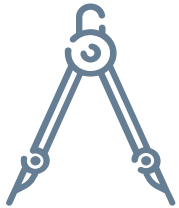
TablutGo

A Q-Learning Deep Neural Network for playing the game of Tablut

by Gaetano Signorelli, Jip Maijers & Valerio Tonelli



The Inspiration

- Based on the technique of **Deep Q-Learning**:
  - *Q-Learning* is a type of reinforcement learning which produces a table of maximum expected future rewards for each action at each state;
  - a *Convolutional Neural Network* (CNN) is a NN used often in visual applications; it is used to approximate the Q-table.
- From the get-go, a challenge:
  - Applications in this field focus more on agents subjected to high number of stimuli in a world which changes often (eg. videogames);
  - Convergence is hard (although there are many techniques to do so).
- Inspiration from:
  - Playing Atari w/ Deep Reinforcement Learning (https://arxiv.org/abs/1312.5602);
  - *AlphaGo* by *DeepMind* (https://www.nature.com/articles/nature16961).

The Agent

- **Implementation:** Python + Tensorflow library.
  - Most of the inner working already there, however correct parametrization is necessary;
  - Optimization of the default *fit()* routine to obtain a much faster training.
- **Parameters:** 1 input layer with 3 channels, 5 hidden layers, 1 output layer with 1296 (9*9*16) output nodes, as well as a discount factor, an epsilon factor to choose a random move (for exploration) and rewards or punishments for certain moves (eg. captures).
- **Training:** 2 such identical agents played against each other, one for White and the other for Black. Also note that the game was re-created locally, to speed up the process.

The Results

- After about 5000 games, the agents definitely show **some** game knowledge.
- *Overfitting* seems to be a prevalent issue, even with varying parameters (but we had little time to test out different possibilities). Possible improvements to this:
  - Change the opponents periodically?
- Overall, the agents do not yet perform at the level of a human player. However, it was a successful project in the sense that we learned a lot from it!

Thanks for your attention!