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**Course description and objectives:**

To introduce the fundamentals of image formation; Linear filtering methods, Edge detection and Segmentation based on Color and Texture and to provide the student with programming experience from implementing computer vision and object recognition applications in MATLAB.

**Course Outcomes:**

The Student will be able to:

- ✓ Understand the basic concepts of Camera and Projection system.
- ✓ Describe known techniques of Filters and edge detection Techniques.
- ✓ Understand the various Segmentation Techniques based on Color, Texture.
- ✓ Understand the design of a computer vision system for a specific problem learn how to apply their theoretical knowledge in practice.

**Skills:**

- ✓ Learn about various linear filters.
- ✓ Analyze various Edge detection Methods
- ✓ Analyze the various Segmentation techniques for specific applications.
- ✓ Study and implement of various Computer Vision Case studies

**Activities:**

- ✓ Design the smoothing filter with a Gaussian function.
- ✓ Implement using the Laplacian to detect edges.
- ✓ Design & Implement shot boundary detection.
- ✓ Implement segmentation using simple clustering methods.
- ✓ Implementation of the EM algorithm .
- ✓ Implement the linear filter response to additive Gaussian noise
- ✓ Implement the inverse Fourier transforms.

**Unit – I**

**IMAGE FORMATION AND IMAGE MODELS:** CAMERA-pinhole cameras, camera with lenses, the human eye, sensing, geometric camera models-elements of analytical Euclidean geometry, camera parameters and the perspective projection, affine cameras and affine projection equations, color-human color perception, representing color, a model for image color.

**Unit – II**

**FILTERING TECHNIQUES:** linear filters-Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as templates, technique: normalized correlation and finding patterns, technique: scale and image pyramids.

**Unit – III**

**EDGE DETECTION and TEXTURE:** Noise- estimating derivatives, detecting edges, Texture-representing texture, analysis using oriented pyramids, application, shape from texture.

#### **Unit – IV**

**SEGMENTATION:** Segmentation by clustering-what is segmentation, human vision, applications, image segmentation by clustering pixels, segmentation by graph, segmentation by fitting a model-Hough transforms, missing data problems fitting and segmentation, the EM algorithm in practice.

#### **Unit – V**

**APPLICATIONS:** finding in digital libraries-organizing collection of information, summary representations of the whole picture, representing parts of picture, image based rendering-3d models from image sequences, transfer based approaches, the light field

#### **TEXT BOOKS:**

1. Computer Vision – A Modern Approach, by D.Forsyth and J.Ponce hall Robot Vision, by B.K.P.Horn, McGraw-Hill.

#### **REFERENCE BOOKS:**

1. Computer Vision: Algorithms and applications, Richard Szeliksy.
2. computer & robot vision, Haralick & shaprio, vol ii.
3. Emerging Topics in Computer Vision ,GeradMedioni and sing bing kang.