~~CURRICULUM REVIEW - 2014~~
~~Part IV - Course Outline~~

Asian Institute of Technology
School of Engineering and Technology

AT74.05 AI and Neuro-Fuzzy Theory 3(3-0) Semester: January

Course Objective: The objective of this course is to provide an understanding of the principle of some of the machine intelligence technologies, including Neural Networks, Fuzzy, Genetic Algorithm, Simulated Annealing, Particle Swarm Optimization, and Artificial Intelligence.

Learning Outcomes: Upon completion of this course, the students should be able to:

- Design appropriate neural network, architecture, and learning algorithm for real application.
- Select appropriate membership functions and fuzzy inference rules in a fuzzy controller.
- Develop optimization techniques to determine the best or acceptable solution for real application.
- Select and design AI searching technique for real application.

Prerequisites: None

Course Outline:

I. Machine Intelligence Technologies: Neural Networks
   1. Introduction to Neural Networks
   2. Perceptron Learning Rule
   3. Hebbian Learning
   4. Widrow-Hoff Learning
   5. Backpropagation
   6. Associative Learning
   7. Competitive Networks
   8. Grossberg Networks and Adaptive Resonance Theory
   9. Hopfield Networks

II. Fuzzy Set Theory
   1. Introduction to Fuzzy Set with Properties
   2. Fuzzy Relations
   3. Fuzzy Arithmetic
   4. Fuzzy Logic
   5. Applications and Fuzzy Control

III. Genetic Algorithm

1. Introduction to Genetic Algorithm
2. GA Operations
3. Standard Method
4. Rank Method
5. Rank Space Method

IV. Simulated Annealing
1. Introduction to Annealing Process
2. Simulated Annealing Optimization

V. Particle Swarm Optimization
1. Introduction to Swarm Behavior
2. Particle Swarm Optimization

VI. Artificial Intelligence
1. Introduction to Artificial Intelligence
2. Knowledge Representation
3. Blind Search, Heuristic Search, and Optimal Search
4. Adversarial Search

Textbook: No designated textbook, but class notes and handouts will be provided.

Reference Books:

1. D.A. Bradley, D. Dawson, N.C. Burd, A.J. Loader: Mechatronics-Electronics in Products and Processes, Chapman & Hall, 1994.
2. D.M. Auslander, C.J. Kempf: Mechatronics, Mechanical System Interfacing, Prentice Hall, 1996.
3. U. Bolton: Mechatronics-Electronic Control Systems in Mechanical Engineering, Longman Scientific & Technical, 5th edition, 2013.
4. M.T. Hagan, H.B. Demuth, M. Beale: Neural Network Design, PWS Publishing Company, 2nd edition, 2002.
5. M. Brown, C. Harris: NeuroFuzzy Adaptive Modelling and Control, Prentice Hall, 1994.
6. H. Adeli, S.L. Hung: Machine Learning, Wiley, 1995.
7. J.A. Freeman: Simulating Neural Networks with Mathematica, Addison Wesley, 1994.
8. G.J. Klir, U. St.Clair, B. Yuan: Fuzzy Set Theory, Prentice Hall Inc., 1997.
9. W. Pedrycz: Fuzzy Sets Engineering, CRC Press, 1995.
10. E. Rich, K. Knight: Artificial Intelligence, McGraw Hill, 3rd edition, 2009.
11. P.H. Winston: Artificial Intelligence, Addison-Wesley, 1992.

Journals and Magazines:

1. Mechatronics, Elsevier

2. AI Magazine, the Association for the Advancement of Artificial Intelligence (AAAI)
3. Artificial Intelligence, Elsevier

Teaching and Learning Methods: Methods used are lectures and class tutorials.

Time Distribution and Study Load:
Lectures: 40 hours
Tutorials: 10 hours
Self study: 135 hours

Evaluation Scheme: Mid semester examination(40%), final examination (40%) (both are opened book), and tutorials (20%).

In the evaluation, an "A" will be awarded if a student demonstrates an excellent level of understanding of the principles and demonstrates excellent capabilities in control related applications.
"B" will be awarded if a student demonstrates an average level of understanding of the principles and demonstrates average capabilities in control related applications.
"C" will be given if a student demonstrates below average level of understanding of the principles and demonstrates below average level of capabilities in control related applications.

Instructor(s): Dr. Manukid Parnichkun

School Recommendation: _____ ADRC Approval: _____

Academic Senate Approval: _____