The Legal House – International Business College
School of Electrical and Computer Engineering

7 Greenfield Parade
Bankstown 2200 NSW Australia

Digital Image Processing Systems
SECE 107

Subject Coordinator and Lecturer: Professor Minh Hung Le
The Legal House – International Business College
School of Electrical and Computer Engineering
7 Greenfield Parade
Bankstown 2200 NSW Australia
Tel: (02) 9790 3300
Fax: (02) 9790 3302
Emails: m.le@sece-unsw.org or minhle@ieee.org

Aim of Unit:

This unit provides concepts and methodologies for digital image processing and computer vision analysis. This unit consists of image fundamentals, image enhancement in the spatial and frequency domains, restoration, color image processing, wavelets, image compression, morphology, segmentation, image description, and the fundamentals of object recognition. It focuses on material that has a broad scope of application.

Unit Outline:

- Introduction to Digital Image Processing
- Digital Image Fundamentals.
- Image Enhancement in the Spatial Domain.
- Image Enhancement in the Frequency Domain.
- Image Restoration.
- Color Image Processing.
- Wavelets and Multiresolution Processing.
- Image Compression.
- Morphological Image Processing.
- Image Segmentation.
- Representation and Description.
- Object Recognition.

Mode of Delivery:

Two hours lecture per week.
One hour tutorial per week.

Unit Assessment:

Attendance at Lectures and Tutorials	20 %
Assignments, Laboratories	40 %
Final Presentation	40 %

Assessment Requirements:

Students must receive 50% or more for each component of Unit Assessment in order to pass the subject.

Student Workload:

Students will have 3 hours per week face-to-face learning during semester. Students are expected to work at least 5 hours per week out of class.

Text Book:

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", 2nd edition, Prentice Hall, 2002

Recommended References:

1. Linda G. Shapiro and George C. Stockman, "Computer Vision", Prentice Hall, 2001
2. J. R. Parker**,** "Algorithms for Image Processing and Computer Vision", Wiley, 1996

Subject Shedule

Weeks	Lecture/Tutorial Topics	Assignments/ Laboratories	Reading from Text Book
1	Introduction to Digital Image Processing	Lab #1	Chapter 1
2	Digital Image Fundamentals	Lab #1	Chapter 2
3	Image Enhancement in the Spatial Domain	Assignment #1	Chapter 3
4	Image Enhancement in the Frequency Domain	Lab #1, Assignment #1	Chapter 4
5	Image Restoration	Lab #1, Assignment #1	Chapter 5
6	Color Image Processing	Collect Lab #1	Chapter 6
7	Wavelets and Multiresolution Processing	Collect Assignment #1	Chapter 7
8	Image Compression	Lab #2	Chapter 8
9	Morphological Image Processing	Assignment #2	Chapter 9
10	Image Segmentation	Lab #2, Assignment #2	Chapter 10
11	Representation and Description	Collect Lab #2	Chapter 11
12	Object Recognition	Collect Assignment #2	Chapter 12
13	Preparing for Final Presentation		
14	Final Presentation		

Subject Description

UNIT	SECE107 Digital Image Processing Systems

FIELD	Analyse and Design

DESCRIPTION	This unit describes the competency required to provide concepts and methodologies for digital image processing and computer vision analysis.

RELATED COMPETENCY STANDARDS	The project lifecycle, Computer Systems and Telecommunications methodologies employed will determine which particular units of competency are relevant to this unit. Some include SECE101, SECE105, SECE106, SECE108.

	ELEMENT	PERFORMANCE CRITERIA
1	Introduction and Digital Image Fundamentals	• Introduction to Digital Image Processing, The Origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamental Steps in Digital Image Processing. Components of an Image Processing System. • Detailed specifications of Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.
2	Image Enhancement in Spatial Domain and Frequency Domain	• Comprehensive treatment of Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods. • Full coverage of the Fourier Transform and the Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency Domain Filters, Homomorphic Filtering, Implementation.
3	Image Restoration, Color Image Processing and Morphological Image Processing	• Comprehensive treatment of the Image Degradation/Restoration Process. Noise Models, Restoration in the Presence of Noise Only-Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering,

		Geometric Mean Filter, Geometric Transformations. • Coverage of essential elements of Color Fundamentals, Color Models, Pseudocolor Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation, Noise in Color Images, Color Image Compression. • Full coverage of Dilation and Erosion, Opening and Closing, The Hit-or-Miss Transformation, Some Basic Morphological Algorithms, Extensions to Gray-Scale Images.
4	Wavelets, Multiresolution Processing and Image Compression	• Implementation of Multiresolution Expansions, Wavelet Transforms in One Dimension, The Fast Wavelet Transform, Wavelet Transforms in Two Dimensions, Wavelet Packets. • Determine Image Compression Models, Elements of Information Theory, Error-Free Compression, Lossy Compression, Image Compression Standards.
5	Image Segmentation and Object Recognition	• Detection of Discontinuities, Edge Linking and Boundary Detection. Thresholding, Region-Based Segmentation, Segmentation by Morphological Watersheds, The Use of Motion in Segmentation. • Include Patterns and Pattern Classes, Recognition Based on Decision-Theoretic Methods, Structural Methods.