TTIC 31230, Fundamentals of Deep Learning

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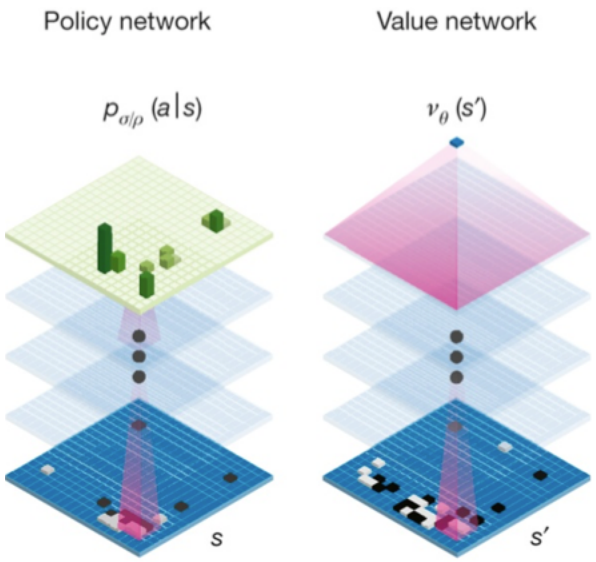
AlphaZero Quantitative Results

The Go-Chess-Shogi Networks



In AlphaZero the networks are either 20 block or 40 block ResNets and either separate networks or one dual-headed network.

Training Time

Single 20 block dual-headed ResNet on Go.

