UNIT I

Syllabus : Introduction : What is Machine Learning, Examples of Machine Learning Applications, Training versus Testing, Positive and Negative Class, Cross-validation. Types of Learning : Supervised, Unsupervised and Semi-Supervised Learning. Dimensionality Reduction : Introduction to Dimensionality Reduction, Subset Selection, Introduction to Principal Component Analysis.

UNIT II

Syllabus : Binary and Multiclass Classification : Assessing Classification Performance, Handling more than two classes, Multiclass Classification-One vs One, One vs Rest, Linear Models : Perceptron, Support Vector Machines (SVM), Soft Margin SVM, Kernel methods for non-linearity.

UNIT III

Syllabus : Regression : Assessing performance of Regression - Error measures, Overfitting and Underfitting, Catalysts for Overfitting, VC Dimensions

Linear Models : Least Square method, Univariate Regression, Multivariate Linear Regression, Regularized Regression - Ridge Regression and Lasso

Theory of Generalization : Bias and Variance Dilemma, Training and Testing Curves Case Study of Polynomial Curve Fitting.

UNIT IV

Syllabus : Distance Based Models : Neighbors and Exemplars, Nearest Neighbor Classification, Distance based clustering algorithms, K-means and K-medoids, Hierarchical clustering.

Rule Based Models : Rule learning for subgroup discovery, Association rules mining – Apriori Algorithm, Confidence and Support parameters.

Tree Based Models : Decision Trees, Minority Class, Impurity Measures – Gini Index and Entropy, Best Split.

UNIT V

Syllabus : Conditional Probability, Joint Probability, Probability Density Function, Normal Distribution and its Geometric Interpretation, Naïve Bayes Classifier, Discriminative Learning with Maximum Likelihood. Probabilistic Models with Hidden variables : Expectation-Maximization methods, Gaussian Mixtures.

UNIT VI

Syllabus : Ensemble Learning : Combining Multiple Models, Bagging, Randomization, Boosting, Stacking

Reinforcement Learning : Exploration, Exploitation, Rewards, Penalties.

Deep Learning : The Neuron, Expressing Linear Perceptron as Neurons, Feed Forward Neural Networks, Linear Neurons and their Limitations, Sigmoid, Tanh and ReLU Neurons.

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