(Practice)
An Introduction to Evolutionary Computation
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Abstract

A series of exersises are given to better understand my lecture. Enjoy!

1 Simplest Examples

Exercise 1 (A test-function — Sphere Model) *Create your code step by step following the bellow.*

1. *Create a population of 20 chromosomes each of which is made up of 10 genes. Assign each of these (a total of 200) genes one by one a random continuous value which ranges from* -1.00 *to* 1.00*. Then show all of those chromosomes on the display screen.*
2. *Evaluate each chromosome of its fitness value* y *(how good it is) by calculating*

$$y = x_1^2 + x_2^2 + x_3^2 + \cdots + x_{10}^2$$

   The smoller the fitness the better it is, because we are looking for the minimum value of y*. Add the value at the end of each displayed chromosomes in 1. (Those are the 1st generation).*
3. *Evolve these 20 chromosomes by*
   (1) *Sort these 20 chromosomes according to the fitness (from better to worse). Re-order your 10 chromosomes in this order on the screen.*
   (2) *Pick up two chromosomes from the best 10 chromosomes at random (Truncate-selection), and create two children by one-point crossover. Then give a mutation with a probability* 0.01 *(create a random number from 0 to 99 and if it is 0 mutate otherwise do nothing) — this is repeated 200 times from gene to gene and from chromosome to chromosome). Then repeat this 10 times to reproduce 20 children. A set of these 20 child-chromosomes is called 2nd generation.*
   (3) *Repeat 3 – 4 until...*
4. *Plot average-fitness and maximum-fitness in the population against generation (fitness vs. generation curve).*

Exercise 2 (Selection) *Repeat all the procedures in the Excercise 1 with*

1. *Tornament Selection*
   - *with tornament size 2 and 5 for example,*
2. *Roulette Wheel Selection (Fitness Proportionate)*

Then Compare the results.

Exercise 3 (Crossover) *Repeat all the procedures in the Excercise 1 under your favorite selection scheme with*

1. *One-point Crossover*
2. *Uniform Crossover*

Then Compare the results.

Exercise 4 (Schwefel Function) *Repeat all the procedures in the Excercise 1 under your favorite selection and uniformcrossover with*

$$y = x_1 \sin |x_1| + x_2 \sin |x_2| + \cdots + x_{10} \sin |x_{10}|$$

2 Neural Network Learning

Weights for XOR