Chess AI: GrandQ

5-Artificiële Intelligentie

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GrandQ

- ▶ Special Q-learner
  - ▶ Alpha-Beta pruning agent inside
- ▶ Our project has 2 agents
- ▶ Based on:
  - ▶ Mannen, H. (2003). *Learning to play chess using reinforcement learning with database games*. Utrecht: Utrecht University. Retrieved 12 12, 2020, from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.109.810&rep=rep1&type=pdf
- ▶ Git: https://gitlab.com/Artificiele_Intelligentie/chess

Q-Learning agent

- ▶ Generalised Q-Learner
- ▶ Highly optimized
  - ▶ Multi-threading
    - ▶ Mutex locking
  - ▶ Caching of states
- ▶ Faster at calculating $\rightarrow$ Faster training

Q-Learning agent: Features

- ▶ Lots of features
  - ▶ Better understanding of environment
  - ▶ Alpha-Beta for predicting
- ▶ Struggles with overlearning
  - ▶ Normalise input
  - ▶ $\sigma^*(x) = \frac{2}{1+e^{-x}} - 1 : \sigma^*(x) \in \,]-1, 1[$
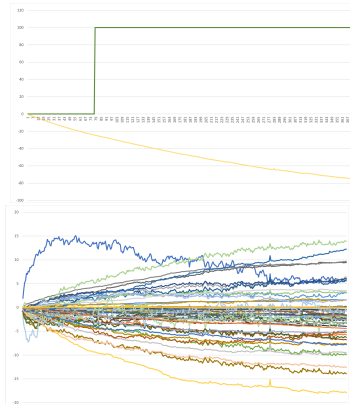   - ▶ Derived from $\sigma(x) = \frac{1}{1+e^{-x}}$

Q-Learning agent: Training

- ▶ Created convenient script
  - ▶ Changing variables quick (like max depth, epsilon, ...)
- ▶ Trained on VPS
  - ▶ Google collab: slow with CPU driven programs
  - ▶ Microsoft Azure:
    - ▶ Ran on Free Credits
    - ▶ About a week
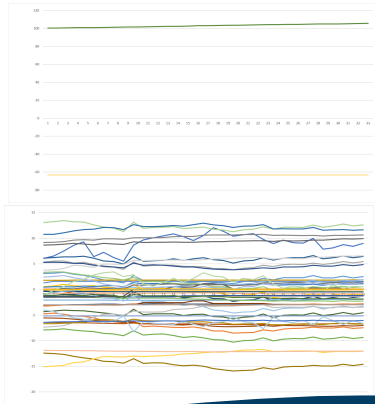- ▶ Opponents: Stockfish, Alpha-Beta, (GrandQ)

Results and conclusion

Stockfish

Alpha-Beta

Demo

▶ GrandQ is open to play with on lichess
  ▶ Possible to play against it yourself
▶ https://lichess.org/@/grandQ_AI