*ENGG*4430*

Neuro-fuzzy and Soft Computing Systems

Winter 2009

Instructor:

- Dr. Simon Yang **Office:** Room 2387; **Phone:** ext. 52437; **Email:** syang@uoguelph.ca;
  Office hours: 9:30-11:30 am, Wednesday

Lecture Schedule:

- 2:30-3:50 pm on Tuesday and Thursday in MACK 304.

Text Book:

No specific textbooks will be assigned. Follow lecture notes and use the following references:

- ***Soft Computing & Intelligent Systems Design***, by Karray & De Silva, Addison-Wesley, 2005.
- ***Neuro-fuzzy and Soft Computing,*** by Jang, Sun & Mizutani, Pretice Hall, 1997.
- ***An Introduction to Fuzzy Sets,*** by Pedrycz & Gomide, MIT Press, 1998.
- ***Evolutionary Computation,*** by Dumitrescu et al., CRC, 2000.

Course Web Page:

- http://www.uoguelph.ca/~syang/Engg4430/

Prerequisite:

- ENGG*3410

Corequisite:

- ENGG*4280

Course Objectives:

Students who successfully complete this course will be able to:

- Have a general understanding of soft computing methodologies, including biological and artificial neural networks, fuzzy sets and fuzzy logic systems, and hybrid neuro-fuzzy systems;
- Develop computational neural network models for some simple biological systems;
- Develop fuzzy models for engineering systems, particularly for control systems;
- Combine neural networks and fuzzy systems to design neuro-fuzzy control and inference systems;
- Appreciate the pros and cons of intelligent control systems and compare their performance to that of classical control systems.

Materials to be Covered (Tentative):

The tentative topics and schedule of this course are listed as the following:

- **Introduction:** Introduction to soft computing; introduction to biological and artificial neural network; introduction to fuzzy sets and fuzzy logic systems. (Week 1)
- **Biological neural networks:** generalization of single neuron; neural dynamics; additive and shunting neural networks; short term and long-term memory. (Week 2-4)
- **Artificial neural networks and applications:** artificial neural network models; learning in artificial neural networks; neural network applications in control systems. (Week 5-8)
- **Fuzzy systems and applications:** fuzzy sets; fuzzy reasoning; fuzzy inference systems; fuzzy control; applications of fuzzy systems. (Week 9-11)
- **Neuro-fuzzy systems:** neuro-fuzzy modeling; neuro-fuzzy control. (Week 12)

Grade Evaluation:

- Assignments   10%
- Term Project   35%
- Mid-term Exam   20%
- Final Exam   35%

Note: All the exams will be closed book, with a letter-size one-page formula sheet. The **mid-term** test is scheduled on *Tuesday, Feb. 24 at 2:30-3:50* in class. The **final exam** is on *Monday, April 6, 8:30-10:30 am.* Students can select the Graduate Option (for details, see the Guidance for Term Project).

Term Project:

Each student is required to complete a term project as part of this course. The project will involve a proposal and a final report. Projects can be done individually or in a group of up to 3 students. Grading for the projects will include:

- Proposal   5%
- Final Presentation   5%
- Final Report   25%

Academic Misconduct:

Please refer to the regulations outlined in the student handbook regarding academic misconduct. The policy for this course is zero tolerance for any form of academic misconduct.

Major Holy Days:

The student must contact the instructor within the first two weeks of class if academic consideration is to be requested due to religious reasons.