

# Introduction to Artificial Neural Network and Fuzzy Systems

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# Course Overview

# Outline

- Overview of the course
- Goals, objectives
- Background knowledge required
- Course conduct
- Content Overview (highlight of each topics)

# Knowledge Required

- Linear algebra:
  - Familiar with matrices, vectors, inner product operations,
  - Know what are matrix inversion, eigenvalues, singular values, subspace
- Probability and statistics:
  - Probability, distribution, density function, Bayes rule
  - Understand mean, variance, expectation, normal distribution
- Calculus
  - Familiar with derivatives, integration,
  - Understand gradients, integral by parts

# Programming

- Matlab<sup>®</sup> will be used for all examples. Neural net toolbox and fuzzy logic toolbox are useful but not required. All Matlab m-files used in class will be posted in the course web page.
- Public domain software will be listed on course web page. These include both Matlab and C program implementation of various neural network paradigms.
- Projects may be conducted using C or C++. Other types of programming languages are acceptable too.

# Course Conduct

- Forty 50-minute lectures. All lectures will be video taped.
- Three to four homework sets. Each includes multiple problems. Some problems may require programming.
- One take home final will be given one week prior to due date.
- One individual course project, with project proposal, project report, and power point presentation. Electronic copies of these three items will be posted on course web page.
- Homework, final exam. and project report must be typed written on 8" x 11" papers and stapled. Graphs and tables must also be printed. Hand-written annotation of the graph is acceptable.
- Teaching assistant will hold office hours, give tutorials.

# Major Topics To Be Covered

- ANN Basics, neurons, learning algorithms
- Perceptron learning, and pattern classification
- Multi-Layer Perceptron (MLP), back-propagation learning, and applications
- Pattern classification, Support vector machine (SVM)
- Clustering, Self-Organization Map
- Radial Basis Network
- Time series prediction, system identification, expert system
- Fuzzy Set Theory and Fuzzy Logic Control
- Genetic Algorithm and Evolution Computing
- Learn vector quantization
- Mixture of Expert network
- Recurrent network