

**CS7.404. Digital Image Processing**  
**Monsoon-2022**  
**Assignment-3**  
**Posted on: 30/10/2022**  
**Due on: 16/11/2022, 23:59 Hrs IST**

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- All your code should be in the `src` directory and images in `imgs` directory.
  - Do not use any external library other than **numpy** for implementing any of the tasks. You can however use external libraries for I/O operations and plotting. If you are not sure if a library is allowed for a particular task, clarify with your TAs.
  - You will be evaluated on correctness and how vectorized your code is - with correctness being the priority.
  - Write modular code with relevant docstrings and comments for you to be able to use functions you have implemented in future assignments.
  - All theory questions and observations must be written in a markdown cell of your jupyter notebook.
  - All academic integrity policies apply. Check the course web page for more clarity.
  - Start the assignment early, push your code regularly and enjoy learning!
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## 1 The Fuzzy Scanner

Sabre's new batch of scanners despite being a hit have started to face issues while scanning the images. The complaints from the customers are flooding in and replacing the scanners in such a large quantity is not an option. Upon testing the scanner yourself, you approximate the degradation function and are asked to roll out a driver in order to fix this problem. Follow the instructions provided to assure Jo that Sabre's tech team has got all bases covered.

Degradation function

$$H(u, v) = \frac{T}{\pi(ua + vb)} \sin[\pi(ua + vb)] e^{-j\pi(ua + vb)}$$

1. Implement a blurring filter using above degradation function
2. Blur the image `book.jpg` using following parameters,  $a = 0.1$ ,  $b = 0.1$  and  $T = 1$
3. Add Gaussian noise of 0 mean and variance of 650 to the blurred image.
4. Restore the blurred image using inverse filter.

5. Restore the noisy blurred image using Wiener deconvolution filter.
6. Add Gaussian noise of 0 mean and different variances to the blurred image and explain the performance of the Wiener Deconvolution filter.

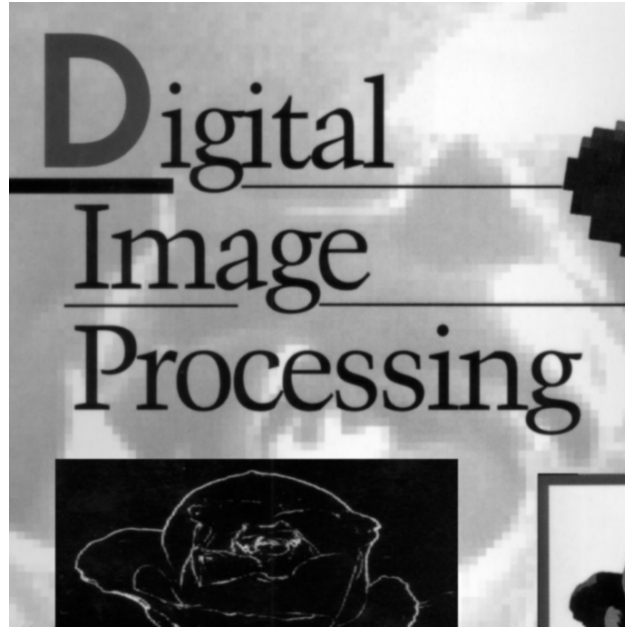


Figure 1: book.jpg

## 2 Data transfer

To be at par with the wireless trend, Sabre is planning to release wireless scanners. However, a major issue is the scanned image needs to be compressed before being transferred to the destination and the destination needs to decompress it before displaying the scanned image. The process needs to be fast which can be done via transferring least amount of bits possible while maintaining the image quality and information contained. Try out few compression and decompression techniques shortlisted by Jo on test.raw and compare the results along with pros and cons of all the methods for Sabre to go ahead with the best possible model.

1. Huffman Coding
2. LZW
3. Run-length encoding (RLE)
4. Discrete Cosine Transform