

Background: Secret Hitler is a social deception card game similar to Mafia. There are two teams, the liberals and the fascists, but the liberals do not know who the fascists are. The goal for the liberals is to figure out who the fascists are and pass liberal policies, while the fascists aim to remain hidden while passing fascist policies. Here's a link to the rules:

<https://secrethitler.io/rules>.

Objective: Create an AI player for Secret Hitler. I will restrict it to the 7-player variant of the game because that is played most often on secrethitler.io, and has about a 50% win rate for each team.

Method: Counterfactual regret has been shown to work well in Poker, and a deep reinforcement learning version of it would also work well. However, counterfactual regret is relatively slow to run (as it involves a Monte Carlo/BFS/DFS/beam search down the game tree each time it makes a move) and so it would take too long to train.

Instead, I will just use reinforcement learning with self-play, the same way AlphaZero was trained. My model will be a deep RNN, with 42 inputs:

- 7 neurons for the AI's seat. This will be inputted every move.
- 3 neurons for the AI's role. These will also be inputted every move.
- 14 neurons for the current cabinet.
- 7 neurons for the votes on cabinets.
- 2 neurons for card claims (1 for president, and 1 for chancellor).
- 1 neuron for whether a liberal or fascist policy was passed.
- 1 neuron for the investigation power.
- 7 neurons for the shooting power.
- Note: no neurons for the special elect power, because that can be learned from the cabinet.

And 30 outputs:

- 1 neuron for whether to discard red or blue.
- 7 neurons for whom to pick as chancellor.
- 7 neurons for whom to shoot.
- 7 neurons for whom to investigate.
- 7 neurons for whom to special elect.
- 1 neuron for voting on cabinets.

I will save the AI every few epochs (perhaps 100? I'll need to experiment on a good number). To train the AI will play against previous iterations.

Finally, to begin the project I will make the AI train on the simpler game of TicTacToe, so I know that it is learning properly.