AlphaGo Research Review

AlphaGo is an Artificial Intelligent agent, designed to play the game Go. Go is a much more complex game than chess, of which a computer first defeated the world champion in 1997. In comparison chess has approximately 35^{80} moves, whereas Go has 250^{150} moves meaning it is a much harder task to create a game winning agent with Artificial Intelligence.

The last breakthrough in Agents playing the game of Go were based on the MCTS (Monte Carlo Tree Search) enhanced by policies that predict human moves. Agents using this technique could play at a strong amateur level.

AlphaGo combines search: MCTS (Monte Carlo Tree Search), with deep neural networks. At the heart of AlphaGo is Machine Learning. It uses Supervised Learning by training itself from a series of expert human moves, and reinforcement learning by learning from the outcomes of self-play. This combination of these Machine Learning techniques creates the policy network. The agent samples actions using this policy network.

A value network predicts the winner of games by using reinforcement learning against itself. To avoid overfitting in the value network, which is caused by just looking at data consisting of complete games. AlphaGo was trained using generated self-play data sets consisting of 30 million distinct positions. The agent evaluates the positions of the board using this value network.

By combining the policy and value networks with MCTS, AlphaGo managed to win 494 out of 495 (99.8%) against the best other Go agents: Crazy Stone, Sen, Pachi and Fuego. All of these programs are based on MCTS algorithms. In addition to these agents, an agent was included clled GnuGo which used state of the are search methods preceding MCTS. The computer used for these games used 40 search threads, 48 CPUs and 8 GPUs.

To beat the reigning European Go champion Fan Hui, AlphaGo ran on multiple machines using 40 search threads, 1202 CPUs and 176 GPUs. The result of the tournament was 5-0 to AlphaGo, which meant that it was the first agent to beat a professional Go player. A feat not though possible for 10 years.