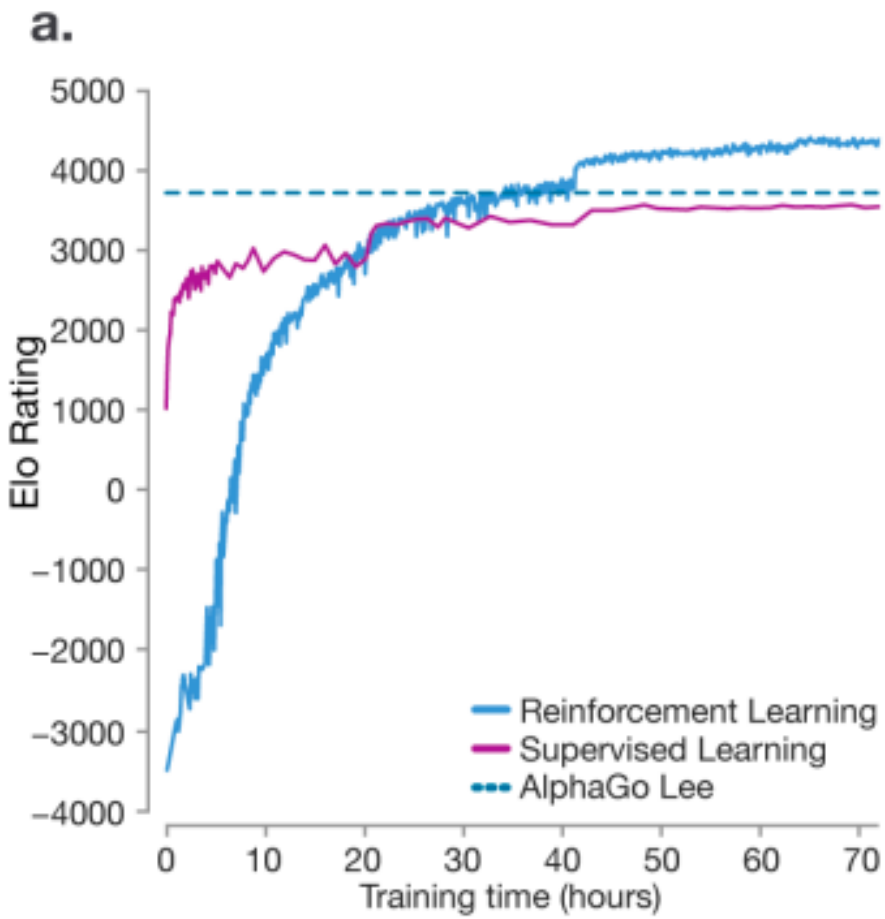
4.9 million Go games of self-play

0.4s thinking time per move

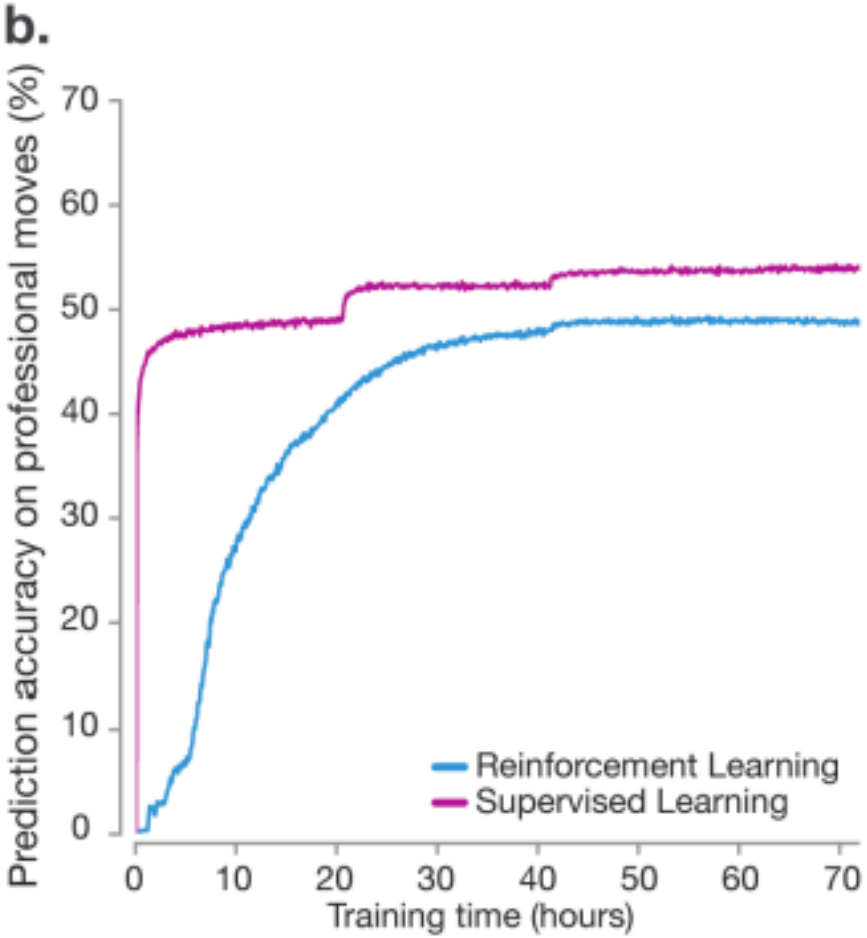
About 8 years of Go thinking time in training was completed in three days

About 1000 fold parallelism.

