We propose a self-adaptive genetic algorithm, SAGA, for the purposes of improving the usability of genetic algorithms on both static and dynamic problems. Self-adaptation can improve usability by automating some of the parameter tuning for the algorithm, a difficult and time-consuming process on canonical genetic algorithms. Reducing the need for parameter tuning helps towards making genetic algorithms more attractive for those who are not experts in the field of evolutionary algorithms, allowing more people to take advantage of the problem solving capabilities of a genetic algorithm on real-world problems.

First, we test on static test problems, where our focus is on usability improvements as measured by the number of parameter configurations to tune and the number of fitness evaluations conducted. Next, we test on dynamic test problems, where the fitness landscape varies over the course of the problem's execution. The dynamic problems allows us to examine whether self-adaptation can effectively react to ever-changing and unpredictable problems. On the dynamic problems, we compare to a canonical genetic algorithm as well as other genetic algorithm methods that are designed or utilized specifically for dynamic problems. Finally, we test on a real-world problem pertaining to Medicare Fee-For-Service payments in order to validate the real-world usefulness of SAGA. For this real-world problem, we compare SAGA to both a canonical genetic algorithm and logistic regression, the standard method for this problem in the field of healthcare informatics.

We find that this self-adaptive genetic algorithm is successful at improving usability through a large reduction of parameter tuning while maintaining equal or superior results on a majority of the problems tested. Furthermore, self-adaptation proves to be a very capable mechanisms for dealing with the difficulties of dynamic environment problems as observed by the changes to parameters in response to changes in the fitness landscape of the problem.

Major: Computer Engineering

Educational Career:
Bachelor's of Aeronautical Engineering, BS, 2013, Embry-Riddle Aeronautical University

Committee in Charge:
Annie S. Wu, Chair, Computer Science
Ronald Demara, Computer Engineering
Ladislau Boloni, Computer Science
Gita Sukthankar, Computer Science
Albert Xinliang Liu, Health Services Administration

Approved for distribution by Annie S. Wu, Committee Chair, on March 2, 2020.

The public is welcome to attend.