

AlphaGo by the DeepMind Team

AlphaGo has played a crucial part in Artificial Intelligence history - by procuring the professional playing skill on par with the best human Go participants. A very first for a computer program. AlphaGo had a 99.8% winning record against not only existing Go programs (Crazy Stone¹³, Zen, Pachi¹⁴, GnuGo and Fuego¹) but also defeated Fan Hui, the human champion by 5-0.

The goal to achieve human-level performance was extremely challenging, a feat that involved a seemingly insurmountable search space, complex decision-making, the evaluation and optimization of board positions and moves. Unlike games of chess and checkers, traditional depth-first minimax search with alpha-beta pruning has never been effective when applied in the game of Go. However, AlphaGo was able to successfully scale the combination of key tasks within a high-performance (40 search threads, 48 CPUs, and 8 GPUs) tree-based lookahead search.

New Techniques

By integrating complementary deep neural networks (trained by using a fresh approach of supervised learning from human game-play and reinforcement learning from games of self-play) and tree search, AlphaGo was able to leverage board position evaluation with value networks and move selection functions or sampling actions with policy networks, to reduce the search space. The use of evaluations with Monte Carlo rollouts was presented. A similar methodology to Monte Carlo tree search (MCTS) methods was enhanced upon by AlphaGo, integrated with policy and value networks.