Artificial Neural Network Training Through Simulated Natural Selection

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Abstract

Artificial Neural Networks (ANN’s) are an effective implementation of artificial intelligence which can be trained to accomplish specific tasks. One promising avenue of research in the area of training ANN’s is simulated natural selection.

This project implements Artificial Neural Networks (ANNs) in the Java programming language in an attempt to “evolve” simple fight-or-flight intelligence within a community of AI objects through simulated natural selection. The program output includes a visual simulation of the community as the individuals interact with each other in two dimensions. Individuals are represented as a colorful circle moving on a plane. The program imposes a set of laws on the community that affect their condition, but at the initialization of the simulation, each individual begins only with a randomly weighted ANN.

The rules of the world in which the community operates are basically the rules for simple living creatures. When multiple individuals are in contact, they will attempt to consume each other. The value of the consumption is a function of their relative color. The purpose of this is to give each individual some preference toward what they consume. They must also multiply (create a new individual) once they have consumed a certain amount. The offspring begin with an ANN weighted similarly to its parent, but with each weight having been randomly varied by a small percentage. In theory, the individuals who have the most effective weights will survive to reproduce, and others will not. As the generations pass, the ANNs should become increasingly effective at ensuring survival.

The inputs to the ANNs are essentially the sensory input of each individual. They include the individual’s color and relevant data on a variable number other nearby individuals - relative position in polar coordinates and color. The output of the ANN is simply the desired direction of movement in radians.

After running for a sufficient number of generations, the ANNs inside each individual should be weighted in a manner that attempts to keep themselves alive. That is, they should move toward others that they prefer to eat, and stay away from others that would eat them. Assuming the simulation is successful, it will be particularly interesting to observe how they interact with other individuals for whom they have no consumption preference.