

Deep Learning for Image Processing and Transformers: **Pothole Detection and Traffic Data Collection**

Course Overview

Introduction :

- Start your Image Processing and Transformer journey today

What You'll Learn :

- Learning Deep Learning Concepts and Tensor Flow
- Exploring Computer Vision, Image Processing,
- Explore different models, datasets, documents, and ecosystems.
- Pothole Detection and Traffic Data Collection using YOLO
- Transformers, HuggingFace,

Highlights :

- Course Duration - 10 days (80 Hours)
- Number of Modules - 27

Prerequisites:

- Basic understanding of Python programming and Machine Learning
- Familiarity with Computer Vision concepts is recommended

NOTE :

- The hands-on labs will provide practical experience with setting up
 - Hands-on Approach
 - This course can be customized based on the audience's prior knowledge and specific areas of interest.
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SECTION 1 - DEEP LEARNING USING TENSOR-FLOW 2.0

MODULE 1 : Deep Learning basics for Computer Vision

- Introduction to Deep Learning for Computer Vision
- Machine Learning Basics
- Understanding Classification Metrics
- Introduction to Deep Learning Topics
- Understanding a Neuron
- Understanding a Neural Network

MODULE 2 : Introduction to Tensor Flow 2.0

- Introduction To Tensor-Flow
- How to define Tensor
- Operations on Tensors
- Variable and Variable Type Tensors
- Introducing Google Colab
- Tensorflow basic syntax
- What is Tensor flow?
- Tensor Flow code-basics
- Graph Visualization
- Constants, Placeholders, and Variables
- Tensor flow and basic operations

MODULE 3 :Neural Networks

- Introduction to Perceptron
- History of Neural networks
- Activation functions
 - a) Sigmoid
 - b) Relu
 - c) Softmax
 - d) Leaky Relu
 - e) Tanh

MODULE 4 :Deep Learning Networks

- What is a deep learning network?
- Why Deep Learning Networks
- How Deep Learning Works
- Feature Extraction
- Working of Deep Network
- Training using Backpropagation

MODULE 5 :Artificial Neural Network (ANN)

- What is artificial neural network?
- Machine Learning Vs Artificial Neural Networks
- History of ANN
- Building Blocks
- Network Topology
- Evaluating the ANN

SECTION 2 - CONVOLUTIONAL NEURAL NETWORK

MODULE 6 : Convolutional Neural Network

- What is Convolution?
- Convolution on Color Images
- CNN Architecture
- CNN Code Preparation
- CNN - MNIST

MODULE 7 : Working with images and CNN Building Blocks

- Introduction - Working with Images
- Reshaping understanding
- Sampling and Quantization
- Working with images - Filtering

MODULE 8 : CNN Architectures and Transfer Learning

- CNN Architecture and LeNet Case Study
- GPU vs CPU
- Transfer Learning Principles and Practice

SECTION 3 - COMPUTER VISION

MODULE 9 : Introduction to Computer Vision

- Introduction to Computer Vision
- Applications
- Recent Research in Computer Vision
- Introduction to Segmentation
- Why transfer learning?
- Basic Terminologies

MODULE 10 : Mathematics for Computer Vision

- Linear Algebra
- Calculus
- Probability Theory
- Aligning RGB channel,

MODULE 11 : Introduction to OpenCV

- Introduction to OpenCV
- Image basics with Numpy
- Open an Image with Matplotlib
- Get familiar with RGB channels
- Differences between Matplotlib and OpenCV

SECTION 4 - IMAGE PROCESSING

MODULE 12 :Image Features

- Feature Detection
- Feature descriptors
- Model fitting

MODULE 13 :Lighting

- Photometry
- Lightness

MODULE 14 :Image Classification

- Introduction to Image Classification
- Image Classification with KNN

MODULE 15 :Image Processing

- What is a digital image?
- Manipulating Images
- Manipulating Images One Pixel At a Time

SECTION 6 - SEMANTIC SEGMENTATION

MODULE 16 : Semantic Segmentation

- Semantic Segmentation
- The Segmentation process
- U-Net Architecture

MODULE 17 :Image Segmentation

- Image Segmentation Overview
- Upsampling Methods
- Encoder
- Decoder

MODULE 18 :Object Tracking

- Introduction to Object Tracking
- Optical Flow
- Optical Flow Coding
- Overview of various Tracking API Methods

MODULE 19 :Object Detection

- Object Detection and Sliding Windows
- R-CNN
- Fast R-CNN
- Faster R-CNN

SECTION 8 - YOLO

MODULE 20 : YOLO

- Introduction to YOLO v3
- YOLO Weights Download
- YOLO v3 with Python

SECTION 9 - TRANSFORMER CONTENT

MODULE 21 : Transformer

- Introduction to transformers
- Introduction to Hugging Face transformers
- IMDB project Implementation
- Why are Transformers unique?
- A Developer's View of Transformers

MODULE 22 : Fine-Tuning

- Text classification (e.g. spam detection, sentiment analysis)
- Named entity recognition
- Text summarization
- Machine translation
- Question-answering
- Generating text
- Masked language modeling

MODULE 23 : Transformers In-Depth

- Named Entity Recognition (NER) and POS Tagging
- Seq2Seq and Neural Machine Translation
- Question-Answering

SECTION 8 - POTHOLE DATASET

MODULE 24 : Understanding the Datasets

- Introduction to Datasets
- Data Exploration and Visualization

MODULE 25 : Pothole Detection

- Problem Definition
- Data Preprocessing for Pothole Detection
- Building a CNN for Pothole Detection
- Training and Evaluating the Pothole Detection Model
- Improving Model Performance

MODULE 26 : Traffic Data Collection

- Problem Definition
- Data Preprocessing for Traffic Data Collection
- Building a CNN for Traffic Data Collection
- Training and Evaluating the Traffic Data Collection Model
- Improving Model Performance

MODULE 27 : Deploying the Models

- **Introduction to Model Deployment**
- **Deploying the Pothole Detection Model**
- **Deploying the Traffic Data Collection Model**