

Data Science and Machine Learning Course Outline

Week 1: Python Fundamentals

- Introduction to Python
- Prerequisite Coding
 - Basic Python Syntax
 - Variables and Data Types
- Operators and Expressions
- Control Flow (if statements, loops)
- Functions and Modules
- Lists, Tuples, and Dictionaries
- File Handling in Python
- Exception Handling
- Introduction to NumPy and Pandas

This foundational week aims to ensure that all students possess a robust understanding of fundamental Python concepts, providing a solid base for the subsequent weeks.

Week 2: Pandas and Exploratory Data Analysis (EDA)

- Pandas I: Introduction to Pandas
- Pandas II: Advanced Pandas Techniques
- Pandas III: Practical Applications
- Data Cleaning and EDA I: Exploring and Cleaning Data
- Data Cleaning and EDA II: Advanced EDA Techniques

Week 3-4: Advanced EDA and Visualization

- EDA III: Exploring Patterns and Trends
- Regex (and finish EDA): Using Regular Expressions in Data Analysis
- Mini Project on EDA: Applying EDA Techniques to Real-world Data

- Visualization I: Introduction to Data Visualization
- Visualization II: Advanced Visualization with Matplotlib
- Sampling: Techniques for Data Sampling
- Visualization III: Using Seaborn and Plotly for Enhanced Visualizations
- Transformations: Data Transformations for Analysis

Week 5-6: Modeling and Regression Techniques

- Intro to Modeling, Simple Linear Regression (SLR): Basics of Statistical Modeling
- Constant model, Loss, and Transformations: Model Evaluation and Improvement
- Sampling: Techniques for Data Sampling
- Modeling, Summary Statistics, and Loss Functions: Evaluating Model Performance
- Ordinary Least Squares: Linear Regression Method
- Gradient Descent: Optimization Technique for Model Training
- Cross-Validation and Regularization: Enhancing Model Robustness
- Logistic Regression: Binary Classification Modeling

Week 7-8: Advanced Topics in Data Science & ML

- Neural Networks: Introduction to Neural Networks
- Convolutional Neural Networks (CNN): Image Recognition and Processing
- LSTM: Long Short-Term Memory Networks for Sequential Data
- Transformers: Attention Mechanisms in Data Science
- Nano ChatGPT from Scratch: Building a Simple Chatbot

Week 9-12: Capstone Project

- Application of all Concepts Learned
- Data Analysis and Modeling
- Presentation and Documentation of Project

The final weeks will be dedicated to a comprehensive capstone project, allowing students to apply their knowledge and skills to solve a real-world data science problem.