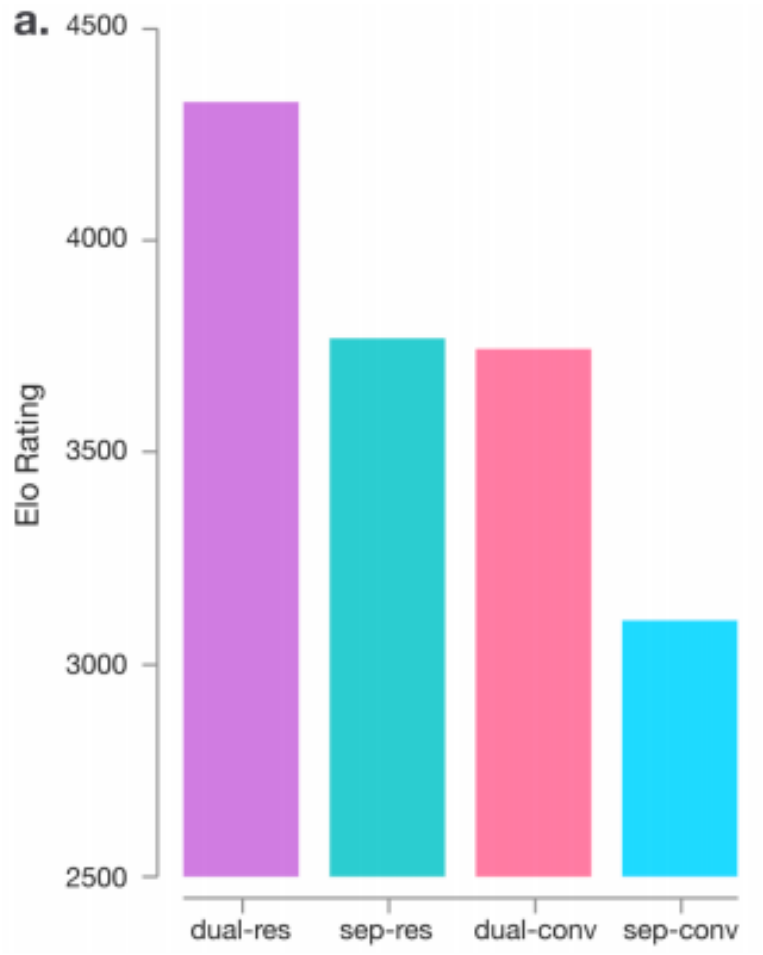
Elo Learning Curve for Go



Learning Curve for Predicting Human Go Moves



Ablation Study for Resnet and Dual-Head



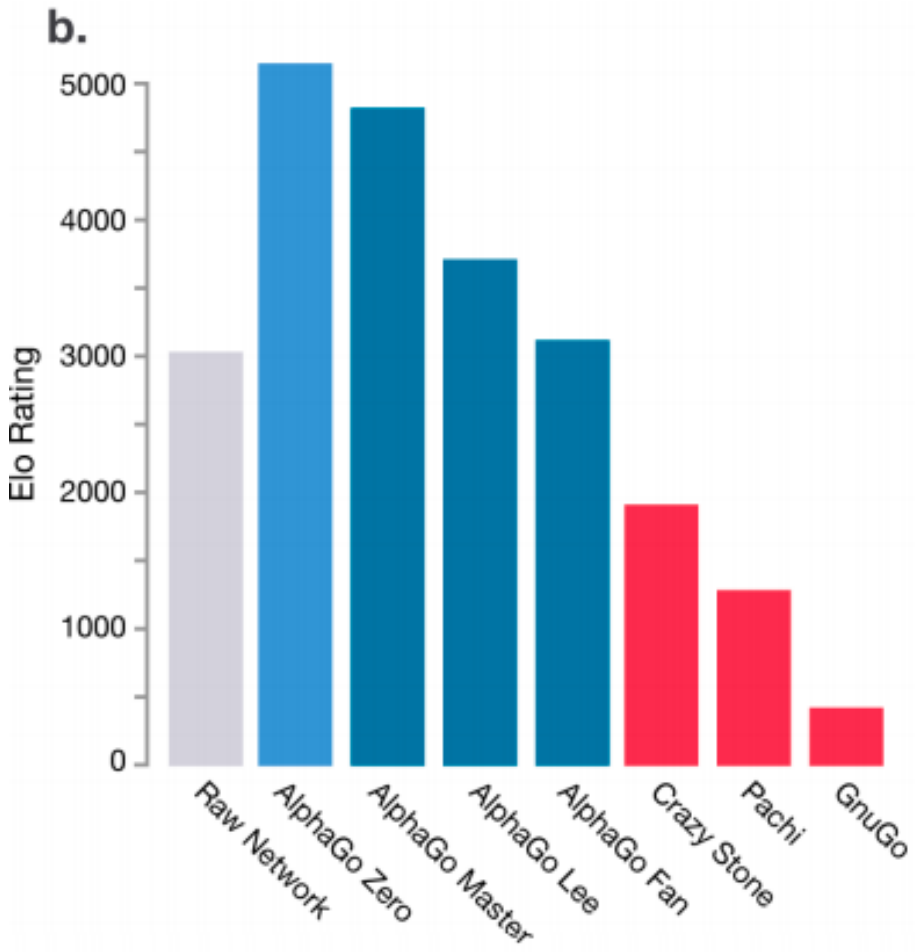
Increasing Blocks and Training

Increasing the number of Resnet blocks from 20 to 40.

Increasing the number of training days from 3 to 40.

Gives a Go Elo rating over 5000.

Final Go Elo Ratings



Is Chess a Draw?

In 2007 Jonathan Schaeffer at the University of Alberta showed that checkers is a draw.

Using alpha-beta and end-game dynamic programming, Schaeffer computed drawing strategies for each player.

This was listed by Science Magazine as one of the top 10 breakthroughs of 2007.

It is generally believed that chess is a draw. It was even conjectured that Stockfish could not be defeated ...

AlphaZero vs. Stockfish in Chess

From white Alpha won 25/50 and lost none.

From black Alpha won 3/50 and lost none.

AlphaZero evaluates 70 thousand positions per second.

Stockfish evaluates 80 million positions per second.

END