

SC42050 Literature Assignment

# Super-human board game playing

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Boardgames offer an interesting testbed for artificial intelligence. They often have simple, discrete and fully observable state and action spaces and very clear performance criteria. Yet despite their apparent simplicity, they are designed to challenge humans. The game of Go is a good example. While the rules of the game are very simple, this simplicity gives rise to a very complex game. Until recently it was believed that mastering this game required human intuition. Humanity has however since been overtaken by computers as the superior Go player. The current best Go playing algorithm is alphaGo Zero (Silver et al., 2017). Read the paper and answer the following questions:

1. An earlier version of the AlphaGo algorithm beat the best human Go player, Lee Sedol, in 2016. Almost two decades earlier in 1997, the DeepBlue chess computer (Hsu, 1999) defeated the human chess world champion Gary Kasparov. Discuss what makes Go so much harder than chess, and how this motivated the different approaches of the two algorithms, specifically related to feature engineering, learning and function approximation.
2. Compare the deep reinforcement learning method in (Silver et al., 2017) to another popular deep reinforcement learning method that is applicable to domains with discrete actions. What additions are in (Silver et al., 2017) and what is their function? What assumptions are needed for the additions to be applicable?
3. The Zero variant of AlphaGo learns entirely from self-play. Discuss the pros and cons of self-play learning and some other works from the literature where self-play or related learning concepts are used on domains other than games.

## References

- Hsu, F.-H. (1999). IBM's deep blue chess grandmaster chips. *IEEE Micro*, 19(2):70–81.
- Silver, D., Schrittwieser, J., Simonyan, K., Antonoglou, I., Huang, A., Guez, A., Hubert, T., Baker, L., Lai, M., Bolton, A., et al. (2017). Mastering the game of go without human knowledge. *Nature*, 550(7676):354.