

EC 701 Elective – I (EC – 7013 Neural Networks)

Unit-I

Neural Network (NN)

Introduction, benefits of neural network, models of a neuron, neural network as directed graph, network architectures, artificial intelligence and neural network.

Learning processes: error correction learning, memory based learning, Hebbian learning, competitive learning, Boltzman learning, learning tasks, adaptation, statistical nature of learning process, statistical learning theory.

Unit-II

Perceptrons

Single layer perceptrons: adaptive filtering problem, unconstrained optimization technique, linear least squares filter, least mean square algorithm (LMS), perceptron convergence theorem

Multi layer perceptron: architecture, back propagation algorithm, generalization, approximations of functions, network pruning techniques.

Unit-III

Radial Basis Function (RBF) Networks

Cover's theorem on the separability of patterns, interpolation problem, supervised learning as an ill-posed hyper surface reconstruction problem, regularization theory, regularization network, generalized radial basis function networks (RBF), estimation of the regularization parameter, approximation properties of RBF networks, comparison of RBF networks and multilayer perceptrons, Kernel regression and its relation to RBF networks, learning strategies.

Unit-IV

Information- Theoretic Models

Entropy, maximum entropy principle, mutual information, Kullback-Leibler divergence, mutual information as an objective function to be optimized, maximum mutual information principle, infomax and redundancy reduction, spatially coherent and incoherent features, independent components analysis, maximum likelihood estimation, maximum entropy method.

Unit V

Dynamically Driven Recurrent Networks

introduction, recurrent network architectures, state space model, non-linear autoregressive with exogenous inputs model, computational power of recurrent networks, learning algorithms, back propagation through time, real time recurrent learning, Kalman filter, decoupled Kalman filter, vanishing gradients in recurrent networks, system identification, model reference adaptive control.

References:

1. Haykin: Neural Networks- A Comprehensive Foundation, PHI Learning.
2. Sivanandam, Sumathi and Deepa: Introduction to Neural Networks using Matlab, TMH.
3. Freeman and Skapura: Fundamentals of Neural Networks- algorithms, applications and programming techniques, Pearson Education.
4. Hagan, Demuth and Beale: Neural Network Design, Cengage Learning.
5. Anderson: An introduction to Neural Networks, PHI Learning.
6. Satish Kumar: Neural Networks, TMH.