INT423:MACHINE LEARNING-II

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

Course Outcomes: Through this course students should be able to

CO1 :: explain the core concepts of unsupervised learning and implement K-Means clustering with evaluation techniques such as the elbow method.

CO2 :: analyze various advanced clustering algorithms and anomaly detection methods including PCA, Isolation Forest, hierarchical and DBSCAN clustering.

CO3 :: evaluate the effectiveness of clustering algorithms using evaluation metrics

CO4 :: describe the principles of reinforcement learning including policy formulation, MDPs, Monte Carlo and Temporal Difference methods.

CO5 :: determine Q-learning and deep reinforcement learning techniques such as DQN, Double DQN, and Dueling DQN for sequential decision-making tasks.

CO6 :: develop various recommender systems using collaborative, content-based, and hybrid filtering approaches

Unit I

Introduction to Unsupervised Learning & K-Means : Introduction to unsupervised learning, what is clustering?, K-means intuition, K-means algorithm, Optimization objective, Initializing K-means, Choosing the number of clusters, hard versus soft clustering, using the elbow method to find the optimal number of clusters

Unit II

Advanced Clustering Techniques : Anomaly detection algorithm-: Isolation Forest, Anomaly detection vs. supervised learning, Choosing what features to use (PCA), organizing clusters as a hierarchical tree, agglomerative clustering, DBSCAN clustering

Unit III

Clustering metrics : Silhouette Score, Davies-Bouldin Index, Dunn Index, Adjusted Rand Index (ARI), Normalized Mutual Information (NMI), Homogeneity, Completeness, and V-measure, Fowlkes-Mallows Index, Adjusted Mutual Information (AMI)

Unit IV

Foundations of Reinforcement Learning : What is Reinforcement Learning and its concepts?, Markov Decision process (MDP), Policies and Value Functions, Learning Methods- Monte Carlo Learning, Temporal Difference Learning, Exploration Vs Exploitation, Bellman Equation

Unit V

Q-Learning & Deep Q- Networks : Introduction to Q learning, Q learning algorithm, epsilon-greedy strategy, deep Q-networks, Double DQN, Dueling DQN

Unit VI

Recommender Systems : Collaborative filtering algorithm, Binary labels: favs, likes and clicks, Mean normalization, Content-based filtering, Collaborative filtering vs Content based filtering, Recommendation strategies and use cases, Hybrid recommender System

List of Practicals / Experiments:

List of Practical

- Write a Program to implement K-means clustering algorithm on a given dataset
- Write a program to find the optimum value of K for K means clustering using the elbow method on a given dataset.
- Write a program to implement the anomaly detection algorithm.
- Write a program to implement the hierarchical clustering algorithm on a given dataset.
- Write a program to implement the agglomerative clustering algorithm on a given dataset.
- Write a program to implement the DBScan clustering algorithm on a given dataset.
- Write a program to implement PCA for dimension reduction for a given dataset.

- Write a program to evaluate the performance of clustering algorithms using different evaluation metrics.
- Write a program to demonstrate the reinforcement learning task.
- Write a program to implement the reinforcement learning using Q learning approach.
- Write a program to make a simple recommendation system using a rule base approach.
- Write a program to implement a recommendation system using collaborative filtering approach.

Text Books:

1. MACHINE LEARNING : A PRACTITIONER by CHANDRA S.S., VINOD HAREENDRAN S., ANAND, PHI Learning

References:

1. MACHINE LEARNING by KAMALKANT HIRAN, DR. RUCHI DOSHI, RITESH KUMAR JAIN, DR. KAMLESH LAKHWANI, BPB PUBLICATIONS