EC 4460 - Neural Networks

Text and References:

Text (1): Neural Network Design, Hagan, Demuth, and Beale, PWS, 1996.
Text (2): Neural Network Toolbox user's guide, Mathworks Inc.
Ref (1): Neural Networks, Haykin, MacMillan, 1999.
Ref (2): Neural Networks for Pattern Recognition, Bishop, Oxford, 1997
Ref (3): Netlab – algorithms for pattern recognition, I. T. Nabney, Springer, 2001.
Ref (4): Mathematical methods and algorithms, T. Moon, W. Stirling, Prentice Hall, 1998.

Course Objectives:

To introduce students to the treatment of concepts of neural networks: modeling of brain, applicable algorithms, and related applications. Emphasis will be placed on the algorithms for implementing simple artificial neural nets and their applications of interest in electrical engineering in general and signal processing in particular.

Examinations, Homework, and Grading:

1 in-class test, worth: 30%, Projects: 40%; Technology brief presentation: 20%; Class participation: 10%; no final examination.

Computer Usage:

You will need to use the MATLAB Neural Network toolbox.

Tentative In-class Exam Schedule: Monday, August 14th.

Course Outline:

Intro: history, applications, biological relations; learning procedures (Text1, Chap. 1)
Neuron model and network architectures (Text1, Chap. 2)
Perceptron learning rule and single layer networks (Text1, Chap. 4 & notes)
Widrow-Hopf learning (Text1, Chap. 9 & 10, Text 2, Sect. 4)
Multi-layer network; Backpropagation (Text1, Chap. 11 & 12)
Radial basis networks (Text 2, Sect. 6)
Unsupervised learning (Text 1, Section 14 & 15, notes)
Pattern classification and unsupervised networks (time permitting, notes)

Projects:

Several (3 to 4) projects will be assigned during the quarter and will require the use of MATLAB. On average, two weeks will be given to complete the projects. You are allowed and encouraged to discuss the projects with fellow students in the course. However, the work returned (report and software implementation) should be your own work. Data and code from other students are not to be used in the reports. Code found someplace else is not be used without discussing with and getting the approval of the instructor. Note that I routinely do NOT approve such use. If approved, external code is to be explicitly identified and properly referenced in the report.

Technology Brief / Report:

A set of topics related to specific applications of neural networks will be assigned to each student enrolled in the course by the end of the second week of the quarter (see topics list for specifics). Each student will:

1) Conduct a thorough search of the specific area (including database searches) to gather background and up-to-date information on the topic.
2) Investigate specific domains of applications, advantages, drawbacks of neural network technology in that application,

3) Present findings towards the end of the quarter in a ~30mn brief to the rest of the class, the brief will be to be supported by information presented on PowerPoint or overhead transparencies.
4) Turn in a 10 pages max written report summarizing finding, with supporting references included at the back of the report.

Grading will be based on the following:

1. Thorough research of the area assigned,
2. Completeness and accuracy of the information presented (including complete references),
3. Professional presentation of the issues brought up in the articles assigned,
4. Quality of the report (including report organization, grammatical construction used).

Class participation grade:

Will be based on class participation and attendance during the quarter.

Project grading policy guidelines. See attached handout.