

Instructions for Creating and Running your own Genetic Algorithm

Cognitive Science, Fall 2010

Professor Blank, CS371

In this lab, we will use the GA package written in Python. You can read background material on this here: <http://pyrorobotics.org/?page=PyroModuleEvolutionaryAlgorithms>

- 1) Log into one of the computers in the Computer Science Linux network with the password provided in class (you can change your password with the command **cspasswd**).
- 2) Start a Terminal (Menu → Applications → System Tools → Terminal)
- 3) At the Terminal prompt, type:

export PYTHONPATH=/home/dblank

Match the case of letters and spaces exactly. If you make a mistake, press the UP-ARROW and edit the command (or just re-type it).

- 4) At the Terminal prompt, type:

idle

You are now running IDLE, a Python environment for running and editing programs. In this lab, we will be putting multiple commands into a file, and loading them at once. Use the idle → menu → File → New Window command.

In the first demo, you will build a GA that creates a list of 10 large numbers. Enter

```
from pyrobot.brain.ga import *

class MaxSumGA(GA):
    def fitnessFunction(self, i):
        return max(sum(self.pop.individuals[i].genotype), 0)
    def isDone(self):
        return self.pop.bestMember.fitness > 30

ga = MaxSumGA(Population(15, Gene, size=10, mode='integer',
                        verbose=1, elitePercent = .1),
              mutationRate=0.1, crossoverRate=0.5, verbose=1,
              maxGeneration=50)

ga.evolve()
```

In this example:

- we use a population size of 15 individuals
- each individual is length 10, of integers (whole numbers)
- the sum of an individual's numbers is its fitness
- we run for a maximum of 50 generations
- we stop if we get a sum of all numbers greater than 30
- on each generation, 10% are mutated, 50% are used in sexual recombination, and 10% are saved without any changes (the so-called “elite”)

Try running some of the other demonstrations from the Pyro Robotics web page:

- 1) Large Binary Numbers
- 2) A Neural Network that can perform Exclusive-Or
- 3) 8 Queens

You can read about controlling a robot, Genetic Programming, and the next section in Pyro Robotics, “Evolution of Language” but you need not do any of those experiments.

For Monday, design your own GA and let it evolve.

Some possible questions:

- 1) How is the GA like real evolution? How is it unlike it?
 - 2) How is evolving XOR different from learning XOR with a neural network?
 - 3) How does changing the mutation and crossover rates affect evolution?
 - 4) How does changing the population size affect evolution?
 - 5) Can evolution account for creating human intelligence?
 - 6) What is a real FitnessFunction?
-