

ENGG*4430

Neuro-fuzzy and Soft Computing Systems

Winter 2011

Instructor

- Dr. Simon Yang **Office:** Room 217; **Phone:** ext. 52437; **Email:** syang@uoguelph.ca;
Office hours: 10:00-12:00 am, Wednesday

Lecture Schedule

- 11:30-12:50 on Tuesday and Thursday in MACK 234.

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, Prentice 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 5%
- Quizzes 5%
- Term Project 30%
- Mid-term Exam 20%
- Final Exam 40%

Note: All the exams will be closed book, with a letter-size one-page formula sheet. The **mid-term** test is scheduled on *Tuesday, March 1 at 11:30-12:50* in class. The **final exam** is on *Saturday, April 16, 7:00-9:00 pm*. 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 interim report and a final report. Projects can be done individually or in a group of up to 3 students. Grading for the projects will include:

- Interim Report 5%
- Final Presentation 5%
- Final Report 20%

Important Notes

- **Academic Misconduct:** Please refer to the regulations outlined in the student handbook.
- **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.
- **Electronic Recording of Classes:** The electronic recording of classes is expressly forbidden without the prior consent of the instructor. This prohibition extends to all components of the course, including, but not limited to, lectures, seminars, and lab instruction, whether conducted by the instructor or a seminar leader or demonstrator, or other designated person. When recordings are permitted they are solely for the use of the authorized student and may not be reproduced, or transmitted to others, without the express written consent of the instructor.