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P23CST06	**MACHINE LEARNING**	3	0	0

Requisites : None

ctives:

To understand the concepts and mathematical foundations of machine learning and ty problems tackled by machine learning.

To explore the different supervised learning techniques including ensemble methods.

To learn different aspects of unsupervised learning and reinforcement learning.

To learn the role of probabilistic methods for machine learning.

To understand the basic concepts of neural networks and deep learning.

rse Outcomes: **B**

completion of the course, students would be able to **(h**

O1 Understand and outline problems for each type of machine learning.

O2 Design a Decision tree and Random Forest for an application.

O3 Implement Probabilistic Discriminative and Generative algorithms for an application and analyse the results.

O4 Use a tool to implement typical Clustering algorithms for different types of applications.

O5 Design and implement an HMM for a Sequence Model type of application and identify applications suitable for different types of Machine Learning with suitable justification.

rse Contents

I INTRODUCTION, MATHEMATICAL FOUNDATIONS

t is Machine Learning? Need - History - Definitions - Applications - Advantages, Disadvant llenges - Types Of Machine Learning Problems - Mathematical Foundations - Linear Alg ytical Geometry - Probability And Statistics - Bayesian Conditional Probability - Vector Calc mization - Decision Theory - Information Theory.

II SUPERVISED LEARNING

oduction - Discriminative and Generative Models - Linear Regression - Least Squares - Under erfitting - Cross-Validation - Lasso Regression - Classification - Logistic Regression - Gradient els - Support Vector Machines - Kernel Methods - Instance based Methods - K-Nearest Neigh based Methods - Decision Trees - ID3 - CART - Ensemble Methods - Random Forest - Evalua sification Algorithms.

III UNSUPERVISED LEARNING AND REINFORCEMENT LEARNING

oduction - Clustering Algorithms - K-Means - Hierarchical Clustering - Cluster V ensionality Reduction - Principal Component Analysis - Recommendation Systems - EM algo

IV PROBABILISTIC METHODS FOR LEARNING

forcement Learning - Elements - Model based Learning - Temporal Difference Learning -Introd ïve Bayes Algorithm - Maximum Likelihood - Maximum Apriori - Bayesian Belief Netw abilistic Modelling of Problems - Inference in Bayesian Belief Networks - Probability I nation - Sequence Models - Markov Models - Hidden Markov Models.

V NEURAL NETWORKS AND DEEP LEARNING

al Networks - Biological Motivation - Perceptron - Multi-layer Perceptron - Feed Forward Ne t Propagation - Activation and Loss Functions - Limitations of Machine Learning - Deep Lea volution Neural Networks - Recurrent Neural Networks - Use cases.

ext Books:

1. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", Chapman & Hal Edition, 2014.
2. Kevin Murphy, "Machine Learning: A Probabilistic Perspective", 2012, MIT Press.
3. Ethem Alpaydin, "Introduction to Machine Learning", Third Edition,2014,Adaptive Co Machine Learning Series, MIT Press.

eference Books:

1. Tom M Mitchell, "Machine Learning",2013, McGraw Hill Education.
2. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense Edition, 2012, Cambridge University Press.
3. Shai Shalev-Shwartz and Shai Ben-David, "Understanding Machine Learning: F Algorithms", 2015, Cambridge University Press.
4. Hal Daumé III, "A Course in Machine Learning", 2017 (freely available online).

'eb URL(s):

1. https://onlinecourses.nptel.ac.in/noc21_ma38/preview
2. https://onlinecourses.nptel.ac.in/noc20_cs62/preview