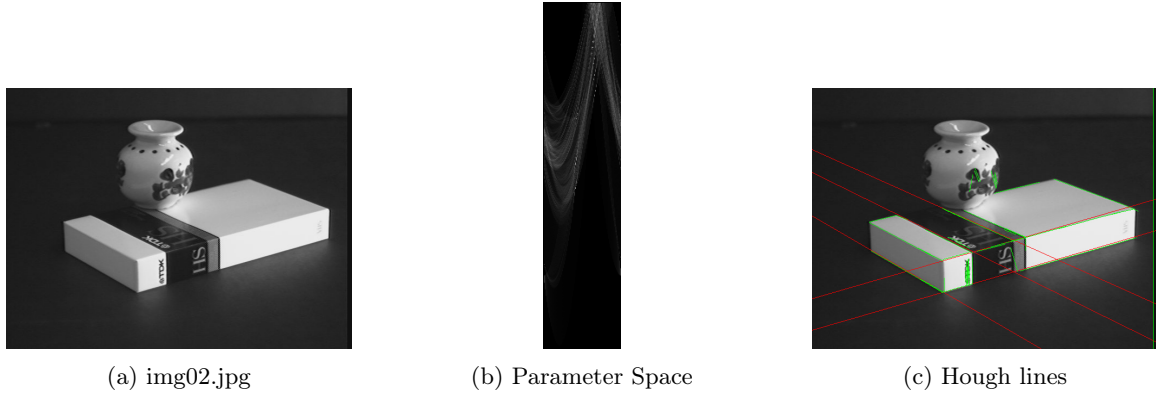(a) img02.jpg   (b) Parameter Space   (c) Hough lines

Figure 5: Hough Transform of img02.jpg

In img01.jpg, 15 lines are detected. Most of the horizontal lines are identified correctly, but only one of the nearly vertical lines was found, which instead can be detected by `cv2.HoughLinesP()`. There is also one extra line detected at the left-bottom which does not contribute to any real lines, which should be thrown away.

In img02.jpg, 4 lines are detected. OpenCV appears to detect more lines, and the hand-written one cannot detect more than 4 (all others have very few votes). The top right line (edge of the book) cannot be detected.

Q5. Feature Extraction

Figure 6: SIFT matching of book.jpg

Most of the features on the book are correctly found and matched. There is one small mismatch that lines up the corner of the book with the corner in the background, which is not expected.