

Advanced Image Processing (IT507)

Assignment 4

April 4, 2022

1 Instructions

- Implement the following problems in Python or MATLAB.
- **Do not copy code from any source.**
- Prepare a report based on the theory and observations (one report per group).
- Submit the report (PDF format) in the Google Classroom within the deadline.
- The assignments will be evaluated on Monday from 5:30 PM to 7:30 PM.

2 Problems

1. Consider the image of Fig.1 and apply unsharp masking and highboost filtering to enhance the edges of the image. Vary the scaling factor from 2 to 4 for high-boost filtering. Consider a row of the original image and plot the intensity values. This kind of plot is known as intensity profile of that row. Plot similar intensity profiles (consider the same row) for the blurred image, unsharp mask, sharpened image, and the high-boost filtered image. Explain your observation.



Figure 1

2. Smooth the image of Fig.1 by using Bilateral filtering. Compare the result with average filtering and Gaussian smoothing (9×9 mask). Which result is better?—Explain your understanding.
3. Consider the image of Fig.2 and process it to bring out more skeletal detail. (You may use combination of sharpening and smoothing operations).

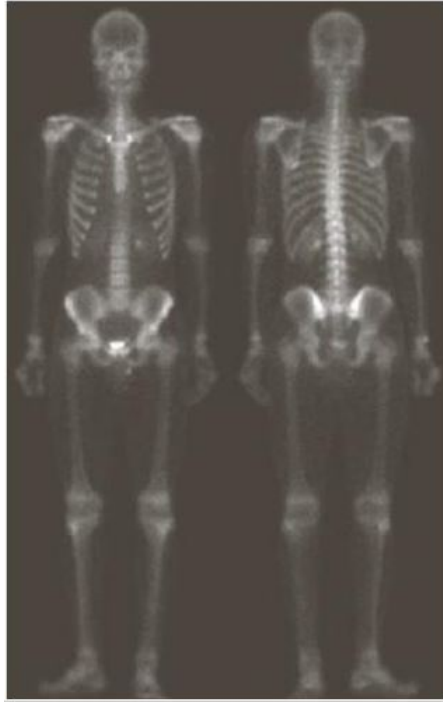


Figure 2

4. Generate a 1D rectangular pulse $rec(t)$ in time domain, perform the following operation on the pulse:
 - Plot $rec(t)$.
 - Write a code to transform the signal into frequency domain.
 - Plot the magnitude (magnitude spectrum).
 - Vary the length of the rectangular pulse and observe the magnitude spectrum for each case.
 - Write a code to perform inverse transformation from frequency domain to time domain with all the frequency components.
 - Instead of using all frequency-components to reconstruct the time-domain signal, select a range of low-frequency components to reconstruct the time-domain signal. (Use a low pass filter with a specified bandwidth)
 - Compare the two reconstructed time-domain signals using all frequency-domain components and partial frequency-domain components, respectively. What are the differences?
 - Vary the bandwidth of the low pass filter for reconstruction, and observe the changes.