

Deep Learning Course Curriculum

School: Sabai Code Thursday and Saturday

Module 1: Introduction to Deep Learning and Basic Neural Networks

1.1 Introduction to Deep Learning

- Historical context and evolution
- Applications and significance in various domains
- Overview of the course
- Differences between Machine Learning and Deep Learning

1.2 Introduction to Neural Networks

- Structure of a neuron and how it mimics biological neurons
- Activation functions and their types: Sigmoid, ReLU, Tanh
- Design and architecture of feedforward neural networks
- Backpropagation and its importance in training
- Gradient descent and its variants: Stochastic, Mini-batch, and Momentum-based

Module 2: Neural Networks for Regression

2.1 Implementing a Neural Network for Regression

- Understanding regression and its applications
- Loss functions suitable for regression tasks
- Designing a network for regression
- Hands-on coding session
- Real-world applications and examples

Module 3: Neural Networks for Classification

3.1 Basics of Classification

- Binary vs. Multi-class classification
- Overview of classification problems in various industries

3.2 Loss functions for classification

- Binary cross-entropy

- Categorical cross-entropy
- Softmax activation for multi-class classification

3.3 Implementing a Neural Network for Classification

- Hands-on coding session
- Multi-class classification challenges and solutions
- Evaluation metrics for classification: Accuracy, Precision, Recall, F1-Score

Module 4: Introduction to Convolutional Neural Networks (CNN)

4.2 Basics of CNNs

- Understanding the convolution operation
- Importance of pooling layers
- Role of fully connected layers in CNNs
- Filters and feature maps

4.1 Implementing a CNN

- Hands-on coding session
- Image preprocessing and data augmentation techniques
- Applications: Image classification, object detection

Module 5: Advanced CNN Concepts

5.1 Advanced topics in CNNs

- Transfer learning and its importance
- Data augmentation techniques for improving model performance
- Regularization techniques in CNNs: Dropout, Batch Normalization

5.2 Practical session on Advanced CNNs

- Hands-on coding session using popular frameworks
- Implementation of transfer learning on a pre-trained model

Module 6: Introduction to Recurrent Neural Networks (RNN)

6.1 Basics of RNNs

- Challenges with traditional neural networks in sequence data
- Understanding the structure and design of RNNs

- The vanishing and exploding gradient problem in RNNs

6.2 Implementing an RNN

- Hands-on coding session
- Applications: Time series prediction, sentiment analysis

Module 7: Advanced RNN and LSTM Networks

7.1 Differences between RNNs and LSTMs

- Understanding gates in LSTM: Input, Forget, and Output
- Advantages of LSTM over basic RNNs

7.2 Practical session on LSTMs

- Hands-on coding session using popular frameworks
- Applications: Text generation, machine translation

Module 8: ML and DL in Data Engineering

8.1 Data Engineering for Deep Learning

- Importance of data pipelines in ML and DL tasks
- Tools and frameworks for big data: Apache Spark, Hadoop
- Integration of ML/DL models in data engineering pipelines

Course Recap and Capstone Project

- Overview of the entire course and key takeaways
- Introduction to the capstone project involving end-to-end ML/DL implementation