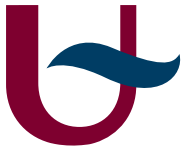

Chess AI: GrandQ

5-Artificiële Intelligentie

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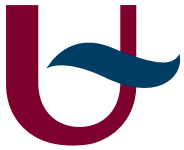
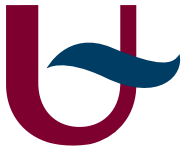


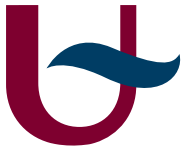
GrandQ

- 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



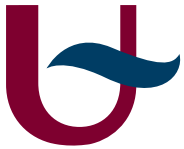
Alpha-Beta pruning agent

- Normal alpha-beta pruning agent
- Not a too complex evaluation function



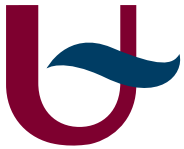
Q-Learning agent

- 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 $\sigma(x) = \frac{1}{1+e^{-x}}$

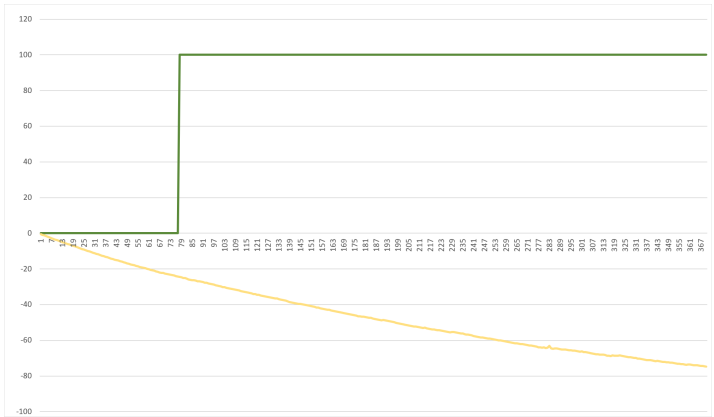


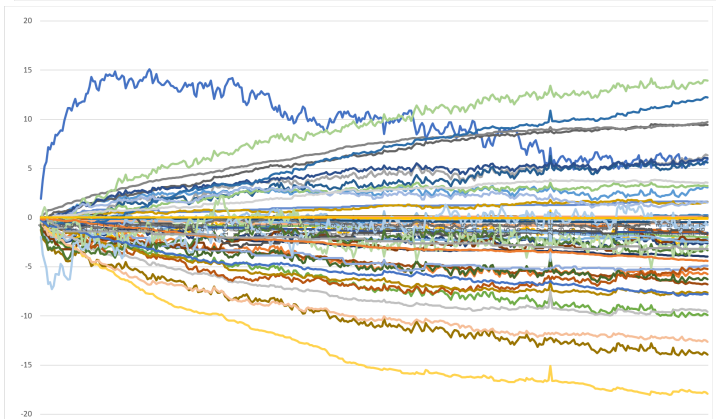
Q-Learning agent: Training

- 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)

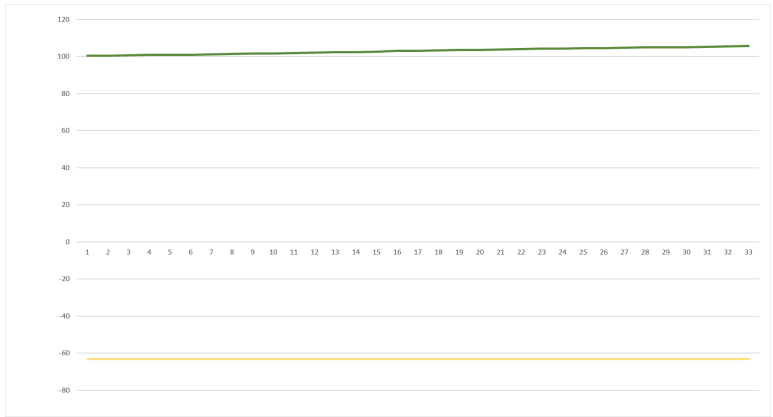
Results and conclusion

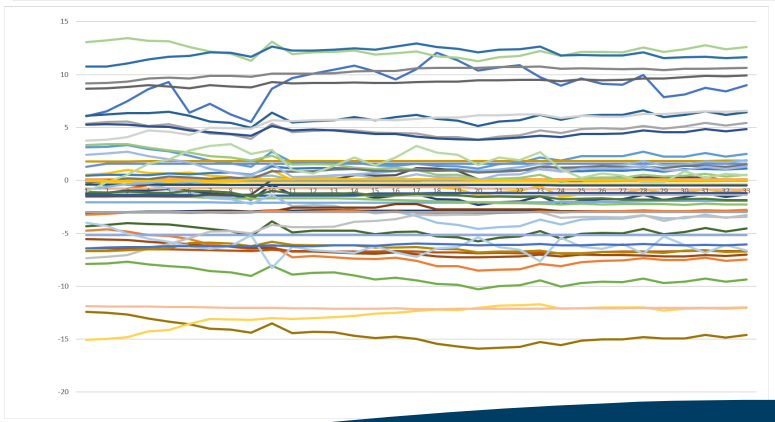
Stockfish

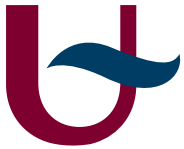




Alpha-Beta







Demo

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