Course Outline: Introduction to Deep Learning and Its Applications

Session 1: Introduction to Neural Network and TensorFlow

- Introduction to neural networks
    - Neural Networks
    - Neurons
- Activation functions
    - Sigmoid, Tanh, ReLU
- Feed Forward neural network
    - Layer Details
- Training a neural network
- Error and Loss function
- Optimization
- Gradient descent
    - Gradient
    - Gradient Descent Variations
    - Backpropagation
- Introduction to Tensorflow and Keras.

Session 2: Building Blocks of ANN

- Feed forward
- Back propagation
- Fully connected layer
- Activation functions
- Softmax function
- Cross-Entropy loss

Session 3: Tuning and Regularization of ANN

- Weight initialization
    - Exploding gradient descent
    - Vanishing gradient descent
- Regularization -
    - Batch Normalization

    - Drop out
- Choosing the right architecture
- Hyperparamater optimization

<u>Session 4</u>: Image Processing using OpenCV

- Basics of Images
- Understanding filtering

<u>Session 5</u>: CNN

- Architecture of CNN
- Convolution and Filter - Hands on
- Feature Map
- Max-pool layers
- Other pooling types
- Sequential model compilation - Hands on
- Cass study ; Image classification using CNN - Hands On

<u>Session 6:</u> Transfer Learning

- What is Transfer learning (TL) ?
- Comparison between normal training and TL •
AlexNet
- VGGNet
- GoogleNet
- ResNet

<u>Session 7:</u> Object Localization

- Object Localization
- Instance Segmentation
- Semantic Segmentation

<u>Session 8:</u> Object Detection_YOLO

- What is Object detection ?
- Performance metrics
- Object detection approaches

- Various algorithms with region proposals ○

    R-CNN

    - Fast R-CNN
    - Faster R-CNN

- Various algorithms without region proposal ○

    YOLO

    - SSD

<u>Session 9:</u> Semantic Segmentation_UNET

- Segmentation Approaches
- Sliding window, fully convolutional, upSampling
- U-Net
- Depth-wise Separable Convolutions
- MobileNet

<u>Session 10:</u> Siamese Network

- Metric Learning
- Examples of Metric Learning
- Siamese Network
- Applications of Siamese Networks
- How to train Siamese Networks
- Triplet Loss

Frequently asked questions

1.**What is the Learning outcome of the course DL ?**
Ans: This course aims to cover the basic building blocks of Artificial neural networks and its working principles. The implementation of neural networks in complex real life problems is also captured. Another section of the course focuses on computer vision related applications and the deep learning models used for image classification, Object detection and localization.

2. Do we have flip videos for all the sessions?
Ans: Yes, we do have.

3. How many Quizzes do we have in this course?
Ans: 4 quizzes and there. 10 marks each.

4. What is the assessment pattern for Graded assessment in DL?
Ans: In DL we have 2 parts for GA. One part is proctored (20 marks) , here questions from basic tensor operations and ANN are asked (Duration 2 hours). Second part is non proctored (20 marks) , here a case study is framed and students are asked to use certain deep learning models to solve the problem statement (Duration 1.5 hours).

5. What are the assessment components for this course?
Ans: Quiz – 40 marks, Graded Assessment – 40 marks, Mandatory assignments – 10 marks, hackathon – 20 marks, Attendance – 10 marks (Total 120 which will be scaled down to 100).

6. What is the pattern of End Semester Assessment (ESA)?
Ans: ESA is both handwritten (20 marks) and coded – python based (80) marks.

7. How is the DL Hackathon conducted and evaluated?
Ans: Its conducted in Olympus Hackathon platform. The evaluation will be based on the leaderboard scores achieved and it will be done based on relative grading.

8. Are there any textbooks to supplement the material shared?
Ans:

1. **Grokking Deep Learning by Andrew W. Trask published by Manning Publications** (very good for starters with focus on intuition building) – **Download Link**

2. **Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville published by MIT Press**
    - **Part 1** brushes your knowledge and concepts of applied mathematics and machine learning basics in terms of math,

- **Part 2** contains detailed study on Deep learning: Modern practices (Deep Feedforward network, Regularization, Optimization, Convolutional Networks, Sequence Modeling, Applications). - **Link**

3. **Introduction to Neural Networks | Artificial Neural Network | Back Propagation** by **Great Learning**

Pre-requisite Courses : Python for data science, Statistics, Mathematical foundation, Machine Learning-I