MACHINE LEARNING

Course Code: KG21CM601

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B. Tech. III Year II - Semester

Prerequisites: Knowledge on Basics of Data Structures and statistical methods.

Course Objectives: The objectives of this course for the student are to:

1. Apply concept learning and supervised Algorithms on data samples.
2. Illustrate the Back Propagation Algorithm in Machine Learning.
3. Classify Bayesian, Computational Learning Theory and Instance Based Learning in Machine Learning.
4. Develop Genetic Algorithm, Learning Set of Rules and Reinforcement Learning approaches.
5. Discuss Inductive and Analytical Learning in Machine Learning.

Course Outcomes: After completion of this course, the students will be able to

CO1: Apply Concept Learning and supervised Algorithms on data samples.

CO2: Illustrate the Back Propagation Algorithm in Machine Learning.

CO3: Classify Bayesian, Computational Learning Theory and Instance Based Learning in Machine Learning.

CO4: Develop Genetic Algorithm, Learning Set of Rules and Reinforcement Learning approaches.

CO5: Discuss Inductive and Analytical Learning in Machine Learning.

UNIT-I

Introduction - Well-posed learning problems, designing a learning system, Perspectives and issues in machine learning, Concept learning and the general to specific ordering – introduction, a concept learning task, concept learning as search. Find-S: finding a maximally specific hypothesis, version spaces and the candidate elimination algorithm, remarks on version spaces and candidate elimination, inductive bias.

Decision Tree Learning: Introduction, decision tree representation, appropriate problems for decision tree learning, the basic decision tree learning algorithm, hypothesis space search in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning.

UNIT-II

Artificial Neural Networks - 1: Introduction, neural network representation, appropriate problems for neural network learning, perceptions, multilayer networks and the back-propagation algorithm.

Artificial Neural Networks - 2: Remarks on the Back-Propagation algorithm, An illustrative example: face recognition, advanced topics inartificial neural networks.

Evaluation Hypotheses: Motivation, estimation hypothesis accuracy, basics of sampling theory, a general approach for deriving confidence intervals, difference in error of two hypotheses, comparing learning algorithms.

UNIT-III

Bayesian learning – Introduction, Baye's theorem, Baye's theorem and concept learning, Maximum Likelihood and least squared error hypotheses, maximum likelihood hypotheses for predicting probabilities, minimum

description length principle, Baye's optimal classifier, Gibs algorithm, Naïve Bayes classifier, an example: learning to classify text, Bayesian belief networks, the EM algorithm.

Computational learning theory: Introduction, probably learning an approximately correct hypothesis, sample complexity for finite hypothesis space, sample complexity for infinite hypothesis spaces, the mistake bound model of learning.

Instance - Based Learning: Introduction, *k*-nearest neighbor algorithm, locally weighted regression, radial basis functions, case-based reasoning, remarks on lazy and eager learning.

UNIT-IV

Genetic Algorithms: Motivation, Genetic algorithms, an illustrative example, hypothesis space search, genetic programming, models of evolution and learning, parallelizing genetic algorithms.

Learning Sets of Rules: Introduction, sequential covering algorithms, learning rule sets: summary, learning First-Order rules, learning sets of First-Order rules: FOIL, Induction as inverted deduction, inverting resolution.

Reinforcement Learning: Introduction, the learning task, *Q*–learning, non-deterministic, rewards and actions, temporal difference learning, generalizing from examples, relationship to dynamic programming.

UNIT-V

Analytical Learning - 1: Introduction, learning with perfect domain theories: PROLOG- EBG, remarks on explanation-based learning, explanation-based learning of search control knowledge.

Analytical Learning-2: Using prior knowledge to alter these arch objectives, using prior knowledge to augment search operators.

Combining Inductive and Analytical Learning – Motivation, inductive analytical approaches to learning, using prior knowledge to initialize the hypothesis.

TEXT BOOKS:

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill, 1st Edition, 1997.
2. Kevin P. Murphy," Machine Learning: A Probabilistic Perspective", MIT Press, 1stEdition, 2012
3. Shai Shalev - Shwartz and Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms", Cambridge University Press, 1st Edition, 2014

REFERENCE BOOKS:

1. Stephen Marshland, "Machine Learning: An Algorithmic Perspective", Taylor &Francis, 2nd Edition, 2015.
2. Christopher M. Bishop, "Pattern Recognition and Machine Learning", CRC Press, 1st Edition, 2006.