

**AI Computer Vision**

**Course Number:** AI-142WA  
**Duration:** 3 days

**Overview**

This AI Computer Vision course gives attendees a deep understanding of computer vision concepts, techniques, and applications. The course covers everything from image processing fundamentals and feature extraction to advanced deep learning architectures and object detection. Participants gain hands-on experience implementing computer vision algorithms and building end-to-end applications using popular frameworks and libraries.

**Prerequisites**

* Strong programming skills in Python and familiarity with machine learning concepts
  + Pandas, NumPy, scikit-learn
* Basic understanding of linear algebra recommended (vectors)
* Foundations of machine learning - classification, regression, clustering, etc
  + Feature engineering, feature selection, data pre-processing for ML
  + Model metrics and evaluation - MSE, R-squared, Precision, Recall, etc

**Materials**

All Generative AI training students receive comprehensive courseware.

**Software Needed on Each Student PC**

All attendees must have a modern web browser and an Internet connection.

**Objectives**

* Grasp the fundamentals of computer vision and its diverse applications across industries
* Apply image processing techniques to enhance, restore, and manipulate digital images
* Implement traditional feature extraction and classification algorithms for image analysis
* Utilize deep learning architectures (CNNs) and transfer learning for state-of-the-art computer vision tasks
* Develop object detection and segmentation models for real-world applications
* Explore advanced computer vision techniques, including attention mechanisms, generative models, and unsupervised learning
* Analyze real-world case studies to understand the impact of computer vision in various domains

**Outline**

* Introduction to Computer Vision
  + Overview of computer vision and its applications
  + Digital image fundamentals and representation
  + Image processing techniques (e.g., filtering, enhancement, and restoration)
* Feature Extraction and Image Classification
  + Traditional feature extraction techniques (e.g., SIFT, SURF, and HOG)
  + Bag-of-words model and feature aggregation techniques
  + Classic image classification algorithms (e.g., SVM and k-NN)
* Deep Learning for Computer Vision
  + Introduction to convolutional neural networks (CNNs)
  + Popular CNN architectures (e.g., LeNet, AlexNet, VGGNet, and ResNet)
  + Transfer learning and fine-tuning techniques for computer vision tasks
* Object Detection and Segmentation
  + Object detection architectures (e.g., R-CNN, Fast R-CNN, and Faster R-CNN)
  + Single-shot object detectors (e.g., YOLO and SSD)
  + Semantic and instance segmentation techniques (e.g., FCN and Mask R-CNN)
* Advanced Computer Vision Techniques
  + Attention mechanisms and transformer architectures for computer vision
  + Generative models for image synthesis and augmentation (e.g., GANs and VAEs)
  + Unsupervised and self-supervised learning techniques for computer vision
* Computer Vision Applications and Case Studies
  + Autonomous vehicles and robotics
  + Facial recognition and biometric systems
  + Medical imaging and diagnosis
  + Retail and e-commerce applications (e.g., product recognition and visual search)
* Conclusion