DEEP LEARNING SYLLABUS

Module 1: Introduction to Neural Networks and Deep Neural Networks

- Neural Networks Basics
- Functions in Neural Networks
    - Activation Function
    - Loss Function
- Function Approximation
- Classification and Clustering Problems
- Deep Networks Basics
- Shallow Neural Networks
- Activation Functions
- Gradient Descent
- Back Propagation
- Deep Neural Networks
    - Forward and Back Propagation
    - Parameters
    - Hyperparameters

Module 2: Improving Deep Neural Networks

- Mini-batch Gradient Descent
- Exponential Weighted Averages
- Gradient Descent with Momentum
- RMSProp and Adam Optimization
- Hyperparameter Tuning
- Batch Normalization
- Softmax Regression
- Softmax Classifier
- Deep Learning Frameworks
- Data Augmentation
- Underfitting vs Overfitting

Module 3: Convolutional Neural Networks

- Foundations of Convolutional Neural Networks
- CNN Operations
- Architecture
- Simple Convolution Network
- Deep Convolutional Models
    - ResNet
    - AlexNet
    - InceptionNet
    - Others

Module 4: Recurrent Networks

- Recurrent Neural Networks
- Bidirectional RNNs
- Encoder
- Decoder
- Sequence-to-Sequence Architectures
- Deep Recurrent Networks
- Autoencoders
- Bidirectional Encoder Representations from Transformers (BERT)

Module 5: Recursive Neural Networks

- Long-Term Dependencies
- Echo State Networks
- Long Short-Term Memory (LSTM)
- Other Gated RNNs
- Optimization for Long-Term Dependencies
- Explicit Memory

Module 6: Advanced Neural Networks

- Transfer Learning
- Transfer Learning Models
- Generative Adversarial Networks (GANs)
    - Variants of GANs
- Region-Based CNN
- Fast RCNN
- You Only Look Once (YOLO)
- Single Shot Detector

Module 7: Deep Reinforcement Learning

- Deep Reinforcement Learning
- Q-Learning
- Deep Q-Learning
- Policy Gradients
- Advantage Actor Critic (A2C)
- Asynchronous Advantage Actor Critic (A3C)
- Model-Based Reinforcement Learning
- Challenges