AI in video games using Neural Networks and genetic algorithm

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Introduction

In video games, artificial intelligence is used to generate intelligent behaviors primarily in non-player characters (NPCs), often simulating human-like intelligence. The techniques used typically draw upon existing methods from the field of artificial intelligence (AI). However, the term game AI is often used to refer to a broad set of algorithms that also include techniques from control theory, robotics, computer graphics and computer science in general.

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Purpose

Creating different AI for each individual game can be demanding and time consuming. Instead, we could use a generic neural network trained with a good set of training rules.

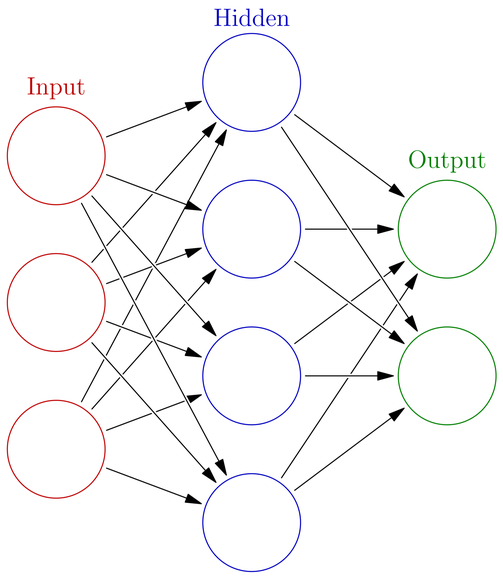
A player has to learn the game himself, why not make the AI do the same?

Methods

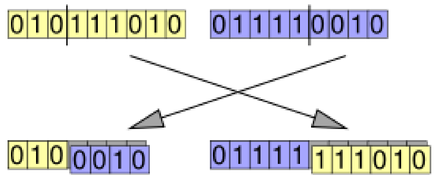
Initial neural network structure is predefined. Number of input neurons, hidden layer structure and output neuron count may vary from game to game. Programmer must know and set these parameters in advance.

There must also exist an environment where neural networks can be trained.

Using genetic algorithm, we must make a initial population of randomly generated neural networks and a fitness function which indicates how successful the neural networks was in accomplishing a given task. After the initial parameters have been set, neural network must be trained until the it has accomplished the task.



Basic Neural Network Structure



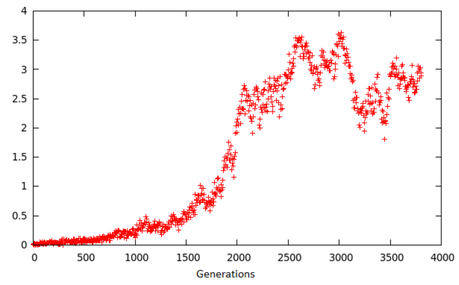
Genetic algorithm

Results

In the graph below we can see results of training a neural networks for a top down shooter game. After 2000 generations we can see that the average fitness has started to increase exponentially.

For some more complex games, where the game rules are far more complex, using neural networks and genetic algorithm may not be optimal.

Training times also vary quite a lot. In some instances, neural networks learn the task in few hundred generations, and in other cases a few thousand.



Fitness of each neural network through generations