PONTIFICIA UNIVERSIDAD CATÓLICA DE CHILE
COLLEGE OF ENGINEERING
DEPARTMENT OF ELECTRICAL ENGINEERING
ABET COURSE SYLLABI

IEE2714 FUNDAMENTALS OF IMAGE PROCESSSING

Credits and contact hours:	10 UC credits /10 hours (3 h. Lectures and 7 h. Independent learning experiences)
Instructor's name:	Cristián Tejos (I semester) Domingo Mery (II semester)
Course coordinator's name	To be defined
Textbook:	Gonzalez R., Woods R. "Digital Image Processing" Third Edition, Prentice Hall, 2007
Course Catalog Description:	In this course we will study the theoretical fundamentals used in the area of Digital Image processing and Analysis. Students will develop the abilities to process digital images so that to extract relevant information or characteristics either in the image or the frequency domain. Students will also develop the ability to improve or restore images that have been corrupted by noise or other artifacts. Finally, students will be able to segment objects of interest from the images, and to identify the presence of some structures within the images.
Prerequisite Courses:	>= 300 CR
Co-requisite Courses:	To be defined
Status in the Curriculum:	Elective
Course Learning Outcomes:	1. To understand the differences, advantages and disadvantages of processing digital images in the image and frequency domain. 2. To apply processing techniques in the image domain to enhance structures or to correct image distortions. 3. To apply processing techniques in the frequency domain to enhance structures or to correct image distortions. 4. To apply inverse filters or deconvolution techniques to restore images affected by noise o artifacts. 5. To apply morphological operators to extract structures in the images. 6. To apply segmentation methods to isolate structures of interest within the images.

Relation of Course to ABET Criteria:

a. Knowledge of mathematics, science and engineering
b. Design and conduct experiments: analyze and interpret data
c. Design a system, component, or process
e. Identify, formulate, and solve engineering problems
j. Knowledge of contemporary issues
k. Techniques, skills, and modern tools for engineering practice.

Topics covered:

1. Introduction
   1.1. Historical overview and image processing applications
   1.2. Components and steps of a typical image processing system
2. Physical and physiological fundamental of images
   2.1. Physiological and perceptual elements of the human visual system
   2.2. Electromagnetic spectrum
   2.3. Image acquisition
   2.4. Sampling and quantization of images
   2.5. Pixels and their relationships in the images
   2.6. Linear and nonlinear operations
3. Image enhancement in the spatial domain
   3.1. Basic transformations of gray levels and histograms
   3.2. Image enhancement using logic and arithmetic operations
   3.3. Spatial filters for smoothing and sharpening
4. The Fourier transform
   4.1. 1D Fourier transform
   4.2. 2D Fourier transform
   4.3. Properties of the Fourier transform
5. Image enhancement in the frequency domain
   5.1. Frequency filters for smoothing and sharpening
   5.2. Homomorphic filters
6. Image restoration
   6.1. Image degradation models
   6.2. Noise models
   6.3. Image restoration methods for noise and periodic artifacts
   6.4. Linearly invariant degradations and their estimations
   6.5. Inverse filters and deconvolution
7. Morphological image processing
   7.1. Dilation, erosion, closing and opening
   7.2. Complex morphological algorithms
   7.3. Gray level extensions
8. Image segmentation
   8.1. Edge detection
   8.2. Thresholding
   8.3. Region growing
   8.4. Watersheds