

# Training a Neural Network for Checkers

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# 1 Declaration

I, Daniel Boonzaaier, declare that this thesis A Learning Program for Checkers is my own work, that it has not been submitted before for any degree or assessment at any other university, and that all the sources I have used or quoted have been indicated and acknowledged by means of complete references.

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## 2 Abstract

*This project will attempt to create a learning program that teaches itself how to play checkers using a neural network. Learning will be done by having the program play checkers numerous times and then evolve based on the outcomes of each game played.*

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### **3 Introduction**

Machine learning is not a new concept in computer science. Arthur L. Samuels Some Studies in Machine Learning Using the Game of Checkers was originally published in July 1959.

Machine learning is about computer algorithms that allow a computer to learn and is related to a branch of statistics called computational learning theory. Neural Networks are but one type of Machine Learning methods that use input nodes that are connected to a hidden layer via different weights which are in turn connected to an output layer via more weights.

Checkers is a good game to train as it provides complete information. Which means that the complete status of any game is known to the players at all times throughout the game.

### **4 Proposal**

This project will attempt to create a learning program for the game of checkers using a neural network to autonomously learn to play checkers from scratch. In other words, the program will teach itself how to play checkers.

The main focus of this project will be training of a neural network by having the program play the game of checkers a multitude of times. By having the program play against itself the goal is that this program will learn from a predetermined set of rules how to play. Consideration will have to be made in order to make sure that the neural net for this program is not over trained.

### **5 Project Plan**

This project will have four main parts that will take place throughout the year of 2017 with each part of the project taking place in each quarter of the year.

The first part of the project which is the analysis of the project is the research into what the project will require and the analysis of said requirements from the stand point of the user and software. Researching past works related to the project as well as technologies and software related to the project will assist in guiding the projects development.

The second part of the project is the projects design and development. This entails the creation of a User Interface Specification and prototype. From this an Object Orientated Analysis and then an Object Orientated Design can be done. This will take a closer look at the setup of the neural network and other related software.

The third part of the project is the projects implementation where the design previously done will be used to create the projects learning program. The implementation will need full documentation.

The final part of the project will be the projects testing, evaluation and presentation. Here the created program will be tested to determine whether it works according to expectations and refined if needed.

## 6 User Requirements

The program shouldn't require much from the user. The user simply needs to determine whether or not the program has developed in its playing abilities.

The program will need to play checkers in some way and learn the best moves to make in order to win.

How the neural net will work, its layout and application will need to be well thought out. The interface be it graphical or otherwise will need to be thought.

The program simply needs to show that it has learned how to play checkers without outside help from a user. Playing against the program should be possible and could be done further but is not the goal.

## 7 Requirements Analysis

There are previous works done on autonomous game playing systems that involve various games, checkers included. One such work, which was mentioned in the introduction, is Arthur L. Samuels implementation.

Another implementation was done by Nelis Franken and Andries P. Engelbrecht. Particle Swarm Optimisation was used in the implementation of their game playing program.

Thus one implementation of the checkers game learning/playing program may be done using the neural net in conjunction with gradient decent in its back propagation and the second using the particle swarm optimisation technique in its back propagation.

All possible moves need to be analysed and the system should determine which move is the best one to make in order to win. The program will need a look ahead to determine possible moves.

Testing of the program should be as simple as seeing whether or not the program follows the rules set out for the game of checkers and if it has learned to play the game properly and the a decent level of competency.

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