

## CSC-XXX: Digital Image Processing

### General Information

Course Number	CSC-XXX
Credit Hours	3 (Theory Credit Hour = 3, Lab Credit Hours = 0)
Prerequisite	Introduction to programming
Course Coordinator	Not Specified

### Course Objectives

This course provides an introduction to image processing concepts, algorithms and techniques. This course contents can be divided into three phases. Initially, Fundamental concepts of image representation, digitizing existing images and camera models are introduced which serve as baseline for upcoming high level image processing algorithms. In the second phase, high-level concepts such as linear and non-linear filtering, image de-noising and convolution based spatial filters are introduced. In the final phase, algorithms related to digital image processing are introduced and applications of image processing including morphological operations, feature estimation (such as lines, edges and corners) and segmentation of image are introduced. Few lab sessions will be conducted as well to provide students the confidence to implement any image processing algorithms using any language of their choice.

### Catalog Description

CSC-XXX

### Course Content

Weeks	Topics	Suggested Readings (Chapters)	Activities
1-2	<b>Introduction and overview</b> <ul style="list-style-type: none"><li>• Overview and applications</li><li>• Human visual system and image model</li><li>• Camera models</li><li>• Digital image processing</li></ul> <b>Matlab basics</b>	1-2	
3	<b>Spatial domain representation of an image</b> <ul style="list-style-type: none"><li>• Image representation</li><li>• Spatial representation of image<ul style="list-style-type: none"><li>◦ Pixel adjacency</li><li>◦ Pixel connectivity</li><li>◦ Distance measures.</li></ul></li></ul> <b>Visualization of images, their types, pixel adjacency, connectivity and distance measures in Matlab</b>	2	
4-5	<b>Image processing in spatial domain</b> <ul style="list-style-type: none"><li>• Image enhancement in Spatial domain<ul style="list-style-type: none"><li>◦ Image negatives</li><li>◦ Log transformation</li></ul></li></ul>	3	Quiz 1 Assignment 1

	<ul style="list-style-type: none"> <li>◦ Power-law transformations</li> <li>• Histogram Processing</li> <li>◦ Equalization</li> <li>◦ Matching</li> <li>◦ Statistical enhancement</li> </ul> <b>Implementation of few spatial filters</b>		
<b>First Mid Exams</b>			
7	<b>Filtering</b> <ul style="list-style-type: none"> <li>• Convolution based filtering</li> <li>◦ Smoothing spatial filters</li> <li>◦ Sharpening spatial filters</li> <li>◦ Combined spatial filters</li> </ul>	3,4	
8-9	<b>Filtering (cont..)</b> <ul style="list-style-type: none"> <li>• Image restoration</li> <li>• Noise models</li> <li>• Noise only spatial filters</li> <li>◦ Mean filters</li> <li>◦ Order statistics filters</li> <li>◦ Adaptive filters</li> </ul> <b>Implementation of addition of noise and suppression/removal of noise from the images</b>	5	Quiz 2 Assignment 2
10-11	<b>Color images</b> <ul style="list-style-type: none"> <li>• Color Image Processing</li> <li>◦ Spaces and transforms</li> <li>• Color segmentation</li> </ul> <b>Project selection</b>	6	
<b>Second Mid Exams</b>			
13	<b>Image edge detection</b> <ul style="list-style-type: none"> <li>• Image Segmentation</li> <li>◦ Gradient operators <ul style="list-style-type: none"> <li>▪ Sobel</li> <li>▪ Robert</li> <li>▪ Prewitt</li> </ul> </li> <li>◦ Feature Extraction <ul style="list-style-type: none"> <li>▪ Edges</li> <li>▪ Lines</li> </ul> </li> <li>◦ Global Thresholding</li> </ul>	9	Assignment 3
14	<b>Binary image processing</b> <ul style="list-style-type: none"> <li>• Morphological image processing</li> <li>• Dilation and Erosion</li> <li>• Opening and Closing</li> </ul>	10	Quiz 3
15-16	<b>Presentations/submissions of projects</b>		
<b>Final Examination</b>			

### Text Book

1. R.C. Gonzales & R.E. Woods “Digital Image Processing” (2nd or 3rd edition), Prentice Hall, ISBN 0-201-18075-8

## Reference Material

1. K.R. Castleman “Digital Image Processing”, Prentice Hall.
2. R. C. Gonzalez “Digital Image Processing using MATLAB”, 2<sup>nd</sup> edition.
3. J.C. Russ “The Image Processing Handbook”, IEEE Press.

## Course Learning Outcomes

	Course Learning Outcomes (CLO)
1	Understand core principles of image processing, analysis and concepts (representation, filtering, feature extraction, morphological image processing etc)
2	Apply their acquired knowledge to facilitate basic computer vision related tasks (such as segmentation and object detection etc)
3	Ability to work on image processing related toolboxes and libraries

## CLO-SO Map

	SO IDs											
CLO ID	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GA10	GA11	GA12
CLO 1	1	0	0	0	0	0	0	0	0	0	0	0
CLO 2	0	0	1	0	0	0	0	0	0	0	0	0
CLO 3	0	0	0	0	1	0	0	0	0	0	0	0

## Approvals

Prepared By	Sajid Khan
Approved By	Not Specified
Last Update	17/09/2020