

Asian Institute of Technology
School of Engineering and Technology

AT74.06 Pattern Recognition and Image Processing 3(2-3) Semester: January

Course Objective:

This course focuses on the Pattern Recognition and Image Processing algorithm. An overview of basic image algorithms will be discussed. This is a project-oriented course in which the students will be designing and evaluating the designed system.

Learning Outcomes:

The students on the completion of this course would be able to:

- Apply knowledge on pattern recognition and image processing
- Select the appropriated image algorithms for a given problem

Prerequisite: None

Course Outline:

I. Introduction

1. Human Vision vs. Machine Vision
2. Scene Constraints
3. Camera lens and Optics Theory

II. Image Acquisition and Preprocessing

1. Sensors for Image Acquisition
2. Camera Interfaces and Video Standards
3. Image Sampling and Quantization
4. Image Preprocessing: Point, Global and Neighborhood Operations
5. Image Filters
6. Edge Detection Techniques

III. Image Analysis Techniques

1. Image Segmentation
2. Edge Based and Region Based Segmentation
3. Edge Linking and Boundary Detection
4. Image Matching
5. Image Feature Extraction
6. Mathematical Morphology

IV. Image Transforms

1. Continuous Image Mathematical Characterization
2. Discrete Image Mathematical Characterization
3. Discrete Fourier Transform
4. Other Image Transforms

V. Object Recognition and Image Understanding

1. Knowledge representation
2. Pattern Classification
3. Neural Nets

VI. Advanced Research Areas in Machine Vision

1. Geometry for 3 D Vision
2. 3 D Objects Representation and Modeling Techniques
3. Machine Vision: Industrial Application
4. Robot Vision

Laboratory Sessions:

- Image acquisition
- Histogram study
- Convolution and image filter study
- Edge detection
- Morphology operation
- Object recognition

Textbook:

R. C. Gonzalez, and R. E. Woods: Digital Image Processing, Prentice Hall, 3rd ed., 2007.

Reference Books:

1. R. C. Gonzalez, R. E. Woods, and S. L. Eddins, Digital Image Processing Using MATLAB, Gatesmark Publishing 2nd ed., 2009
2. Marques, O., Practical Image and Video Processing using MATLAB, Wiley, 2011
3. Nixon, M., and Aguado A. S. , Feature Extraction and Image Processing for Computer Vision, Elsevier, 3rd ed., 2012
4. G. A. Awcock and R. Thomas: Applied Image Processing, McGraw-Hill, 1996.
5. L.J. Galbiati: Machine Vision and Digital Image Processing Fundamentals, Prentice Hall, NJ, 1990.
6. M. Sonka, V.Hlavac, R. Boyle: Image Processing, Analysis, and Machine Vision, PWS Publishing, NJ, 1999.

Journals:

1. International Journal of Computer Vision, Springer
2. Machine Vision and Application, Springer
3. Pattern Recognition, Elsevier
4. Sensor Review, Emerald

Teaching and Learning Methods:

Lecture with hand-on lab. There will be project at the end of semester when students solve some real-world image processing problem.

Time Distribution and Study Load:

Lectures: 30 hours
Laboratory sessions: 45 hours
Presentations: 3 hours
Self-study: 90 hours

Evaluation Scheme: The Final Grade will be computed according to the following weight distribution: Final Exam 35%; Lab./ Assignments 20%, Presentation 5%, Project 40%. Open-book examination is given in the final.

An "A" would be awarded if a student can demonstrate clear understanding of the knowledge learned in class as well as from the laboratory assignments and literature reviews.

A "B" would be awarded if a student can understand the basic principles of the knowledge learned in class, from the laboratory assignments and from literature reviews.

A "C" would be given if a student can understand partially the basic principles of the knowledge learned in class, from the laboratory assignments and from literature reviews.

A "D" would be given if a student shows lack of understanding of the knowledge learned in class, from the laboratory assignments and from literature reviews.

Instructor(s): Dr. Mongkol Ekpanyapong

School Recommendation: _____ ADRC Approval: _____
Academic Senate Approval: _____