

Programme Name	M. Tech. (IoT), SEMESTER-I (Open Elective)
Course Code	EEIT5061S
Course Title	ARTIFICIAL NEURAL NETWORKS AND MACHINE LEARNING

COURSE OBJECTIVE

The course is designed to introduce the field of neural network systems and Artificial Neural Networks. The basic concepts of machine learning are also the main goal of this subject.

COURSE OUTCOME

Students will be able to understand the fundamental concepts of the neural network systems. This area new field of research thus students will get to know about the recent trends in research fields.

Module 1: Introduction: Biological neurons and memory
Structure and function of a single neuron; Artificial Neural Networks (ANN); Typical applications of ANNs : Classification, Clustering, Vector Quantization, Pattern Recognition, Function Approximation, Forecasting, Control, Optimization.
Module 2: Supervised Learning
Single-layer networks; Perceptron-Linear separability, Training algorithm, Limitations; multi-layer networks-Architecture, Back Propagation Algorithm (BTA) Adaptive Multi-layer networks-Architecture, training algorithms; Recurrent Networks; Feed-forward networks; Radial-Basis-Function (RBF) networks;
Module 3: Unsupervised Learning
Winner-takes-all networks; Hamming networks; Maxnet; Simple competitive learning; Vector-Quantization; Counter propagation networks; Adaptive Resonance Theory; Kohonen's Self-organizing Maps; Principal Component Analysis.
Module 4: Associated Models and Optimization Methods
Hopfield Networks, Brain-in-a-Box network; Boltzmann machine; Hopfield Networks for- TSP, Solution of simultaneous linear equations; Iterated Gradient Descent; Simulated Annealing; Genetic Algorithm.
Module 5: Introductory Material to Machine Learning and AI
Motivations for Studying ML, Supervised and Unsupervised learning, Machine Learning in the Large
Module 6: Classical and Theoretical ML Topics

Concept Learning (also called Learning from Examples), Learning from Analogy, Explanation Based Learning, Structure Learning, Reinforcement Learning, Decision Tree Learning, Decision List Learning , Oracle Based Learning, Probably Approximately Correct (PAC) Model, Boosting, Bayesian Learning: Maximum Likelihood Estimates, Parameter Estimation, Bayesian Belief Networks
Expectation Maximization as a fundamental technique, Hidden Markov Models (HMM): Motivation for Generative Models, Forward-backward Algorithm, BaumWelch Iteration, Feature Enhanced HMM.
Module 8: Maximum Entropy Markov Models (MEMM)
Motivation for Discriminative Models, Training of MEMMs (v) Introductory Optimization Based Methods: Neural Nets, Support Vector Machines, Genetic Algorithms (v) Applications: Text Learning, Speech Processing, Data Mining, Bioinformatics

Reference Books:

1. Simon Haykin, "Neural Networks - A Comprehensive Foundation", Macmillan Publishing Co., New York, 1994.
2. A Cichocki and R. Unbehauen, "Neural Networks for Optimization and Signal Processing", John Wiley and Sons, 1993
3. J. M. Zurada, "Introduction to Artificial Neural Networks", (Indian edition) Jaico Publisher, Mumbai, 1997.
4. Hui Jiang, "Machine Learning Fundamentals: A Concise Introduction" Cambridge University Press, 2022
5. Alexander Jung, "Machine Learning: The Basics (Machine Learning: Foundations, Methodologies, and Applications)" Springer, 2022