TOPICS IN EVOLVING SOFTWARE

ASU CSE 591

Spring Term, 2018
Mon, Wed 12:15 - 1:30 BYAC 260

Professor: Stephanie Forrest

Office: BYENG 394
Phone: 480-727-0492 (during office hours only)
Email: stephanie.forrest@asu.edu (anytime)
Office Hours: Wed 2 - 3 (BYENG 394), Thu 10:30 - 11:30 (Biodesign), or by appointment
Web site: TBD

Textbook: *Introduction to Genetic Algorithms* M. Mitchell, MIT Press 1996
Introduction to Evolutionary Computing A.E. Eiben and J.E. Smith,
Springer 2015 (optional)

Selected Readings

Course Description:

A graduate introduction to selected topics in the field of evolutionary computation, biological underpinnings, and evolutionary aspects of software. The course will introduce genetic algorithms, genetic programming, and other examples of evolutionary computation. It will focus, in particular, on applications of evolutionary computation to software engineering problems, evidence that software is produced, at least to some extent, through Darwinian evolutionary dynamics, and it will explore quantitative methods and theoretical models in evolutionary biology that may be relevant to software.

There will be some assigned programming projects, and significant amounts of reading and discussion, which will require knowledge of computer science and intellectual maturity. In addition to lectures, we will read one to two papers per week, and there may be some small writing assignments. Students will be responsible for presenting the papers, giving a short summary and asking discussion questions.

Programming maturity or permission of instructor required.

Course Assignments and Grading:

Expect to spend a significant amount of time each week reading and preparing the assigned papers (plan on one or two scientific papers per week).

Assignments will involve reading, discussing, and presenting research papers, and 2-3 programming assignments. 50% of the course grade will be based on class participation and individual presentations and 50% on the assignments. Class participation includes summarizing and presenting papers, leading a class discussion, and contributing substantive and critical ideas to class discussions.

Course Topics

Introduction (1 week

Biological Underpinnings (1 week)
Lecture: Introduction to genetics
Discussion: Origin of Species, Ch. 1-3

Computational tools (2 weeks)
Genetic algorithms
Theory
Genetic programming and artificial life models

Using Evolutionary Computation to Solve Problems (3 weeks)
Function optimization
Multiobjective search
Evolving neural networks (NEAT) and novelty search
Distilling free-form natural laws from experimental data
Evolutionary robotics

Evolving Software (2 weeks)
Automated software repair
Nonfunctional properties of software
Other software engineering applications, e.g., test cases
Malware evolution

Neutral landscapes and the evolutionary theory (2 weeks)
Biological underpinnings
Mutation testing
Software mutational robustness

Is software engineered or evolved? (1 week)
The nature of technology
Software repositories and other experimental systems

Project Presentations and Course Wrapup (2 weeks)