Fundamental 3D Computer Vision
Prof. Shohreh Kasaei
Sharif University of Technology

Homework4 Date:1403/2/9

Theorical:

1. A. Explain histogram matching.

   B. Consider the following two 8x8 images. Perform histogram matching for the image on the left using the reference image on the right and plot the histogram of the reference image and the resulting histogram of the matching.

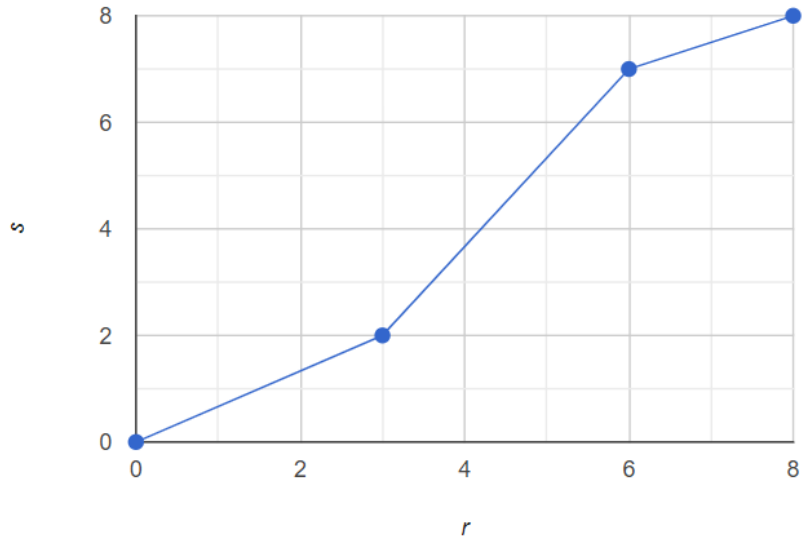
1	5	2	2	5	0	1	4
3	5	1	3	4	4	6	1
6	2	3	4	5	7	5	3
6	3	2	7	5	5	3	4
0	0	7	3	1	1	1	2
3	7	7	7	1	2	3	2
4	1	0	2	7	3	3	4
3	0	5	5	1	7	0	2

Original Image

6	6	3	0	4	1	5	2
7	2	0	2	2	2	7	1
5	4	4	4	0	3	1	5
2	0	3	5	4	4	5	6
4	3	5	3	6	3	2	2
0	2	5	6	3	7	5	6
7	1	5	5	0	4	5	5
7	1	0	7	2	7	0	0

reference image

2. The horizontal axis *r* represents the input pixel value, and the vertical axis *s* represents the output pixel value. As seen, there are three straight line segments used to transform an input pixel to its resulting output pixel value. Stated otherwise, the transformation from the input pixel value to the output pixel value is via the piecewise linear profile shown in the figure.



find stretching contrast transformation and apply it on below image.

0	6	7	3
5	3	2	5
1	1	4	0
2	8	7	3

3. Consider a scenario that the degradation process can be modelled as a linear filter with the two-dimensional impulse response given below:

$$h(x,y) = \begin{cases} 1 & -1 \le x \le 1\,, y = 0 \\ 0 & elsewhere \end{cases}$$

Estimate the frequency pairs for which Inverse Filtering cannot be applied.

Hint:

$$H(u,v) = \frac{1}{NN}\sum_{x=0}^{N-1}\sum_{y=0}^{N-1} h(x,y)e^{-j2\pi(\frac{ux}{N}+\frac{vy}{N})}$$

Practical:

4. *CLAHE* is a variant of *Adaptive histogram equalization (AHE)* which takes care of over-amplification of the contrast. CLAHE operates on small regions in the image, called tiles, rather than the entire image. The neighboring tiles are then combined using bilinear interpolation to remove the artificial boundaries. In this part you should implement ***CLAHE*** from scratch then apply it on image1.jpg.

5. Complete restoration.ipynb notebook.