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Mastering the game of Go with deep neural networks and tree search

Techniques

The main idea of the paper is the usage of deep neural network to create a game playing agent with an exceptional performance when playing Go. The paper mentions an approach in which they use three neural networks as follow:

Supervised learning network

Supervised learning policy network trained with human expert moves, this network is build with 13 layers and is trained using image representation of the board with moves taken from the KGS Go server, performing a classification task which produces a policy gradient.

Reinforcement learning network

Reinforcement learning policy network that evaluates self-play outcomes of the current state of the game, producing a probability distribution of moves.

Reinforcement learning network

Reinforcement learning value network that predicts the winner of games played with the previous network, with input as the output of the previous network performing a regression to establish the winner.

In combination with Monte-Carlo tree search which utilizes random sampling of the tree evaluating each game tree branch, storing evaluations for each branch that determines the most promising moves. The value for each explored node is the mean of an evaluation function over the number of visits on that node.

Results

Due to the combination of policy and value networks with tree search the game agent is able to evaluate far fewer moves than DeepBlue did in its chess match.