

Syllabus

Chapter 1: Fundamentals of Linear Algebra for Deep Learning:-

Data Structures and Operations, Matrix Operations, Vector Operations, Matrix-Vector Multiplication, The Fundamental Spaces, The Column Space
The Null Space, Eigenvectors and Eigenvalues

Chapter 2: Fundamentals of Probability:

Events and Probability, Conditional Probability, Random Variables, Expectation, Variance, Bayes' Theorem, Entropy, Cross Entropy, and KL Divergence

Chapter 3: The Neural Network:

Building Intelligent Machines, The Limits of Traditional Computer Programs, The Mechanics of Machine Learning, The Neuron, Expressing Linear Perceptrons as Neurons. Feed-Forward Neural Networks, Linear Neurons and their Limitations, Sigmoid, Tanh, and ReLU Neurons, Softmax Output Layers, Training Feed-Forward Neural Networks.

Chapter 4: Training Feed-Forward Neural Network:

Gradient Descent, The Delta Rule and Learning Rates, Gradient Descent with Sigmoidal Neurons, The Backpropagation Algorithm with Problem solving, Stochastic and Minibatch Gradient Descent, Test Sets, Validation Sets, and Overfitting, Preventing Overfitting in Deep Neural Networks.

Chapter 6: Beyond Gradient Descent:

The Challenges with Gradient Descent, Local Minima in the Error Surfaces of Deep Networks, Model Identifiability, Momentum-Based Optimization, NN Optimizer – Adam, AdaGrad, RMSProp, Problem Solving.

Chapter 7: CNN

Neurons in Human Vision, The Shortcomings of Feature Selection, Filters and Feature Maps, Full Description of the Convolutional Layer, Max Pooling, Problem Solving, Building a Convolutional Network for CIFAR-10. Batch normalization (with problem solving), Different types of parameters (learnable, non-learnable, hyperparameter)[how to calculate it], Data preprocessing[Data augmentation, Data normalization]

Chapter 8: Embedding and Representation Learning:

Autoencoder, Discuss the advantages of Autoencoders over CNNs, Explain the architecture of a basic autoencoder.

Chapter 9: Model for Sequence Analysis:

Models for Sequence Analysis, Analyzing Variable-Length Inputs, Recurrent Neural Networks, Long Short-Term Memory (LSTM), Augmenting Recurrent Networks with Attention Dissecting a Neural Translation Network, Self-Attention and Transformers.

Chapter 10: Generative Models:

Generative Adversarial Network (GAN)