University of Wisconsin - Madison
College of Engineering [EGR]
Last Offered: 2015-2016 Spring [1164]
Direct Link to this Syllabus:

1. E C E 539, Introduction to Artificial Neural Network and Fuzzy Systems
2. Credits: 3  Contact Hours:
4. Specific Course Information:

   a. Brief description of the content of the course (Course Catalog Description): Theory and applications of artificial neural networks and fuzzy logic: multi-layer perceptron, self-organization map, radial basis network, Hopfield network, recurrent network, fuzzy set theory, fuzzy logic control, adaptive fuzzy neural network, genetic algorithm, and evolution computing. Applications to control, pattern recognition, nonlinear system modeling, speech and image processing.
   b. Pre-requisites or Co-requisites: Comp Sci 302, or Comp Sci 310, or knowledge of C programming language
   c. This is a Selected Elective course.

Specific Goals for the Course:

   a. Course Outcomes:

      1. Students will be able to determine if a given data analysis task is a pattern classification problem or a model approximation problem.
      2. Students will be able to apply multi-layer perceptron neural network training algorithm to develop artificial neural network (ANN) based pattern classifiers and data predictors.
      3. Students will be able to apply support vector machine (SVM) to develop pattern classifiers.
      4. Students will be able to apply radial basis function to model given data sets.
5. Students will be able to apply self organization map and k-means to perform clustering operations of a given data set.
6. Students will be able to develop a fuzzy logic controller to perform simple control task on a given data set.
7. Students will be able to apply stochastic optimization methods, including simulated annealing, genetic algorithm and random search to solve a discrete optimization problem.

• ABET Student Learning Outcomes:

(a) Ability to apply mathematics, science and engineering principles.
(b) Ability to design and conduct experiments, analyze and interpret data.
(e) Ability to identify, formulate and solve engineering problems.
(j) Knowledge of contemporary issues.
(k) Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

• Brief List of Topics to be Covered:

1. Learning paradigms, perceptron learning
2. Multi-Layer Perceptron and Back-propagation learning
3. Pattern classification
4. Support vector machines
5. Clustering, Self-Organization Map, Radial Basis Network,
6. Time series analysis, system identification and expert system applications
7. Fuzzy Set Theory and Fuzzy Logic Control
8. Genetic Algorithm and Evolution Computing
9. Recurrent Network, Hopfield network (time permit)