Computer Vision

Code	Credit Hours
CS-867	3-0

Course Description:

As a postgraduate-level offering, this course focuses on computer vision with an intermediate level of complexity, emphasizing visual recognition. It is tailored to cater to students eager to explore the fundamental principles and significant applications of computer vision. Throughout the course, students will cover topics such as feature detection and matching, visual recognition, image classification, object detection, semantic segmentation, motion estimation, and tracking using deep learning. This is not an introductory course. This course is designed to familiarize students to the current state of the art so a solid background in computer vision and deep learning is strongly recommended.

Text Book:

1. Computer Vision: Algorithms and Applications by Rick Szeliski

Reference Book:

1. Hands-On Computer Vision with TensorFlow 2.0 by Benjamin Planche, Eliot Andres
2. Deep Learning for Computer Vision : Image Classification, Object Detection, and Face Recognition in Python by Jason Brownlee
3. Dive into Deep Learning : An interactive deep learning book with code, math, and discussions by Aston Zhang, Zack C. Lipton, Mu Li

Prerequisites

NA

Assessment System

Quizzes	10%
Assignments	10%
Mid Semester Exam	30%
End Semester Exam	50%

Teaching Plan

Week No	Topics	Learning Outcomes

1-8	Introduction, Feature Detection and Description, Classical Visual Recognition, Bag of Visual Words, Geometric & Photometric Image Formation,	Students will gain a thorough understanding of its foundational concepts and advanced applications. They will start by exploring the fundamental challenges and practical uses of computer vision. Topics such as image processing principles, camera models, stereo geometry, and camera calibration will equip them with essential skills in image formation and geometric transformations. Students will also learn about feature extraction methods like SIFT and SURF, as well as modern techniques such as convolutional neural networks (CNNs) for image classification.
9	**MID-TERM EXAM**	
10-17	Deep learning for Visual Recognition, Motion and Object Tracking, Human Activity & Action Recognition, Remote sensing and Crops monitoring	Students will focus on cutting-edge techniques crucial for modern visual data analysis. They will specialize in semantic segmentation using deep learning for precise image partitioning and master object detection with Faster R-CNN and YOLO models. They will then explore sequence modeling with RNNs, LSTMs, and vision transformers, followed by language and vision models for tasks like generating image descriptions and answering visual questions. The course will conclude with a deep dive into generative models, covering supervised and unsupervised learning approaches, including variational autoencoders, generative adversarial networks (GANs), and more, preparing students to innovate in visual content generation and complex data understanding.
18	**END-TERM EXAM**	