Neural Networks (GE)

Credits: Theory-03+ Practical-01 **Theory Lectures: 45h**

Course Learning Objectives

- To realize the significance of Artificial Intelligence in today's era
- To study neural networks and become able to design neural network based algorithms
- To study fuzzy logic and use it as an alternative tool for modelling.
- To study genetic algorithms and learn about optimizing solutions using genetic algorithms
- To be able to work with imprecise and uncertain solution data for solving problems.

Course Learning Outcomes

At the end of this course, students will be able to

CO1 Realize the significance of Artificial Intelligence and basic Neural Networks
CO2 Learn the neural network algorithms, modelling using optimizing solutions
CO3 Apply the knowledge of Hyrid Systems
CO4 Work with imprecise and uncertain solution data for solving problems

Prerequisite: Basic knowledge about the principles of artificial intelligence and machine learning

L-T-P: 3-0-1

Syllabus Contents

Unit-1 **(9 Lectures)**

Basics of Artificial Intelligence System: Neural Network, Fuzzy Logic, Genetic Algorithm, Human intelligence vs Machine intelligence.

Fundamentals of Neural Networks: Definition of Neural Network, Model of Artificial Neuron, Neural Networks as Directed Graphs, Learning rules and various activation function.

Unit-2 **(12 Lectures)**

Neural Network Architecture: Mathematical Models of Neurons, Artificial neuron model Error Correction Learning, Learning Paradigms-Supervised, Unsupervised and Reinforcement Learning, ANN training algorithms- perceptron, training rules, Single Layer Feed-forward networks, Multilayer Feed-forward networks.

Unit-3 **(12 Lectures)**

Single Layer Perceptrons: Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Techniques, Perceptron –Convergence Theorem

Multilayer Perceptron: Back Propagation Algorithm XOR Problem, Heuristics, Output Representation and Decision Rule

Unit-4 **(12 Lectures)**

Feedback Neural Networks: Pattern storage and retrieval, Hopfield Model, Boltzmann Machine, Recurrent Neural Networks.

Fuzzy Logic and Genetic Algorithm: Introduction to Fuzzy Logic, Overview of Fuzzy Sets and Membership.

References:

1. NEURAL NETWORK by Simon Haykin, Pearson
2. NP Padhy,"Artificial Intelligence and Intelligent Systems", Oxford University Press
3. Rajasekaran S. and Pai G.A.V., "Neural Networks, Fuzzy Logic and Genetic Algorithm Synthesis and applications", PHI New Delhi.
4. Lin C. and Lee G., "Neural Fuzzy Systems", Prentice Hall International Inc.
5. Goldberg D.E. "Genetic Algorithms in Search Optimization & Machine Learning", Addition Wesley Co., New York.
6. Kosko B., "Neural Networks & Fuzzy Systems A dynamical systems approach to machine intelligence", Prentice Hall of India.
7. T. Terano K Asai and M. Sugeno, "Fuzzy System Theory and its applications", Academic Press

Neural Networks Lab

Course Learning Outcomes

At the end of this course, students will be able to

CO1 Design and train neural networks for pattern recognition problems
CO2 Design and train neural networks for classification and association problems
CO3 Design fuzzy logic based systems for real time applications

Syllabus Contents

1. Create a Perceptron with appropriate number of inputs and outputs. Train it using fixed increment learning algorithm until no change in weights is required.
2. Implementation of Unsupervised Learning Algorithm.
3. Implementation of Perceptron Learning model.
4. Write a program to implement Artificial Neural Network with and without back propagation.
5. Write a program to implement Logic Gates.
6. Pattern Recognition using Hopfield Network.
7. Implementation of Fuzzy Operations.
8. Implementation of Fuzzy Relations (Max-min Composition).