

IT_4054: SOFT COMPUTING PARADIGMS [3 0 0 3]

Course objectives:

This course will enable students to

- To Conceptualize the working of human brain using ANN.
- To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems.
- To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
- To provide the mathematical background for carrying out the optimization and familiarizing genetic algorithm for seeking global optimum in self-learning situation.

Abstract:

Soft Computing, Artificial Intelligence, Soft-Computing Techniques, Expert Systems Types of Problems, Modeling the Problem, Machine Learning, Handling Impreciseness, Clustering, Hazards of Soft Computing, Road Map for the Future Artificial Neural Networks, The Biological Neuron, The Artificial Neuron, Multilayer Perceptron, Modeling the Problem, Types of Data Involved, Training, Issues in ANN, Example of Time Series Forecasting Types of Artificial Neural Networks, Radial Basis Function Network, Learning Vector Quantization, Self-Organizing Maps, Recurrent Neural Network, Hopfield Neural Network, Adaptive Resonance Theory, Character Recognition by Commonly Used ANNs Fuzzy Systems, Fuzzy Logic, Membership Functions, Fuzzy Logical Operators, More Operations, Fuzzy Inference Systems, Type-2 Fuzzy systems, Other Sets, Sugeno Fuzzy Systems, Example: Fuzzy Controller Evolutionary Algorithms: Evolutionary Algorithms, Biological Inspiration Evolutionary Algorithms Genetic Algorithms, Fitness Scaling, Selection, Mutation, Crossover, Other Genetic Operators, Algorithm Working, Diversity, Grammatical Evolution, Other Optimization Techniques, Metaheuristic Search, Traveling Salesman Problem Introduction, Key Takeaways from Individual Systems, Adaptive Neuro-Fuzzy Inference Systems, Evolutionary Neural Networks, Evolving Fuzzy Logic, Fuzzy Artificial Neural Networks with Fuzzy Inputs, Rule Extraction from ANN, Modular Neural Network

Syllabus:

INTRODUCTION :

Soft Computing, Artificial Intelligence, Soft-Computing Techniques, Expert Systems Types of Problems, Modeling the Problem, Machine Learning, Handling Impreciseness, Clustering, Hazards of Soft Computing, Road Map for the Future [**10 Hours**]

ARTIFICIAL NEURAL NETWORK –I :

Artificial Neural Networks, The Biological Neuron, The Artificial Neuron, Multilayer Perceptron,

Modeling the Problem, Types of Data Involved, Training, Issues in ANN, Example of Time Series Forecasting

ARTIFICIAL NEURAL NETWORKS II :

Types of Artificial Neural Networks, Radial Basis Function Network, Learning Vector Quantization, Self-Organizing Maps, Recurrent Neural Network, Hopfield Neural Network, Adaptive Resonance Theory, Character Recognition by Commonly Used ANNs **[10 Hours]**

FUZZY INFERENCE SYSTEMS :

Fuzzy Systems, Fuzzy Logic, Membership Functions, Fuzzy Logical Operators, More Operations, Fuzzy Inference Systems, Type-2 Fuzzy systems, Other Sets, Sugeno Fuzzy Systems, Example: Fuzzy Controller Evolutionary Algorithms: Evolutionary Algorithms, Biological Inspiration

EVOLUTIONARY ALGORITHMS:

Evolutionary Algorithms Genetic Algorithms, Fitness Scaling, Selection, Mutation, Crossover, Other Genetic Operators, Algorithm Working, Diversity, Grammatical Evolution, Other Optimization Techniques, Metaheuristic Search, Traveling Salesman Problem **[10 Hours]**

HYBRID SYSTEMS:

Introduction, Key Takeaways from Individual Systems, Adaptive Neuro-Fuzzy Inference Systems, Evolutionary Neural Networks, Evolving Fuzzy Logic, Fuzzy Artificial Neural Networks with Fuzzy Inputs, Rule Extraction from ANN, Modular Neural Network **[06 Hours]**

Course outcomes:

Learner will be able to...

- Ability to analyze and appreciate the applications which can use fuzzy logic.
- Ability to design inference systems.
- Ability to understand the difference between learning and programming and explore practical applications of Neural Networks (NN).
- Ability to appreciate the importance of optimizations and its use in computer engineering fields and other domains.
- Students would understand the efficiency of a hybrid system and how Neural Network and fuzzy logic can be hybridized to form a Neuro-fuzzy network and its various applications.

Reference Books:

1. Shukla A., Tiwari R., Kala R., *Real Life Applications of Soft Computing*, CRC Press, Taylor and Francis Group, London 2010.
2. Ross T.J., *Fuzzy Logic with Engineering Applications*, Wiley publication, 2010.
3. Sivanandam S.N., Deepa S.N., *Principles of Soft Computing*, (2e), Wiley Publication, 2010.

4. Rajasekaran S., and Pai G. A. V., *Neural Networks, Fuzzy Logic and Genetic Algorithms*, PHI Learning, 2010.
5. Jang J. S .R., *Neuro-Fuzzy and Soft Computing*, PHI 2003.