GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3171712
Semester – VII
Subject Name: Image Processing (IC)

Type of course: Professional Elective

Rationale: Image processing has become a very important aspect in various industries ranging from process industry to medical field. This course will help to understand the fundamental concepts of image processing. Student will also learn to apply various processes on images for image understanding and analysis.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Introduction and Digital Image Fundamentals** Types of images, Fields and applications of digital image processing, Fundamental steps, Components, Digital image fundamentals, Human visual system, Image as a 2D data, Image model, Image representation – Gray scale and Color images, Image sampling andquantization, Basic relationships between pixels.	06
2	**Image Enhancement in the Spatial Domain** Basic gray level transformations, Histogram equalization, Basics of spatial filtering, Smoothing spatial filters, Sharpening spatial filters, Combining spatial enhancement methods.	06
3	**Image Enhancement in the Frequency Domain** Preliminary concepts, Extension to functions of two variables, Image smoothing, Image sharpening, Ideal, Butterworth and Gaussian filters, Properties of 2D Fourier transform.	06
4	**Image Compression** Fundamentals of redundancies, Basic compression methods: Huffman coding, Arithmetic coding, LZW coding, Bit plane coding, Discrete cosine transform, Walsh-Hadamard transform, JPEG compression standard.	06
5	**Morphological Image Processing** Basic concepts, Erosion, Dilation, Opening, Closing, Basic morphological algorithms:	06

	Boundary extraction, Region filling, Connected components extraction, Convex hull, Gray scale morphology and its applications.	
6	**Image Segmentation** Point, line and edge detection, Thresholding, Edge linking and boundary detection, Hough transform, Thresholding: Foundation, illumination, global and adaptive thresholding, Region growing segmentation.	06

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
7	**14**	**21**	**14**	**14**	**0**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: The weightage and the specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary from above table.

Text Books

1. Gonzalez & Woods, ―Digital Image Processing, 3rd ed., Pearson education,2008
2. Jain Anil K., Fundamentals Digital Image Processing, Prentice Hall India,2010

Reference Books:

1. Milan Sonka, Vaclav Hlavav, Roger Boyle, ―Image Processing, Analysis and Machine Vision, 2nd ed., Thomson Learning,2001
2. Rangaraj M. Rangayyan, ―Biomedical Image Analysis, CRC Press,2005
3. Pratt W.K, ―Digital Image Processing, 3rd ed., John Wiley & Sons,2007

Course Outcome:

After learning the course the students will be able to:

CO1 compare different methods for image acquisition, storage and representation in digital devices and computers.
CO2 apply the knowledge of mathematics for digital image enhancement.

CO3 appreciate the role of image transforms in representing, highlighting, and modifying image features.
CO4 summarize different reshaping operations on the image and their practical applications.
CO5 apply various methods for image segmentation and identifying image components.

List of Experiments:

1. Introduction to Image processingtoolbox.
2. Read an 8 bit image and then apply different image enhancementtechniques:
    a. Brightnessimprovement
    b. Brightnessreduction
    c. Thresholding
    d. Negative of animage
    e. Logtransformation
    f. Power lawtransformation.
3. Implement different interpolation techniques.
4. Read an image, plot its histogram then perform histogram equalization. Comment about theresult.
5. (a) Implement gray level slicing (intensity level slicing) on the image.
    (b) Read an 8 bit image and to see the effect of each bit on theimage.
    (c) Read an image and extract 8 different planes i.e. “bit planeslicing”.
6. Implement various smoothing spatialfilters.
7. Read an image and apply (i) Gaussian 3x3 mask for burring (ii) High pass filter mask with different masks (iii) Laplacian operator with center value positive and negative.
8. Write a program to implement various low pass filters and high pass filters in frequencydomain.
9. Write a program for erosion and dilation, opening and closing using inbuilt and without inbuilt function.
10. Implement and study the effect of different masks (Sobel, Prewitt andRoberts).
11. Implement various noise models and theirhistogram.
12. Implement inverse filter and Wiener filter over image and comment onthem.
13. Implement image compression using DCT transform.

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Design based Problems (DP)/Open Ended Problem:

Find out the application of image processing in automation field. Do the simulation of the application that you have identified.

Major Equipment: Computers, simulation software – MATLAB/

SciLab, etc. List of Open Source Software/learning website:

https://nptel.ac.in/courses//106/105/106105032/

https://nptel.ac.in/courses/117/105/117105079/