

ABUSVAC04- Machine Learning

Learning Objectives

The objective of the course is

- To understand the basic theory underlying machine learning.
- To be able to formulate machine learning problems corresponding to different applications.
- To understand a range of machine learning algorithms along with their strengths and weaknesses.
- To be able to apply machine learning algorithms to solve problems of moderate complexity.
- To apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

Course Outcomes

After completing this course, the student will be able to

- Appreciate the importance of visualization in the data analytics solution
- Apply structured thinking to unstructured problems
- Understand a very broad collection of machine learning algorithms and problems
- Learn algorithmic topics of machine learning and mathematically deep enough to introduce the required theory
- Develop an appreciation for what is involved in learning from data.

Unit 1 Introduction

Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.

Unit 2 Neural Networks and Genetic Algorithms

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.

Unit 3 Bayesian and Computational Learning

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

Unit 4 Instant Based Learning

K- Nearest Neighbour Learning – Locally weighted Regression – Radial Bases Functions – Case Based Learning.

Unit 5 Advanced Learning

Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning. “Current Streams of Thought”.

Text Books:

Marco Gori , Machine Learning: A Constraint-Based Approach, Morgan Kaufmann. 2017

Ethem Alpaydin, Machine Learning: The New AI, MIT Press-2016

Supplementary Readings

Ryszard, S., Michalski, J. G. Carbonell and Tom M. Mitchell, Machine Learning: An Artificial Intelligence Approach, Volume 1, Elsevier. 2014

, Stephen Marsland, Taylor & Francis 2009. Machine Learning: An Algorithmic Perspective.