

CAP781: MACHINE LEARNING

L:3 T:0 P:2 Credits:4

Course Outcomes: Through this course students should be able to

CO1 :: understand the key concepts and principles of machine learning, including supervised and unsupervised learning techniques, feature extraction, and model evaluation.

CO2 :: analyze machine learning algorithms and models, understanding their strengths, limitations, and applications in various domains

CO3 :: evaluate the performance of machine learning models using appropriate evaluation metrics

CO4 :: develop machine learning solutions for real-world problems, designing and developing effective algorithms and models

Unit I

Introduction to Machine Learning : History of Machine Learning, Programs vs learning algorithms, Basic definitions, Supervised Learning, Unsupervised Learning, Reinforcement Learning, Issues in machine learning, Different Applications of Machine learning.

Unit II

Supervised Learning : Regression, Linear Regression, Polynomial Regression, Classification, Logistic Regression, k-Nearest Neighbors (k-NN), Support Vector Machines (SVM), Decision Trees and Random Forests, Ensemble Methods, Bagging, Boosting, Model Evaluation Techniques, Cross-Validation, Hyperparameter Tuning, Introduction to Scikit-learn, Hands-on with Real-world Datasets

Unit III

Unsupervised Learning : Clustering, k-Means, Hierarchical Clustering, Dimensionality Reduction, Principal Component Analysis (PCA), Anomaly Detection, Autoencoders and Feature Learning, Case Studies and Applications of Unsupervised Learning

Unit IV

Image Processing : Introduction to Digital Image Processing, Image Enhancement Techniques, Histogram Equalization, Contrast Stretching, Filtering, Image Segmentation, Threshholding, Region-based Segmentation, Feature Extraction from Images, Edge Detection, Corner Detection, Blob Detection, Case Studies and Applications of Image Processing in Computer Vision

Unit V

Neural Networks and Deep Learning : Introduction to Neural Networks, Perceptrons and Multi-Layer Perceptrons (MLPs), Activation Functions: Sigmoid, ReLU, and others, Convolutional Neural Networks (CNNs) for Image Recognition, Recurrent Neural Networks (RNNs) for Sequence Data, Transfer Learning and Pre-trained Models

Unit VI

Advanced Topics in Machine Learning : Reinforcement Learning, Q-Learning, Deep Q Networks (DQNs), Model Compression and Optimization, Recent Advances in Machine Learning, Future Trends and Challenges in Machine Learning

List of Practicals / Experiments:

Practical

- Importing and Exporting Data in python, Data wrangling, Exploratory Data Analysis
- Implementation and performance analysis of Linear Regression, Multi Regression, NonLinear Regression
- Implementation and performance analysis of KNN, SVM and Logistic Regression
- Implementation and performance analysis of k-Means and Hierarchical Clustering
- Implement and compare any two ensemble-based machine learning approaches on different datasets
- Design of an Artificial Neural Network for given dataset
- Implement and compare the performances of any three-machine learning based classification models on different datasets

Text Books:

- Text Books:**
1. APPLIED MACHINE LEARNING by MADAN GOPAL, M.G.Hills
- References:**
1. MACHINE LEARNING by TOM MITCHELL, M.G.Hills
 2. PRINCIPLES OF SOFT COMPUTING by S. N. SIVANANDAM AND S. N. DEEPA, Wiley India