IT_4031: COMPUTER VISION [3 0 0 3]

Objectives:

- Learn formation of image and different camera models and their calibration.
- Learn different feature detection and mathematics of description methods.
- Learn object recognition through different learning algorithms.

Abstract:

Introduction to computer vision and its applications, Image formation, Liner Filtering, magetransformations and Colour models, Edge Detection methods (Laplacian detectors and Canny edge detector), Points and patches, Harris corner detector, Histogram of Gradients, Difference of Gaussian detector, SIFT, Colour and Texture, Feature based alignment, least squares and RANSAC, Camera models, Camera calibration, Stereo vision, Stereo correspondence, Epipolar geometry, Optical flow, Lucas Kanade method, KLT tracking method, Mean shift method, Dense motion estimation, Support Vector Machines, Face detection and recognition, Bag of words, Deep learning.

Syllabus:

INTRODUCTION:

Introduction to computer vision and its applications, Image formation, Liner Filtering, Image transformations and Colour models. [**07 Hours]**

FEATURE DETECTION AND MATCHING:

Edge Detection methods (Laplacian detectors and Canny edge detector)**,** Points and patches, Harris corner detector, Histogram of Gradients, Difference of Gaussian detector, SIFT, Colour and Texture, Feature based alignment, least squares and RANSAC [**09 Hours]**

CAMERA CALIBRATION:

Camera models, Camera calibration, Stereo vision, Stereo correspondence, Epipolar geometry

[08 Hours]

TRACKING:

Optical flow, Lucas Kanade method, KLT tracking method, Mean shift method, Dense motion estimation. **[06 Hours]**

OBJECT RECOGNITION:

Support Vector Machines, Face detection and recognition, Bag of words, Deep learning.

[06 Hours]

Outcomes:

After studying this course, students will be able to:

- Understand the concepts of image formation, colour models and linear filtering.
- Understand the mathematics behind feature detection and description methods.
- Demonstrate a thorough understanding of fundamental concepts in camera calibration.
- Understand and analyze various object tracking algorithms.
- Comprehend object and scene recognition and categorization from images.

References:

1. Szeliski R., *Computer Vision: Algorithms and Applications,* Springer 2011.
2. David A. F. and Ponce J., *Computer Vision: A Modern Approach, PHI learning* 2009.
3. Solem J. E., *Programming Computer Vision with Python,* O'Reilly, 2012.

https://www.cs.cornell.edu/courses/cs5670/2023sp/projects/projects.html

http://cs231n.stanford.edu/