

Master Thesis

From Board Games to Real Life: Using AlphaZero for Decision Making of Automated Vehicles

Super-human performance in the game of Go was achieved by Deepmind's AlphaGo and AlphaGo Zero algorithms [1,2]. Those algorithms combine the strengths of neural networks trained by reinforcement learning (RL) and Monte Carlo tree search (MCTS) in a powerful way. Those algorithms have been generalized to other board games [3] and have been used in the domain of automated driving before.

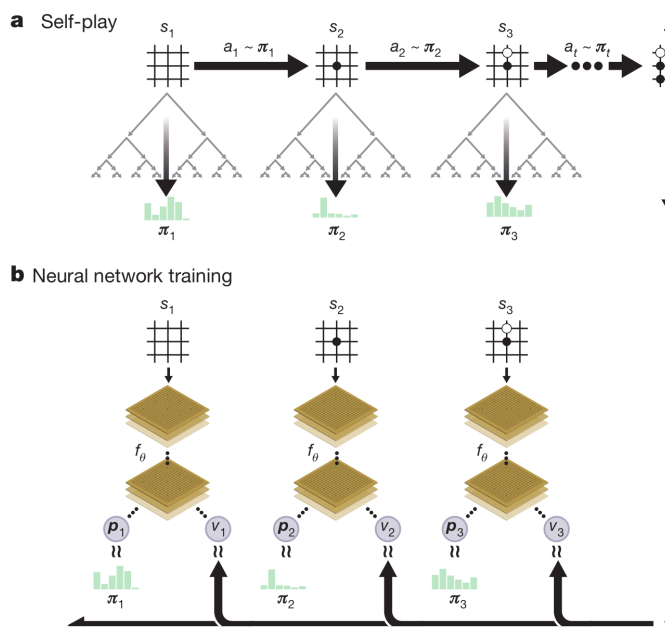


Illustration of AlphaZero training [2]

Following this work, the goal of the thesis is to explore further applications and improvements of AlphaZero for decision making in autonomous driving. Possible extensions are the implementation of a dynamic input representation [5], considering partial observability of the environment [6] or learning a model of the environment before solving the problem [7].

This sounds exciting? Then apply to us! Methods and scope of the thesis can be adapted to your interests and previous knowledge. I am happy to answer any questions you might have. Feel free to ask for an appointment or directly ask at my office!

References

- [1] Silver et al., "Mastering the Game of Go with Deep Neural Networks and Tree Search", (2016)
- [2] Silver et al., "Mastering the Game of Go without Human Knowledge", (2017)
- [3] Silver et al., "Mastering Chess and Shogi by Self-Play with a General Reinforcement Learning Algorithm", (2017)
- [4] Hoel et al., "Combining Planning and Deep Reinforcement Learning in Tactical Decision Making for Autonomous Driving", (2020)
- [5] Huegle et al., "Dynamic Input for Deep Reinforcement Learning in Autonomous Driving", (2019)
- [6] Bouton et al., "Cooperation-Aware Reinforcement Learning for Merging in Dense Traffic", (2019)
- [7] Schrittwieser et al., "Mastering Atari, Go, Chess and Shogi by Planning with a Learned Model", (2020)

Institute of Measurement and Control Systems (MRT)
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Advisor:

Johannes Fischer, M.Sc.

Programming language(s)¹:

Python or advanced
Julia

System, Framework(s):

Linux

Required skills:

- Solid mathematical foundations
- Work on your own

Language(s):

German, English

For more information please contact:

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Or directly send in your application including your current grades as well as our questionnaire!



¹ skill levels:

beginner < 500 lines of code (LOC)
advanced 500 – 5000 LOC
proficient > 5000 LOC