
AI Courses by OpenCV

DEEP LEARNING WITH PYTORCH

Module 1 : Getting Started

1. Introduction to Artificial Intelligence

- History of AI
- Applications of AI
- AI in Computer Vision
- AI Terminology
- Why Deep Learning so popular

2. Numpy Refresher

- Introduction to NumPy
- Why do we need a special Library for Maths an DL
- NumPy Basic Operations
- Mathematical Functions
- Reshape & Combine Array
- Element-wise Operations
- Linear Algebra
- Array Statistics

3. Introduction PyTorch

- Why PyTorch
- Introduction to PyTorch
- PyTorch Basics

4. What is inside an ML Algorithm

- Machine Learning Pipeline
- Solving ML Problems
- Gradient Descent
- Gradient Descent for Optimization

Assignment1: Implement ReLU, Softmax and Neuron using PyTorch

Assignment2: Implement Gradient Descent for two variables

Module 2 : Neural Networks

1. Feature Vectors 1-D to N-D
 - Feature Vectors and Normalization
2. Neural Network Basics
 - What is Neural Network
 - Loss Functions for Regression
 - Loss Functions for Classification
 - Types of Activation Functions
 - How does the network learn
 - Demystifying Neural Networks
3. Binary Classification using Perceptrons
 - Binary Classification using a Perceptron
4. PyTorch NN Module
 - Introduction to pyTorch NN Module
 - PyTorch NN Module
 - MLP using Functional API
 - MLP using Sequential API
5. Image Classification using Multilayer Perceptron

- MLP Classifier for Handwritten Digits(MNIST)

Assignment3: Implement MSE and MAE

Module 3 : Convolutional Neural Network

1. Convolution Operation

- What is Convolution Operation
- CNN Building Blocks
- Layers in CNN

2. How to implement LeNet using PyTorch

- How to implement LeNet
- Implementing LeNet using PyTorch
- LeNet with BatchNorm
- Effects of Batch Normalization

3. Evaluation of Classification Performance

- Performance Metrics for Classification
- How to Implement Classification Metrics

4. Introduction to Torchvision

- TorchVision Overview
- Datasets
- What are the different Transforms used to Train a Network
- Different Models in TorchVision
- Utils: Utility Functions in TorchVision
- IO Operations in TorchVision
- Ops module in TorchVision

5. Important CNN architectures

- Different CNN Architecture
- Pre-trained Models in Torchvision
- Pre-trained Classification Models in TorchVision

Assignment4: Implement CNN for Image Classification on CIFAR10 Dataset

Module 4 : Deep Neural Networks

1. Optimization

- What are Optimizers
- Learning Rate Decay Methods
- LR Scheduler

2. Training Deep Neural Networks

- Step1: Data understanding
- Step2: Data Preparation
- Step3: Check Training Pipeline
- Step4: Train the Model
- Step5: Improve the Model
- Check Training Pipeline

3. How to add Robustness to a model

- Bias variance Tradeoff
- How to prevent Overfitting
- Training with Regularization

4. Data Loader with Image Folder

- How to load Custom Datasets in PyTorch

5. GPU access on Azure

- How to get Microsoft Azure Pass
- Redeem Azure Pass
- Create an Instance on Azure
- Run Jupyter Notebooks on Azure
- Login to your instance using SSH
- How to stop your instance

Assignment5: Implement Adam Optimizer

Project1: Implement an Image Classifier from scratch

Module 5 : Best Practices in Deep Learning

1. Troubleshooting Training with Tensorboard

- Tensorboard Overview
- Tensorboard Dashboard
- Logging using Tensorboard
- Sharing Tensorboard Logs

2. Leveraging Pre-Trained models

- CNN Architectures(Recap)
- Fine-Tuning and Transfer Learning
- Fine-Tuning using ResNet

3. How to structure your project for scale

- Introduction to py_modules Package
- Motivation of Trainer Pipeline
- Hands-on Trainer Pipeline

4. PyTorch Lightning

- Introduction to PyTorch Lightning

- Inference on Production(ONNX)
- Transfer Learning with Lightning

Project2: Kaggle Competition on Image Classification

Module 6 : Object Detection

1. Object Detection overview
 - Introduction to Object Detection
2. Evaluation Metrics
 - Evaluation Metrics for Object detection
 - Compute Evaluation Metrics
3. Traditional Algorithms in Object Detection
 - Different Traditional Algorithms
 - Implement Non-Maximum Suppression
4. Two stage Object Detectors
 - Introduction to Two Stage Object Detectors
 - Faster RCNN using TorchVision
 - Understanding Faster RCNN
 - Faster RCNN Fine-tuning
 - Faster RCNN Fine-Tuning Training

Module 7 : Single Stage Object Detectors

1. YOLO
 - Introduction to YOLO
2. Single Stage Multibox Detector(SSD)
 - Introduction to SSD
 - SSD with PyTorch Hub
3. RetinaNet
 - Introduction to RetinaNet
 - RetinaNet with Detectron2
4. How to create Custom Single Stage Detector

- Detector NN Architecture
- Generating Anchor Boxes
- Matching Predictions with Ground Truth
- Loss Function
- Experiment

Assignment6: Focal Loss Implementation

Project3: Number Plate Detection

Module 8 : Segmentation

1. Semantic Segmentation Architecture
 - Semantic Segmentation Architectures
 - Dilated Convolution
 - Transposed Convolution
 - Fully Convolution Network (FCN)
 - U-Net
 - SegNet
 - Deeplab
2. Evaluation Metrics for Semantic Segmentation
 - Dice Coefficient Metrics
3. LinkNet Architecture
 - Introduction to LinkNet Architecture
4. Soft-Dice Loss
 - Introduction to Soft-Dice Loss
5. FCN and DeepLab using TorchVision
 - FCN and DeepLabV3 using Torchvision
6. U-Net for MRI Abnormality Segmentation
7. Train your Model from scratch
8. Instance Segmentation
 - Instance Segmentation using Mask RCNN

Assignment7: LinkNet Architecture with VGG16

Project4: Kaggle competition on Semantic Segmentation



Module 9 : Pose Estimation

1. Dense Pose
 - Introduction to DensePose
 - DensePose Inference
 - DensePose Training
2. Create your own Gym Trainer
 - Squat Checker

Project5: Create an App of your choice


Module 10 : Azure Deployment and Cognitive Services

1. How to your App on Azure Cloud Instance
 - Virtual Machine Creation for Deployment
 - Naive Deployment
 - Robust Deployment
 - Deployment using Azure App Service
2. Introduction to Azure Cognitive Services
 - Azure Cognitive Services

Project6: Deploy your App on Azure using Github repository

Module 11 : LibTorch

1. Introduction to TorchScript
2. Introduction to LibTorch
 - LibTorch Installation
 - Introduction to LibTorch

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- From PyTorch to LibTorch
 - Training with Custom Dataset
3. Introduction to ONNX