

BSc(H) Computer Science, V Semester (LOCF)

Digital Image Processing (BHCS16A) Discipline Specific Elective - (DSE)

S.No.	Topic	Reference[1]	Lectures
1	<b>Introduction: Digital Image Fundamentals</b> Brightness, Adaptation and Discrimination, Light and Electromagnetic Spectrum, Image Sampling and Quantization, Some Basic Relationships Between Pixels, Types of images	<b>Ch 1</b> 1.1 (pp -18-19),1.4 (pp 41-43) <b>Ch 2</b> 2.1(pp 50-54) 2.2(pp 54-57, 61-63) 2.4(pp 63-79) 2.5(pp 79-83)	8
2	<b>Spatial Domain Filtering</b> Some Basic Intensity Transformation Functions, Histogram Equalization, Spatial Correlation and Convolution, Smoothing Spatial Filters: Low pass filters, Order Statistics filters, Sharpening Spatial Filters: Laplacian filter	<b>Ch 3</b> 3.1(pp 120-122) 3.2,3.3(pp 122-140), 3.4(pp 153-160), 3.5(pp 164-175), 3.6(1pp 75-182)	10
3	<b>Filtering in Frequency Domain</b> The Discrete Fourier Transformation (DFT), Frequency Domain Filtering: Ideal and Butterworth Low pass and High pass filters, DCT Transform (1D, 2D).	<b>Ch 4</b> 4.4(pp 225-229), 4.5(pp 230-232,240) 4.7(pp 260-268),4.8(pp 272- 276, 278-281), 4.9(pp 284-289) ch 7 (pp 487-488)	10
4	<b>Image Restoration:</b> Image Degradation/Restoration Process, Noise models, Noise Restoration Filters	<b>Ch 5</b> 5.1(pp 318), 5.2(pp 318-325), 5.3(pp 327- 332)	8
5	<b>Image Compression:</b> Fundamentals of Image Compression, Huffman Coding, Run Length Coding, JPEG.	<b>Ch 8</b> 8.1(pp 540-553), 8.2(pp 553-556), 8.6(pp 566-571) 8.9(pp 588-589)	6
6	<b>Morphological Image Processing:</b> Erosion, Dilation, Opening, Closing, Hit-or-Miss Transformation, Basic Morphological Algorithms.	<b>Ch 9</b> 9.1-9.5 (pp 636-666)	10
7	<b>Image Segmentation:</b> Point, Line and Edge Detection, Thresholding, Region Based Segmentation.	<b>Ch 10</b> 10.1, 10.2(pp 700-723, 735-736), 10.3(742-751),	8

### References

1. Gonzalez, R. C., & Woods, R. E. (2017). Digital Image Processing. 4th edition. Pearson Education.
2. Jain, A. K. (1988). Fundamentals of Digital Image Processing. 1st edition Prentice Hall of India.

### Additional Resources

1. Castleman, K. R. (1995.). Digital Image Processing. 1st edition. Pearson Education
2. Gonzalez, R. C., Woods, R. E., & Eddins, S. (2004). Digital Image Processing using MATLAB. Pearson Education Inc.
3. Schalkoff, D. (1989). Image Processing and Computer Vision. 1st edition. John Wiley and Sons.

### Practical List

1. Write program to read and display digital image using MATLAB or SCILAB
  - a. Become familiar with SCILAB/MATLAB Basic commands
  - b. Read and display image in SCILAB/MATLAB
  - c. Resize given image
  - d. Convert given color image into gray-scale image
  - e. Convert given color/gray-scale image into black & white image
  - f. Draw image profile
  - g. Separate color image in three R G & B planes
  - h. Create color image using R, G and B three separate planes
  - i. Flow control and LOOP in SCILAB
  - j. Write given 2-D data in image file
2. To write and execute image processing programs using point processing method
  - a. Obtain Negative image
  - b. Obtain Flip image
  - c. Thresholding
  - d. Contrast stretching
3. To write and execute programs for image arithmetic operations
  - a. Addition of two images
  - b. Subtract one image from other image
  - c. Calculate mean value of image
4. To write and execute programs for image logical operations
  - a. AND operation between two images
  - b. OR operation between two images
  - c. Calculate intersection of two images
  - d. NOT operation (Negative image)
5. To write a program for histogram calculation and equalization using
  - a. Standard MATLAB function
  - b. Program without using standard MATLAB functions
6. To write and execute program for geometric transformation of image
  - a. Translation

- b. Scaling
  - c. Rotation
  - d. Shrinking
  - e. Zooming
7. To understand various image noise models and to write programs for
    - a. image restoration
    - b. Remove Salt and Pepper Noise
    - c. Minimize Gaussian noise
    - d. Median filter
  8. Write and execute programs to use spatial low pass and high pass filters
  9. Write and execute programs for image frequency domain filtering
    - a. Apply FFT on given image
    - b. Perform low pass and high pass filtering in frequency domain
    - c. Apply IFFT to reconstruct image
  10. Write a program in C and MATLAB/SCILAB for edge detection using different edge detection mask
  11. Write and execute program for image morphological operations erosion and dilation.