Guidelines of B.Sc. (H) Computer Science VI Semester/ B.A. Programme V Semester/ Generic Elective VII Semester (NEP UGCF 2022)

MACHINE LEARNING

DSC17/DSC-A5/GE7c

(Effective from Academic Year 2024-25)

S.No	Topic	Chapter	Reference	No of Hours
1.	**Unit 1: Introduction** Basic definitions and concepts, key elements, supervised and unsupervised learning, introduction to reinforcement learning, applications of ML.	Chapter 1	[3]	5
2.	**Unit 2: Preprocessing** Feature scaling, feature selection methods, dimensionality reduction (Principal Component Analysis).	Chapter 6 (6.1.1, 6.1.2) Chapter 12 (12.2)	[2] [2]	6
3.	**Unit 3: Regression** Linear regression with one variable, linear regression with multiple variables, gradient descent, over-fitting, regularization. Regression evaluation metrics.	Chapter 3 (3.1, 3.2) Chapter 6 (6.2.1)	[2] [2]	12
4.	**Unit 4: Classification** Decision trees, Naive Bayes classifier, logistic regression, k-nearest neighbor classifier, perceptron, multilayer perceptron, neural networks, Support Vector Machine (SVM), Classification evaluation metrics	Chapter 3 (3.1, 3.2, 3.3, 3.4) Chapter 6 (6.1, 6.2, 6.7, 6.9) Chapter 4 (4.3.1, 4.3.2, 4.3.3, 4.3.4) Chapter 8 (8.1, 8.2) Chapter 10 (10.1, 10.2, 10.7) Chapter 9 (9.1, 9.2, 9.3, 9.4) Chapter 5 (5.1) Chapter 19 (19.7)	[1] [1] [2] [1] [2] [2] [2] [3]	15
5	**Unit 5: Clustering** Approaches for clustering, distance metrics, K-means clustering, hierarchical clustering.	Chapter 12 (12.4.1, 12.4.2)	[2]	7

Essential/recommended readings

1. Mitchell, T.M. Machine Learning, McGraw Hill Education, 2017.
2. James, G., Witten. D., Hastie. T., Tibshirani., R. An Introduction to Statistical Learning with Applications in Python, Springer, 2023.
3. Alpaydin, E. Introduction to Machine Learning, MIT press, Third Edition.

Additional References

1. Flach, P., Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, 2015.
2. Christopher & Bishop, M., Pattern Recognition and Machine Learning, New York: Springer-Verlag, 2016.
3. Sebastian Raschka, Python Machine Learning, Packt Publishing Ltd, 2019.

Practicals

For practical Labs for Machine Learning, students may use softwares like MATLAB/ Octave/ Python/ R. Utilize publically available datasets from online repositories like https://data.gov.in/ and https://archive.ics.uci.edu/ml/datasets.php

For evaluation of the regression/classification models, perform experiments as follows:

- Split datasets into training and test sets and evaluate the decision models
- Perform k-cross-validation on datasets for evaluation

Report the efficacy of the machine learning models as follows:

- MSE and R^2 score for regression models
- Accuracy, TP, TN, FP, TN, error, Recall, Specificity, F1-score, AUC for classification models

For relevant datasets make prediction models for the following:

1. Naïve Bayes Classifier
2. Simple Linear Regression
3. Multiple linear regression
4. Polynomial Regression
5. Lasso and Ridge Regression
6. Logistic regression
7. Artificial Neural Network
8. K-NN classifier
9. Decision tree classification
10. SVM classification
11. K-means clustering
12. Hierarchical clustering