

Syllabus for Learning Machine Learning

- **Module 1: Introduction to Machine Learning**

- What is Machine Learning?
- Types of Machine Learning (Supervised, Unsupervised, Reinforcement Learning)
- Applications of Machine Learning in various fields
- Overview of key concepts: features, labels, training, testing, and evaluation

- **Module 2: Python Basics for Machine Learning**

- Introduction to Python programming language
- Essential libraries for machine learning: NumPy, Pandas, Matplotlib
- Working with arrays, lists, dictionaries in Python
- Data manipulation and visualization with Pandas and Matplotlib

- **Module 3: Data Preprocessing**

- Understanding data preprocessing steps
- Handling missing data
- Data normalization and standardization
- Encoding categorical variables

- **Module 4: Supervised Learning Algorithms**

- Linear Regression
- Logistic Regression
- Decision Trees and Random Forests
- Support Vector Machines (SVM)

- Naive Bayes Classifier
- K-Nearest Neighbors (KNN)
- Model evaluation and metrics (accuracy, precision, recall, F1-score)

- **Module 5: Unsupervised Learning Algorithms**

- K-Means Clustering
- Hierarchical Clustering
- Principal Component Analysis (PCA)
- t-Distributed Stochastic Neighbor Embedding (t-SNE)
- Association Rule Mining (Apriori Algorithm)

- **Module 6: Model Selection and Validation**

- Train-Validation-Test Split
- Cross-Validation techniques (K-fold Cross Validation)
- Hyperparameter tuning and Grid Search

- **Module 7: Deep Learning Fundamentals**

- Introduction to Neural Networks
- Building and training a simple Neural Network using TensorFlow or PyTorch
- Convolutional Neural Networks (CNN) for image classification
- Recurrent Neural Networks (RNN) for sequence data

- **Module 8: Natural Language Processing (NLP)**

- Introduction to NLP and its applications
- Text preprocessing techniques (tokenization, stemming, lemmatization)
- Sentiment analysis using NLP

- **Module 9: Reinforcement Learning**

- Basics of Reinforcement Learning
- Markov Decision Processes (MDP)
- Q-Learning and Deep Q-Learning

- **Module 10: Machine Learning in Practice**

- Building end-to-end machine learning pipelines
- Model deployment and serving predictions
- Monitoring and improving model performance

- **Module 11: Ethics and Bias in Machine Learning**

- Understanding bias and fairness in machine learning models
- Ethical considerations in deploying machine learning systems
- Responsible AI practices

- **Learning Resources**

- Online courses and tutorials (e.g., Coursera, Udacity, edX)
- Books on machine learning and data science (e.g., "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron)
- Kaggle competitions and datasets for hands-on practice

- **Projects and Exercises**

- Predictive modeling on real-world datasets (e.g., housing prices, customer churn)
- Image classification using CNNs on MNIST or CIFAR-10 datasets
- Sentiment analysis on movie reviews or Twitter data
- Implementing a simple recommender system

