Reinforcement Learning Using Cascade-Correlation Neural Networks Presentation Abstract

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1 Background

Reinforcement learning is one of the approaches used in Artificial Intelligence to find solutions to agent-based tasks. Although small problems can be solved using lookup tables, more complicated ones require the use of function approximators. Several of these exist, including neural networks with which many tasks have been solved. However, standard neural networks trained using the back-propagation algorithm require a high degree of parameter tweaking. Cascade-correlation neural networks do not require as much work since they follow a constructive approach.

2 The Problem

Cascade-correlation neural networks cannot be used *per se* in reinforcement learning as they require a batch of data, whereas usual reinforcement learning algorithms function in online mode, learning from each sample as it is collected. During this summer, we attempted to use a cache of samples in order to provide the cascade-correlation algorithm with a batch of data while keeping a certain degree of online learning. This idea had already been developed by Francois Rivest and Doina Precup but not tested on a large-scale task.

3 The Car Rental Task

In order to familiarize ourselves with the various parts of the algorithms, we first set up the simple *Car Rental Task*, which can be solved using a lookup table and dynamic programming. This provided us with additional test results, as well as allowing us to compare the algorithm's performance with that of a lookup table.

4 The Backgammon Task

The core of the research project was spent on applying the algorithm to the game of Backgammon. Backgammon is a large-scale task, with too many positions to correctly be learned by a lookup table. Previous works, such as Tesauro's TD-Gammon, have shown the potential of neural networks in reinforcement learning function approximation. We thus applied our algorithm to this problem in order to compare its performance with that of the standard backpropagation neural network.