INT254:FUNDAMENTALS OF MACHINE LEARNING

L:2 T:0 P:2 Credits:3

Course Outcomes: Through this course students should be able to

CO1 :: define the concepts of linear algebra and multivariate calculus

CO2 :: demonstrate the usage of various python libraries for data handling and visualization

CO3 :: explain the concepts of dimensionality reduction using PCA

CO4 :: make use of fuzzy logic to handle uncertainity in data

CO5 :: solve the optimization problems using genetic algorithms

CO6 :: examine the various swarm optimization techniques to solve optimization problems

Unit I

Linear algebra : Introduction to linear algebra, operations with vectors, modulus and inner product, cosine and dot product, projection, changing basis, matrices, solving simultaneous equation problems, types of matrix transformation, determinants and inverses, matrices changing basis, orthogonal matrices, eigen values and eigen vectors

Multivariate calculus : Introduction to multivariate calculus, definition of a derivative, differentiation examples & special cases,, product rule, chain rule, differentiate with respect to anything, The Jacobian, The Hessian, multivariate chain rule, building approximate functions, power series, linearisation, multivariate taylor

Unit II

Data handling and visualization using python : types of data, reading the data, math operations for data analysis, handling missing values, Converting data into numerical format, correlation matrix, data visualization using different graphs

Unit III

Dimensionality Reduction : statistics of dataset, orthogonal projections, problem setting and PCA objective, finding the coordinates of the projected data, steps of PCA, linear discriminant analysis, kernel PCA

Unit IV

Fuzzy logic : basic definition and terminology, set-theoretic fuzzy operations, fuzzy sets and operations on fuzzy sets, fuzzy relations, fuzzy rules and fuzzy reasoning, fuzzy inference system, fuzzification and defuzzification methods, fuzzy based expert system

Unit V

Genetic algorithms : introduction to genetic algorithms, genetic operators, working of genetic algorithm, applications of genetic algorithm, genetic programming

Unit VI

Swarm optimization techniques : swarm intelligence, ant colony optimization, swarm intelligence in bees, cuckoo search, Firefly Algorithm, Crow Search Algorithm, Hybrid Wolf-Bat Algorithm, Whale Search Algorithm, grasshopper optimization

List of Practicals / Experiments:

Practiclas
- Write a python program to work with scalers.
- Write a python program to work with matrices.
- Write a python program to compute eigen values and eigen vectors.
- Write a python program to read data using pandas.
- Write a python program to deal with missing values.
- Write a python program to convert data into numerical format.
- Write a program to reduce dimensionality using PCA.
- Write a program to reduce dimensionality using LDA.

- Write a program to reduce the dimensionality using KPCA.

- Write a program to implement fuzzy operators.

- Write a python program to implement fuzzy inference system.

- Write a program to implement genetic algorithms.

- Write a program to implement ant colony optimization.

- Write a program to implement bee colony optimization.

Text Books:

1. MATHEMATICS FOR MACHINE LEARNING by MARC DEISENROTH, A. ALDO FAISAL, CHENG SOON ONG, CAMBRIDGE UNIVERSITY PRESS

2. SOFT COMPUTING WITH MATLAB PROGRAMMING by N.P. PADHY & S. P. SIMON, OXFORD UNIVERSITY PRESS

References:

1. PRINCIPLES OF SOFT COMPUTING by PRINCIPLES OF SOFT COMPUTING, WILEY