ANALYSIS OF REINFORCED NEURAL NETWORKS

Adam Amanbaev, Hugo Åkerfeldt, Jonathan Hallström, Romeo Patzer

Supervisors: Ulf Backlund & Bertil Lundberg

Abstract

In late 2017 DeepMind announced a groundbreaking system in a preprint [1] and the results were astonishing. The system was called AlphaZero and utilized *artificial neural networks* in order to teach itself the game chess without any proprietary knowledge, except the rules. After approximately 9 hours it was able to beat the strongest hand-crafted engines, such as Stockfish and it had learned centuries of human knowledge of chess. In this paper we aim to study the effectiveness of different *neural networks* such as the one used in AlphaZero. To be precise, we will analyze the efficiency of those networks in combination with varying *algorithms, optimizations, parameters, hyperparameters* and *architectures* applied to the classic game and variations of connect-four.

Keywords — Machine Learning, AI, Reinforcement Learning, Neural Network, Deep Learning

Contents

1 Motivation

2 Introduction

2.1 What is Reinforcement Learning

2.2 What is Deep Learning

2.2.1 Artificial Neural Networks

2.2.2 Deep Reinforcement Learning

3 Notation and Definitions

3.1 Sigma Function

3.2 Vector

3.3 Matrix

3.4 Derivative

3.5 Gradient

References

[1] Silver, David; Hubert, Thomas; Schrittwieser, Julian; Antonoglou, Ioannis; Lai, Matthew; Guez, Arthur; Lanctot, Marc; Sifre, Laurent; Kumaran, Dharshan; Graepel, Thore; Lillicrap, Timothy; Simonyan, Karen; Hassabis, Demis (December 5, 2017). "Mastering Chess and Shogi by Self-Play with a General Reinforcement Learning Algorithm".