CTMTAIDS SI P1: Mathematical and Computational Foundation for Artificial Intelligence

Teaching Scheme					Evaluation Scheme									
					Theory							Practical		Total
					Internal Exams					University Exams		University Exams (LPW)		
					TA-1		MSE		TA-2 *					
L	T	P	C	TCH	Marks	Hrs	Marks	Hrs	Marks	Marks	Hrs	Marks	Hrs	
03	00	00	03	03	25	00:45	50	01:30	25	100	03:00	-	-	200

* Note: TA-2 will be in form of assignments or workshops.

Objectives

1. To understand the concepts of Vector space and inner-product spaces.
2. To apply the linear algebra concepts in approximations and matrix. decompositions.
3. To understand functions of several variables, gradients relevant for machine learning.
4. To acquire sound mathematical aspects of machine learning and artificial intelligence.

UNIT -I

Vector spaces, linear independence, basis, dimensions, matrix representation of data, inner products and norms on a vector space, lengths, angles.

UNIT -II

Orthogonal matrices and Gram-Schmidt, projections, least square approximations, Matrix decompositions, Cholesky decomposition, eigen decomposition and diagonalization, singular value decomposition.

UNIT -III

Brief overview of simple linear regression, multiple linear regression, and logistic regression. Linear Regression and parameter estimation; Dimensionality reduction - Principal Component Analysis, linear discriminant analysis; Density estimation with Gaussian mixture models.

UNIT -IV

Classification with support vector machines – separating hyperplanes, primal and dual support vector machines, kernels.

UNIT -V

Brief overview of random variables, known special probability distributions; Functions of one random variable, mean, variance, moment. Covariance and correlation.

Reference Book: -

1. Mathematics for Machine Learning, Mark Peter Deisenroth, A. Aldo Faisal and Cheng Soon Ong, Cambridge University Press, 2020
2. Linear Algebra and Learning from Data, Gilbert Strang, Wellesley-Cambridge Press, 2019
3. Linear Algebra, Stephen H. Friedberg, Arnold J. Insel and Lawrence E. Spence, Pearson
4. Probability, Random Variables, and Stochastic Processes, Athanasios Papoulis and S. Unnikrishnan Pillai, Mc-Graw Hill, 2002, Fourth Edition
5. Applied Statistics and Probability for Engineers, Douglas C. Montgomery and George C. Runger, John Wiley and Sons, 2018, Seventh Edition.