UNIT-I Introduction to machine learning, Machine learning life cycle, Types of Machine Learning System (supervised and unsupervised learning, reinforcement learning, Batch and online learning, Instance-Based and Model based Learning), scope and limitations (Advantages of ML), Challenges of Machine learning, data visualization, hypothesis function and testing, data pre-processing, data augmentation, normalizing data sets, Bias-Variance trade-off, Relation between AI (Artificial Intelligence), ML (Machine Learning), DL (Deep Learning) and DS (Data Science).

UNIT-II Regression and Classification algorithm: - Linear Regression, Logistic Regression, Linear Classification, perceptron Update rule, Perceptron convergence, generalization, Maximum Margin classification, Classification errors, regularization Bayesian Networks, Learning Bayesian Networks Decision Tree Classification, Neural Network, K-Nearest Neighbours’ (K-NN), Support Vector Machine, Naive Bayes (Gaussian, Multinomial, Bernoulli). Performance Measures: Confusion Matrix, Classification Accuracy, Classification Report: Precisions, Recall, F1 score and Support. ,

UNIT-II Clustering in Machine Learning: Types of Clustering Method: Partitioning Clustering, Distribution Model-Based Clustering, Hierarchical Clustering, Fuzzy Clustering. Birch Algorithm, CURE Algorithm. Gaussian Mixture Models and Expectation Maximization.Parameters estimations – MLE, MAP. Applications of Clustering. Spectral Clustering, Markov Models, Hidden Markov Models(HMM), Probabilistic inference, Collaborative filtering.

UNIT-IV Ensemble Learning and Random Forest: Introduction to Ensemble Learning, Basic Ensemble Techniques (Max Voting, Averaging, Weighted Average), Voting Classifiers, Bagging and Pasting, Out-of-Bag Evaluation, Random Patches and Random Subspaces, Random Forests (Extra-Trees, Feature Importance), Boosting (AdaBoost, Gradient Boosting), Stacking.

UNIT-V Dimensionality Reduction: The Curse of Dimensionality, Main Approaches for Dimensionality Reduction (Projection, Manifold Learning) PCA: Preserving the Variance, Principal Components, Projecting Down to d Dimensions, Explained Variance Ratio, Choosing the Right Number of Dimensions, PCA for Compression, Randomized PCA, Incremental PCA. Kernel PCA: Selecting a Kernel and Tuning Hyper parameters. Learning Theory: PAC and VC model.

Text books:

1. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.

2. Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.

3. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.

4. Bishop, C., Pattern Recognition and Machine Learning. Berlin: Springer-Verlag

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