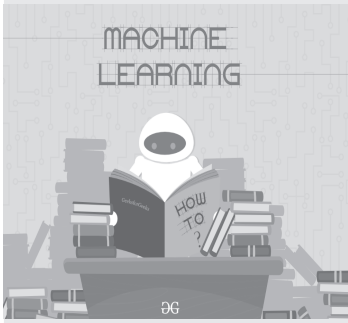
19CS401 MACHINE LEARNING



source:
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Hours Per Week :

L	T	P	C
3	1	-	4

Total Hours :

L	T	P
45	15	-

WA/RA	SSH/HSH	CS	SA	S	BS
10	15	-	-	-	-

COURSE DESCRIPTION AND OBJECTIVES:

This course provides a broad introduction to machine learning, datamining, and statistical pattern recognition. Topics include(i) Supervised learning (parametric/non-parametric algorithms, support vector machines, kernels, neural networks). (ii) Unsupervised learning (clustering, dimensionality reduction, recommender systems, deep learning). (iii) Best practices in machine learning (bias/variance theory; innovation process in machine learning and AI). The course will also draw from numerous case studies and applications, so that students' can also learn how to apply learning algorithms to build smart robots (perception, control), text understanding (web search, anti-spam), computer vision, medical informatics, audio, database mining, and other areas.

COURSE OUTCOMES:

Upon completion of the course, student will able to achieve the following outcomes:

COs	Course Outcomes	POs
1	Apply a wide variety of learning algorithms such as supervised and unsupervised on different kinds of data.	2
2	Analyze the performance of parametric and non-metric approaches on different kinds of data.	3
3	Evaluation of different learning algorithms and model selection.	4
4	Design/Construct a model to realize the solutions for real-world problems.	5

SKILLS:

- ✓ *Implement symmetric and asymmetric encryption techniques.*
- ✓ *Identifying the appropriate firewall, password management and anti-virus models for specific applications.*

UNIT – I **L- 9**

INTRODUCTION- What is machine learning?; Examples of machine learning applications; Learning associations; Classification; Regression; Unsupervised learning; Reinforcement learning.

SUPERVISED LEARNING- Learning a class from examples; Vapnik-Chervonenkis (VC) dimension; Probably approximately correct (PAC) learning; Noise, learning multiple classes; Regression; Model selection and generalization; Dimensions of a supervised machine learning algorithm.

UNIT – II **L- 9**

BAYESIAN DECISION THEORY: Introduction; Classification; Losses and risks; Discriminant functions; Association rules.

PARAMETRIC METHODS: Maximum likelihood estimation; Bernoulli density; Multinomial density; gaussian (normal) density; Evaluating an estimator; Bias and variance.

THE BAYES' ESTIMATOR: Parametric classification; Regression; Tuning model complexity; Bias/ variance dilemma; Model selection procedures.

UNIT – III **L- 9**

MULTIVARIATE METHODS: Multivariate data; Parameter estimation; Estimation of missing values multivariate normal distribution; Multivariate classification; Tuning complexity; Discrete features; multivariate regression.

DIMENSIONALITY REDUCTION: Subset selection; Principal components analysis; Feature embedding; Factor analysis; Singular value decomposition and matrix factorization; Multidimensional scaling; Linear discriminant analysis.

UNIT – IV **L- 9**

CLUSTERING: Mixture densities; Expectation-maximization algorithm; Mixtures of latent variable models; Supervised learning after clustering; Spectral clustering; Hierarchical clustering.

NONPARAMETRIC METHODS: Nonparametric density estimation; Histogram estimator; Kernel esnimator; *k*-nearest neighbor estimator; Generalization to multivariate data; Nonparametric classification; condensed nearest neighbor; Nonparametric regression; Smoothing models; Running mean smoother; Kernel smoother; Running line smoother; How to choose the smoothing parameter.

UNIT - V **L- 9**

LINEAR DISCRIMINATION : Generalizing the linear model; Geometry of the linear discriminant; Two classes; Multiple classes; Pairwise separation; Parametric discrimination revisited; Gradient descent; Logistic discrimination; Two classes; Multiple classes; Discrimination by regression.

MULTILAYER PERCEPTRON: Understanding the brain; Neural networks as a paradigm for parallel processing; The perceptron; Training a perceptron; Learning boolean functions; Multilayer perceptrons; As a universal approximator; Backpropagation algorithm; Nonlinear regression; Two-class discrimination; Multiclass discrimination; Multiple hidden layers; Training procedures; Improving convergence; Overtraining; Structuring the network.

TEXT BOOK:

1. Ethem Alpaydin, “Introduction to Machine Learning”, 3rd edition, The MIT Press, 2014.

REFERENCE BOOKS:

1. Tom M Mitchell, “Machine Learning”, 1st edition, McGraw Hill.
2. Shai Shalev Shwartz and Shai Ben David, “Understanding Machine Learning: From Theory to Algorithms”, Cambridge University Press, 2010.
3. Aurélien Géron, “Hands-on Machine Learning with Scikit Learn and Tensor Flow”, O’reilly, 2017.