

Value Added Course

Code	Title	Hours
VACCAML25	Machine Learning	30

Learning Objectives:

- To understand the basic theory underlying machine learning.
- To be able to formulate machine learning problems corresponding to different applications.
- To apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

Course Learning Outcomes:

- Appreciate the importance of visualization in the data analytics solution.
- Apply structured thinking to unstructured problems.
- Understand a very broad collection of machine learning algorithms and problems.
- Learn algorithmic topics of machine learning and mathematically deep enough to introduce the required theory.
- Develop an appreciation for what is involved in learning from data.

Unit 1: Python for Machine Learning

- Introduction to Python (1 hour)
 - Basics Python for ML
 - Jupyter Notebook & Google Colab basics
- Python Basics (2 hours)
 - Variables, Data Types
 - Conditional Statements, Loops
 - Lists, Tuples, Dictionaries
- Functions & Modules (1 hour)
 - Defining functions
 - Lambda functions
 - Importing libraries
- NumPy & Pandas for Data Handling (2 hours)
 - Array operations using NumPy
 - DataFrames and basic operations using Pandas

Unit 2: Supervised Learning

- Introduction Supervised Learning (0.5 hour)
 - Regression vs Classification
- Linear Regression (1.5 hours)
 - Concept
 - Implementation using scikit-learn
 - Evaluation (MSE, R2)
- Logistic Regression (1 hour)

- Concept
- Hands-on Classification problem
- Decision Trees & Random Forest (1.5 hours)
 - Concept and differences
 - Hands-on comparison
- K-Nearest Neighbors (1 hour)
 - Understanding KNN
 - Real-world use-case: Classifying images or data points
- Model Evaluation (0.5 hour)
 - Confusion Matrix
 - Accuracy, Precision, Recall

Unit 3: Unsupervised Learning

- Introduction Unsupervised Learning (0.5 hour)
 - Use cases and differences from supervised
- K-Means Clustering (2 hours)
 - Concept
 - Clustering customer data
- Hierarchical Clustering (1 hour)
 - Dendrograms and implementation
- Dimensionality Reduction (1 hour)
 - PCA Concept
 - Visualizing high-dimensional data
- Anomaly Detection (1 hour)
 - Use case: Fraud detection
- Mini Project (0.5 hour)
 - Clustering-based hands-on task

Unit 4: Reinforcement Learning

- Introduction to Reinforcement Learning (1 hour)
 - Agent, Environment, Reward
- Q-Learning Basics (1.5 hours)
 - Simple Grid World example
 - Code walkthrough
- Exploration vs Exploitation (0.5 hour)
 - Epsilon-greedy strategy
- Hands-on: Training a simple agent (2 hours)
 - Using Python and OpenAI Gym
 - Visualizing agent behavior
- Real-world Applications (1 hour)
 - Gaming, Robotics, Recommendations

Unit 5: Deep Learning, CV & NLP Basics

- Intro to Neural Networks (1 hour)
 - Neuron, Layers, Activation
- Building Neural Network (1.5 hours)

- Using Keras or TensorFlow
- MNIST Handwritten Digits classification
- Intro to Computer Vision (1 hour)
 - Image preprocessing
 - Real-world demo: Image classifier
- NLP Basics (1 hour)
 - Tokenization, Stopwords
 - Text classification task
- Sentiment Analysis Project (1.5 hours)
 - Using movie reviews or tweets
 - Build & deploy simple sentiment model