राष्ट्रीय प्रौद्योगिकी संस्थान पटना / NATIONAL INSTITUE OF TECHNOLOGY PATNA
संगणक विज्ञान एंव अभियांत्रिकी विभाग / DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
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No:- Date:

CSXX2812 Computer Vision

L-T-P-Cr: 3-0-0-3

Pre-requisites: Linear algebra, Probability theory

Objectives/Overview:

- To introduce various topics of computer vision with their applications.

Course Outcomes:

At the end of the course, a student will be able to understand:

Sl. No	Course Outcome (CO)	Mapping to PO
1.	Basic concepts of computer vision	PO1, PO2
2.	Image formation and camera calibration	PO1, PO3
3.	Concepts of feature detection and matching	PO1, PO2,PO3
4.	Concepts of signal processing and pattern recognition	PO1, PO2,PO3, PO4
5.	Application of machine learning and deep learning in computer vision	PO1, PO2, PO3, PO4, PO5
6.	Application of medical imaging in computer vision.	PO1, PO2, PO3, PO4, PO5

UNIT I: Image formation and camera calibration **Lectures: 08**

Introduction to computer vision, image basics, geometric camera models, orthographic and perspective projections, weak perspective projection, intrinsic and extrinsic camera parameters, linear and nonlinear approaches of camera calibration.

UNIT II: Feature detection and matching **Lectures: 06**

Edge detection, interest points and corners, local image features, feature matching and Hough transform, model fitting and RANSAC, scale invariant feature matching

UNIT III: Signal Processing and Pattern Recognition **Lectures: 10**

Representation of multidimensional signals: Continuous signals, discrete signals, relation between continuous and discrete signals, Vector spaces and unitary transforms, Scale of signals, Scale space and diffusion, Multigrid representations; Motion: flow and correspondence, Optical flow-based motion estimation, Correlation and matching, Modeling of flow fields.

UNIT IV: Machine learning and Deep learning in Computer Vision **Lectures: 06**

Image classification: CNN; Object detection: Fast RCNN, Faster RCNN, YOLO.

UNIT V: Medical Imaging **Lectures: 12**

Radiography—X-rays, interaction with matter, X-ray detectors, dual-energy imaging, image quality, equipment; X-ray computed tomography—X-ray detectors in CT, imaging, cardiac CT, dual-energy CT, image quality, equipment; Ultrasound imaging—Physics of acoustic waves, Generation and detection of ultrasound, Gray scale imaging, Doppler imaging, image quality, equipment; Medical image analysis—Manual analysis, Automated analysis, Computational strategies for automated medical image analysis, Geometric model matching using a transformation matrix.

Text/Reference Books

1. Forsyth, D. A. and Ponce, J., "Computer Vision: A Modern Approach", Prentice Hall, 2nd Ed.
2. Jahne, B., "Computer Vision and Applications", Academic press.
3. P. Suetens, “Fundamentals of Medical Imaging”, Cambridge University Press.