EE263KL Summer 2025

SAN JOSE STATE UNIVERSITY
DEPARTMENT OF ELECTRICAL ENGINEERING

HOMEWORK No.2 – Due Aug. 6

Problem 1 (Use Matlab or Python; Attach well-commented source code and the input & output images.)
As discussed in class, show if "smoothing median" filter is any better than the smoothing-only and the median-only filter. To test the three filters, use the Lena image added with both salt-and-pepper noise and the Gaussian noise with predefined standard deviation (sigma).

Problem 2 (Use Matlab or Python; Attach well-commented source code and the input & output images.)
Add a random noise to Lena image, and apply Gaussian filter as discussed in class. You may use "imnoise" in Matlab and the equivalent in Python.

Problem 3 (Use Matlab or Python; Attach well-commented source code and the input & output images.)
Implement the edge-preserving smoothing filters, bilateral filter and Nagao-Matsuyama's filter, as discussed in class and demonstrate it on the bone scan image in the previous homework.

Problem 4 (Use Matlab or Python; Attach well-commented source code and the input & output images.)
As discussed in class, bilateral filter combines the distance D and the (pixel) difference I between the center and the current pixel by multiplying their Gaussian distribution values. As evaluation of Gaussian function is costly in hardware, one may replace G(I) with the simple division, i.e., G(D)/I or G(D)/I^2, instead of G(D)*G(I). Test this idea and show if this idea is any better than the traditional bilateral filter. .

Problem 5 (Use Matlab or Python; Attach the well-commented source code)
The following 8×8 image was taken from Lena image.

$$G = \begin{bmatrix} 139 & 144 & 149 & 153 & 155 & 155 & 155 & 155 \\ 144 & 151 & 153 & 156 & 159 & 156 & 156 & 156 \\ 150 & 155 & 160 & 163 & 158 & 156 & 156 & 156 \\ 159 & 161 & 162 & 160 & 160 & 159 & 159 & 159 \\ 159 & 160 & 161 & 162 & 162 & 155 & 155 & 155 \\ 161 & 161 & 161 & 161 & 160 & 157 & 157 & 157 \\ 162 & 162 & 161 & 163 & 162 & 157 & 157 & 157 \\ 162 & 162 & 161 & 161 & 163 & 158 & 158 & 158 \end{bmatrix}$$

1. What are the RMSE and PSNR (in dB) resulting from adding a random Gaussian noise with sigma=5 on the image?

2. Find the entropy of the above 8×8 image.