

Syllabus

Foundations of Computer Vision:

specialized course of Computer Engineering , 3 credits program : Undergraduate level
pre-requisite courses : Principles of Computational intelligence

reference book :

- [1] A. Kaehler and G. Bradski, “Learning OpenCV 3”.
- [2] J. Minichino and J. Howse “Learning OpenCV 3 with Python”.
- [3] R. Szeliski, “Computer vision: algorithms and applications”.
- [4] R. C. Gonzalez and R. E. Woods, “Digital Image Processing (4th Edition)”.

Course goals :

The purpose of this lesson is to gain a basic understanding of computer vision and image analysis for 2D computer vision. The lesson will focus on problem solving based on this technology and industrial applications. Sample issues of industry in format Practical projects during the course will be reviewed and resolved by students.

Lesson results :

Students who successfully complete this course will be able to:

1. Processing and analysis of gray level images to understand the scene
2. Binary image processing for simple problem solving
3. Getting to know color and color images and using them to solve visual problems
4. Solving two-dimensional solvable industrial problems using vision
5. Scene analysis for robot vision

List of topics :

1. Introduction:

Computer Vision Definition and Image Processing and Their Differences - History and Applications of Computer Vision

2. Basic Principles of Digital Imaging:

Elements of Visual Understanding - Light and Electromagnetic Spectrum - Image Sense and Imaging - Sampling and Multiplication - Relationships between Image

Points - Linear and Nonlinear Operations - Principles and Color Models - Quasi-colored images

3. Image Editing:

Gray Level Conversions - Histogram Correction - Location Filter - Smoothing and Sharpening

4. Morphological operations:

binary mathematical morphology - operators of corrosion, expansion, opening, and closing - Basic morphological algorithms

5. Image Segmentation:

Segmentation Based on Edge Detection, Thresholding, and Area Growth - Determination

6. Presentation:

Providing Objects with Chain Codes, Views, and Skeletons - Border Descriptors - Area Descriptors

7. Object Identification:

Decision-Making Methods such as Statistical Classification and Neural Networking.

Required Software :

MatLab, LabView

Suggested Projects :

Each student will complete a computer vision application project in the semester.

Assessment :

- projects : 15%
- quiz : 10%
- Practice : 25%
- midterm exam : 25%
- final exams : 25%