

Kadi Sarva Vishwavidyalaya, Gandhinagar

MCA Semester V

MCA 504: Machine Learning

Rationale:

The primary objective of this course is to provide a broad introduction to machine learning and its application.

Prerequisite: Knowledge of statistics, linear algebra, optimization, and core fundamentals of computer science to create automated systems that can sift through large volumes of data at high speed to make predictions or decisions without human intervention.

Learning Outcomes:

Students will learn seven concepts like basics of machine learning, linear regression and logistic regression, neural network representation, Decision Tree, bayes learning, support vector machine, unsupervised learning and basics of deep learning.

1. In introduction to Machine learning, they will understand the types of machine learning and its applications and basics of deep learning.
2. In linear regression and logistics regression they will understand one variable model, classification, hypothesis representation, cost function etc.
3. In neural network they will learn about perceptron learning and model representation.
4. In decision tree and bayes learning they will learn about decision tree algorithms and bayes learning techniques.
5. In unit 5 they will learn about support vector machine and unsupervised learning algorithms.
6. All these concepts are important to build their career as Machine teaching Engineers, Data Scientist and Business intelligence developers.

Teaching and Evaluation Scheme: Students are evaluated on the basis of continuous evaluation system both in theory and practical classes based on various parameters like term work, class participation, practical and theory assignments, presentation, class test, Regular Attendance, etc.

Sub Total Credit	Teaching scheme		Examination scheme				Total Marks
	(per week)		MID	CEC	External		
	Th	Pr	Th	Th	Th.	Pr.	
4	3	2	25	25	50	50	150

Course Contents:

UNIT1: Introduction to Machine Learning

[20%]

Need for Machine Learning, Types of Machine Learning: Supervised Learning, Unsupervised Learning, Reinforcement Learning, Applications of Machine Learning, Type of Data in Machine Learning, Data quality and data pre-processing, Tools in Machine Learning.

UNIT2: Modeling, Evaluation, Feature Engineering and Bayesian Concept Learning [20%]

Selecting Model, Training Model, Model Representation and interpretability, evaluating performance of a model, improving performance of model, define feature engineering, feature transformation, feature subset selection, Bayesian theorem and concept learning.

UNIT 3: Supervised Learning: Classification and Regression [20%]

Introduction to supervised learning, its examples, classification model, classification learning steps, classification algorithms: k-nearest neighbor (kNN), Decision Tree, Random forest, Support Vector Machine (SVM), introduction to regression and its examples, Regression algorithms: simple linear regression, multiple linear regression, problems in regression analysis, logistic regression.

UNIT 4 : Unsupervised Learning : Clustering and Finding Patterns [20%]

Introduction to unsupervised learning, supervised learning vs unsupervised learning, application of unsupervised learning, clustering: types of clustering techniques, partitioning methods, k-medoid, hierarchical clustering, density based methods-DBSCAN, Finding patterns using association rules, apriori algorithm.

UNIT 5: Basics of Neural Network [20%]

Introduction, artificial neuron, types of activation functions, implementation of ANN, Architectures of Neural Network, Learning process in ANN, Active learning, Memory based learning, bootstrap aggregation (bagging) , boosting, gradient boosting machines(GBM), Introduction to Deep Learning and its need and applications.

Text Books:

1. Machine Learning, 1st Edition by Pearson (English, Paperback, Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das)
2. Sebastian Raschka, "Python Machine Learning", PACKT publishing.

Reference Books:

1. Machine Learning, Tom Mitchell, McGraw Hill, 1997. ISBN 0070428077
2. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, 2004
3. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
4. Richard O. Duda, Peter E. Hart & David G. Stork, "Pattern Classification. Second Edition", Wiley & Sons, 2001.
5. Trevor Hastie, Robert Tibshirani and Jerome Friedman, "The elements of statistical learning", Springer, 2001.
6. Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An introduction", MIT Press, 1998.

Web Material:

1. <https://www.youtube.com/watch?v=fgtUFzxNztA>
2. <http://nptel.iitm.ac.in/video.php?courseId=1041>
3. <http://www-formal.stanford.edu/jmc/whatisai/whatisai.html>
4. http://www.webopedia.com/TERM/A/artificial_intelligence.html
5. http://en.wikipedia.org/wiki/Artificial_intelligence

Chapter & Topics –

Unit #	Book	Chapters
Unit 1	1	1,2
Unit 2		3,4,6
Unit 3		7,8
Unit 4		9,10
Unit 5		11

Note: Practicals can be performed using Python/appropriate Open Source Tools

Practical List: (Book1, Book2)

1. Classifying with distance measures,
2. Naïve Bayes algorithm for predictability of a model

Supervised Learning -Classification Algorithms:

3. k-nearest neighbor (kNN),
4. Decision Tree,
5. Random forest,
6. Support Vector Machine (SVM),
7. Simple Linear Regression

Unsupervised Learning –Clustering Algorithms:

8. partitioning methods,
9. hierarchical clustering,
10. density based methods-DBSCAN,
11. Finding patterns using association rules, apriori algorithm
12. Procuring Cognitive Neural network
13. Training and Validation of Cognitive Neural network
14. Understanding and Classification of Brain neurons
15. Clustering of facial expressions through neurons.