Quarter 3

Applications of Genetic Algorithms

TJHSST Computer Systems Lab 2008-2009

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Abstract

The purpose of this project is to explore the applications of genetic algorithms, an evolutionary computation search technique, to find approximate solutions to optimization problems. This project will focus on computing the minimum point on a three dimensional graph. The goal is to find the minimum point without testing every single point on the graph, a very computational intensive process. This project will explore various population sizes on the efficiency and effectiveness of finding the answer to the problem.

Procedures and Methods

I am using C with OpenGL to write my program. I currently have the OpenGL component (3D graphing) completed and I am writing my genetic algorithm in C.

The graph of appears on the screen in a wire-mesh of points. N randomly-generated yellow points appear on the screen, where N is the number in the population. They consist of the population.

The “Step” button allows the user to cycle through the following steps, which consist of one iteration. Each time the step button is pressed, the following commands cycle:

Cycle of the genetic algorithm steps:
- 25% of the population population selected based on the fitness function
- Delete selected points
- New points are bred based on best point
- Random Mutation
- New points become part of the population

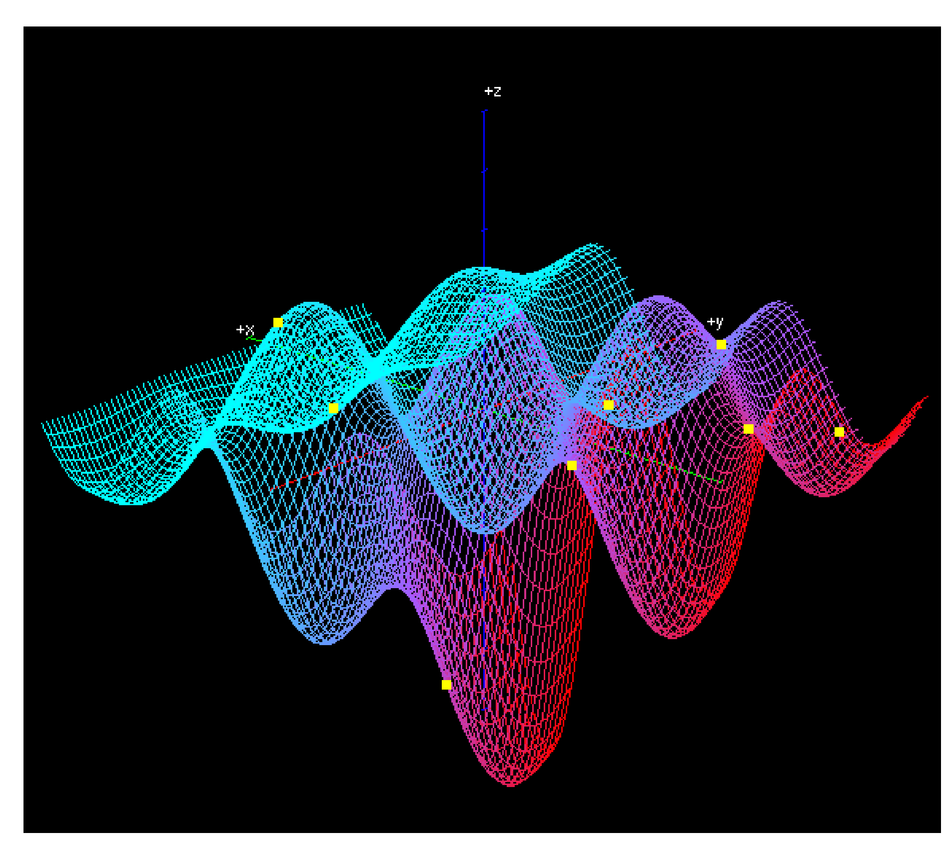
Reset: re-initializes all values, increments seed
Step: steps through the genetic algorithm
One iteration: runs 5 steps (a full cycle)
Single Trial: runs a fixed number of iterations
Multiple Trials: runs a fixed number of single trials

Background

Genetic algorithms can reduce the amount of time and computations required to solve a complex problem. Using a “population” of “individuals,” genetic algorithms can approximate the solution to a wide variety of problems. One such problem is finding the minimum of a three-dimensional graph.

Visual

The program displays the results on a 3D graph:



$$z=\frac{-(\cos(x*8.0)+\cos(y*8.0)*(1-x)*(1-y))}{5.0}$$

Results and Conclusions

True z-value for graph used: -0.84411
Population size of 8
Average result: -0.52009
Difference from true minimum: 0.32403