CampusX Deep Learning for

Computer Vision(DLCV) Course Syllabus

1. Introduction to Computer Vision and Visual Cortex

* Overview of computer vision and its applications
* Understanding the human visual system
* Key historical milestones in the field of computer vision

2. What Are Images and Pixels?

* Fundamentals of digital images
* Understanding pixels and color models (RGB, Grayscale)
* Image types and formats explained

3. Convolution and Edge Detection Techniques

* Introduction to convolution operations
* Edge detection filters (Sobel, Canny, Prewitt)
* Practical examples in Python using OpenCV

4. Padding, Strides, and Spatial Arrangement in Convolution

* Definitions and purposes of padding and strides
* How convolution changes spatial dimensions
* Implementation tips in deep learning frameworks

5. Working with Convolution on RGB Images

* Handling multiple channels in convolutions
* Challenges and considerations for RGB data
* Case studies of RGB image processing

6. Understanding and Building Convolutional Layers

* Anatomy of convolutional layers
* Designing convolutional layers in deep learning models
* Hands-on coding session with TensorFlow/Keras

7. Pooling Mechanisms: Max and Average Pooling

* The role of pooling in feature reduction
* Comparative analysis of max pooling vs. average pooling
* Implementing pooling layers in neural networks

8. Optimizing CNN Training: Techniques and Practices

* Effective strategies to improve CNN training
* Batch normalization and dropout techniques
* Using callback functions and checkpoints

9. Case Study: LeNet Architecture (1998)

* In-depth review of LeNet's design and impact
* Step-by-step walkthrough of the architecture
* Implementation of LeNet in a modern framework

10. Diving into Large Scale Image Recognition with ImageNet

* Challenges and solutions in large-scale image datasets
* Key achievements and lessons from ImageNet competitions
* Impact on the advancement of deep learning

11. Techniques in Data Augmentation for Vision Models

* Importance of data augmentation in training robust models
* Various data augmentation techniques and their implementations
* Case study: Improving model performance using augmented datasets

12. Implementing Convolutional Layers with Keras

* Basic to advanced convolutional network constructions using Keras
* Tips for optimizing model architecture
* Practical coding session

13. Breakthrough with AlexNet: Architecture and Innovations

* Analysis of AlexNet and its groundbreaking performance
* Key innovations introduced with AlexNet
* AlexNet vs. previous models: a comparative study

14. Deep Dive into VGGNet Architecture

* Exploration of VGGNet design and functionality
* Hands-on session: Building VGGNet from scratch
* Discussion on the scalability and adaptability of VGGNet

15. Introduction to Residual Networks (ResNet)

* Understanding the concept of residual learning
* ResNet architecture and variants
* Practical applications and performance analysis

Advanced Topics Sessions

16. Transfer Learning and Applications

* Fundamentals of transfer learning
* Practical demonstrations using pre-trained models
* Applications in real-world scenarios

17. Introduction to Object Detection: From R-CNN to YOLO

* Evolution of object detection frameworks
* Comparative study: R-CNN, Fast R-CNN, Faster R-CNN, and YOLO
* Implementing YOLO for real-time object detection

18. Semantic and Instance Segmentation: Techniques and Applications

* Distinction between semantic and instance segmentation
* Review of leading methods like Mask R-CNN
* Application cases in autonomous vehicles and medical imaging

19. Advanced Topics: GANs for Image Synthesis and Editing

* Introduction to Generative Adversarial Networks (GANs)
* Use cases in image generation and photo editing
* Hands-on GAN training session

20. Special Topics: Recent Breakthroughs and Research Directions

* Latest innovations and research in computer vision
* Emerging technologies and their potential impacts
* Future directions and career opportunities in computer vision

21. Project: Building Blocks of a Self-Driving Car - Vision-Based Navigation Systems

* Design and implementation of computer vision systems for self-driving cars
* Focus on real-time object detection, lane tracking, and traffic sign recognition
* Final presentation of a simulated autonomous driving scenario