2110742 Evolutionary Computation

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Prabhas Chongstitvatana

prabhas@chula.ac.th

Outline

Evolutionary Computation is an approach to computation that emphasize on a general-purpose search algorithm that use principles inspired by population genetics to evolve solutions to problems. Two most well-known methods are Genetic Algorithm (GA) and Genetic Programming (GP). GA and GP has become increasingly popular in recent years as a method for solving complex search problems in a large number of disciplines. This course will illustrate the basic concept of GA/GP and their current applications.

The topics include Evolutionary Strategies (ES), the method of real-value optimization, and Classifier System (CFS), one of the most advanced study in Complex Adaptive System (CAS). The content of the course will be a mixture of mathematical material and up-to-date research materials. The lecture will be mainly the foundation of the subject. Students are expected to do a number of self-study on to answer the questions posted weekly. Those questions concern the subject at a deeper level.

Weekly schedule

- Introduction to Evolutionary Computation
- Simple Genetic Algorithms
- Foundation of Genetic Algorithms : Schemata Theory
- Genetic Algorithms as Search in Hyperplane, k-arm bandit
- Niching and other genetic operators
- Genetic Algorithms Applications
- Genetic Programming
- Some examples of solving problems by GP
- GP implementation
- Classifier systems
- Evolutionary strategy
- Ant colony system
- Current issues in GA/GP

Assesment

written exam, final 50
mid term paper 30
presentation 20
homework every two weeks, no score (each takes 3-5 hours)

Text

1. Goldberg, D., Genetic algorithms, Addison-Wesley, 1989.
2. Holland, J. H., Adaptation in natural and artificial systems, MIT press, 1992.
3. Vose, M., The simple genetic algorithm: foundation and theory, MIT press, 1999.
4. Winter, G., Periaux, J., Galan, M., Cuesta, P. (eds), Genetic algorithms in engineering and computer science, John Wiley, 1995.
5. Mitchell, M., An introduction to genetic algorithms, MIT press, 1996.
6. Koza, J., "Genetic Programming Vol 1, 2, 3", MIT Press, 1992, 1994, 1999.

Uptodate handouts on various current researches will be distributed in the class.