

Year: B. Tech III (Semester V)

Subject Name: Machine Learning and Applications

Subject Code: BTEA19522

Type of course: Honor (Group: Artificial Intelligence and Machine Learning)

Prerequisite (if any): Probability and Statistics, introduction to Artificial Intelligence and Robotics

Rationale: In today's world, we see various applications of machine learning like face recognition, recommendation on e-commerce portals, weather forecasting, prediction in various domains like medicine, finance and cyber crimes. This course aims to make machines emulate the human learning process. The course gives a detailed insight into various types of machine learning techniques which will assist in data analysis and analytical model building for various applications.

Teaching and Examination Scheme:

Teaching Scheme				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
4	0	2	5	60	25	15	30	20	150

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests CA2: Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems TEE: Term End Examination TEP: Term End Practical Exam (Performance and viva on practical skills learned in course) CA3: Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. No	Contents	Total Hrs
1	Fundamentals of Machine Learning: Introduction to Machine Learning,, Overview of Supervised Learning, Unsupervised Learning, Reinforcement Learning and Semi-supervised learning, Parametric vs Non-parametric methods, Elements of Computational Learning Theory, Loss Functions, Evaluation Metrics	05
2	Dimensionality Reduction: Feature Selection, Feature Extraction, Variance and Covariance, Eigen values and Eigen vectors, Principal Component Analysis, Linear Discriminant Analysis	06
3	Supervised learning - Regression Methods: Introduction to Regression, Linear Regression, Multiple Linear Regression, Polynomial Regression, Ridge Regression and Applications of regression	08
4	Supervised Learning - Classification Methods : Bayesian Learning- Probability and Bayes' theorem, Maximum Likelihood Estimation, Logistic regression. Decision Trees, Naive Bayes Classification, K-Nearest Neighbour, Ensemble Learning: Bagging, Random Forest, Boosting; Kernel Methods for non-linear data, Support Vector Machines, Performance measures, Applications of Supervised learning	14
5	Unsupervised Learning : Clustering: K-means Clustering, Hierarchical Clustering, Cluster Quality Metrics, Outlier Detection, Applications of Unsupervised learning	08

6	Reinforcement Learning : Introduction to reinforcement learning, passive learning, temporal difference learning, active learning, exploration vs exploitation, bandit problems	05
7	Artificial Neural Networks : Overview of Artificial Neural Networks, Perceptron, Multilayer Perceptrons, Activation Functions, Associative memory, ART networks, Self Organizing Map	09
8	Recommendation Systems : Collaborative Filtering, Content Based Filtering, Hybrid filtering, Applications.	05

Suggested Specification table with Marks (Theory): (For B.Tech only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	25	15	10	0	0

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

Sr.No	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication /Publication Edition
1.	Pattern Recognition and Machine Learning	Christopher M. Bishop	Springer	Latest Edition
2.	Machine Learning	Tom Mitchell	McGraw- Hill	
3.	Introduction to Machine Learning	Ethem Alpaydin	PHI Learning	
4.	Pattern Recognition, Techniques and Applications	Rajjan Shinghal	OXFORD	
5.	Pattern Classification	Richard O. Duda, Peter E. Hart, David G. Stork	Wiley	
6.	Machine Learning	Saikat Dutt, Subramanian Chandramouli. Amit Kumar Das	Pearson	

Note: Students should refer to the latest editions of books

Course Outcomes:



Sr.No	CO statements	Marks % weightage
CO-1	Compare and contrast supervised and unsupervised machine learning techniques	12%
CO-2	Describe important Dimensionality Reduction methods for machine learning	10%
CO-3	Apply regression models for numerical and categorical data	15%
CO-4	Demonstrate usage of supervised learning methods for solving real world problems	30%
CO-5	Demonstrate usage of unsupervised and reinforcement learning methods for solving real world problems	20%
CO-6	Analyze various advanced concepts of machine learning and applications	13%

List of Open learning website:

- <https://nptel.ac.in/courses/106/106/106106139/>
- <https://nptel.ac.in/courses/106/105/106105152/>
- <https://www.coursera.org/learn/machine-learning>

List of Open Source Software:

- Python
- WEKA- Waikato Environment for Knowledge Analysis
- Orange

List of Experiments:

Sr. No	Practical
1.	Implement Linear Regression for the given dataset (dataset to be given during lab sessions).
2.	Implement Logistic Regression for any one application (Sample dataset : <u>Social Networks Ads.csv</u>)
3.	Implement PCA on the sample dataset (dataset to be given during lab sessions).
4.	Implement Decision Tree (without using inbuilt libraries)
5.	Implement K-Nearest Neighbour algorithm (without using inbuilt libraries).
6.	Implement and analyze the Ensemble algorithm (bagging and boosting) on the Iris dataset or any labeled dataset of your choice.
7.	Implement SVM algorithm for classification of the sample dataset (dataset to be given during lab sessions).
8.	Implement k-means clustering on a sample unlabelled dataset.
9.	Design a basic feedforward neural network and evaluate the error.
10.	Implement a User – User Collaborative Filtering Recommendation System on the Movie dataset.

