

Research Review

This work is a small review of the article “Mastering the game of Go with deep neural networks and tree search” - published on NATURE | VOL 529 | 28 JANUARY 2016, describing the DeepMind work on applying IA to the game of Go.

Resume:

This research focus on providing a new approach to Artificial Intelligence on playing Go Games. The Go Game is considered to be the most challenging classic game for artificial intelligence, because of its humongous search space.

Techniques used:

The technique introduced uses search, but not on the game space as is, but in a pre-built “value tree” using Monte Carlo Tree Search.

First, there was built a neural network to predict the next move based on actual state, called “Policy Network”. The game would choose, based on actual state, a new state, based on examples of a professional players database. Then, this network was refined using Reinforcement Learning, playing with itself and rewarding winning moves for this player.

Another network was built, called “value network”, to predict the winner, trained with reinforcement learning analysing states of two policy networks playing with each other. To minimize overfitting, there was generated a sample from different games at different positions, otherwise the network would simply memorize the sequence of previous played games and would not generalize.

Then, the final algorithm combines the two networks using Monte Carlo Tree Search (partially random) with total exploration, but selecting only most promising nodes. To encourage exploration, a visit counter penalizes already explored edges.

Even with all the pretrained value and policy guides, searching in Go is still huge space, with the overhead of evaluating neural networks, several times of magnitude more computing than traditional heuristic. Then, there was developed an asynchronous, distributed, multi-threaded search.

Results:

The results of the research are impressive. The algorithm beat previous Go algorithms almost in all matches made, with . And, for the first time, a machine could beat a professional human Go Champion, the European three times champion Fan Hui, a fact that was achieved ten years before it was expected.

(In fact, with some improvements made with iterations with human players, including Fan Hui, focusing on discover the algorithm weak points, AlphaGo beat the world champion a year later, but this was later than the research publication, so it is not on this text)