

Course Name	Applied Computer Vision using Deep Learning
Course Duration	5 Day (40 hours)
Course Outcomes	Understand computer vision fundamentals and deep learning applications.
	Apply image processing techniques for enhancing and manipulating images.
	Master feature detection and matching for image analysis and recognition.
	Implement state-of-the-art object detection algorithms for accurate and efficient detection.
	Apply advanced deep learning techniques for various computer vision tasks.

Module 1: Introduction to Computer Vision

- Definition and overview of computer vision.
- Different types of computer vision problems, such as image classification, object detection, and image segmentation.
- Introduction to deep learning and its application in solving computer vision problems.

Module 2: Image Processing

- Basic image processing techniques used in computer vision.
- Edge detection: Identifying boundaries between objects in an image.
- Thresholding: Converting grayscale images to binary images based on pixel intensity.
- Morphological operations: Modifying the shape and structure of objects in an image.

Module 3: Feature Detection and Matching

- Finding distinctive features in images using techniques like SIFT (Scale-Invariant Feature Transform) and SURF (Speeded-Up Robust Features).
- Matching features across multiple images to establish correspondences.

Module 4: Object Detection

- Introduction to object detection in computer vision.
- YOLO (You Only Look Once) algorithm: An efficient real-time object detection system.
- R-CNN (Region-based Convolutional Neural Networks): A popular object detection framework.

Module 5: Image Segmentation

- Segmenting images into meaningful regions using techniques like U-Net and SegNet.
- U-Net: A convolutional neural network architecture for image segmentation.
- SegNet: A deep encoder-decoder architecture for pixel-wise segmentation.

Module 6: Deep Learning

- Definition and explanation of deep learning.
- Overview of deep neural networks and their structure.
- Training deep learning models using backpropagation and gradient descent.

Module 7: Convolutional Neural Networks (CNNs)

- How CNNs are specifically designed for image processing and computer vision tasks.
- Convolutional layers, pooling layers, and fully connected layers in CNNs.
- Popular CNN architectures like VGG, ResNet, and Inception.

Module 8: Recurrent Neural Networks (RNNs)

- Introduction to RNNs and their applications beyond natural language processing.
- Utilizing RNNs for sequential data processing in computer vision, such as video classification and object tracking.
- Long Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU) as popular RNN variants.

Module 9: Generative Adversarial Networks (GANs)

- How GANs work for generating realistic images and creative content.
- The generator and discriminator components in a GAN.
- Training GANs using adversarial learning and loss functions.

Module 10: Transfer Learning

- Leveraging pre-trained models and transfer learning for computer vision tasks.
- Fine-tuning pre-trained models on new datasets.
- Improving the performance of deep learning models with limited data by utilizing knowledge from larger datasets.