CRIBBAGE AI

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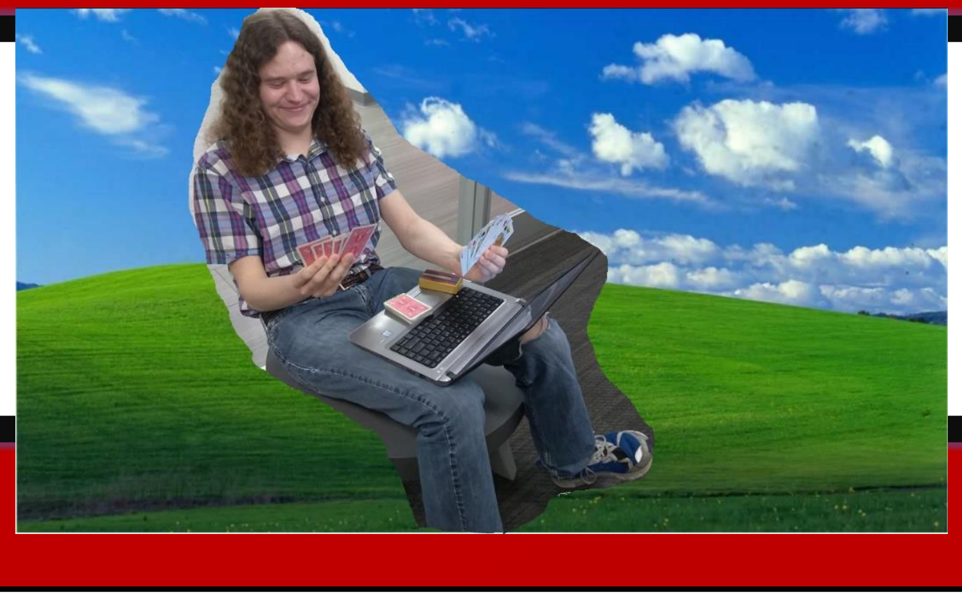

Project Description

A Cribbage AI that used Neural Networks and Reinforcement Learning to defeat Ryan Manny. Our AI uses a Neural Network to decide what cards to throw out and Reinforcement Learning to decide what cards to play during the pegging process.

AI Strategy

In order to choose the best Machine Learning method for this project we need to consider the all the factors/variables that would affect decision making during the two main phases of a Cribbage game:

Throwing away cards

- Selecting cards depends who is the dealer during that turn
- If player is dealer, send cards that would result in highest possible points in a four-card hand
- If player is not dealer, send cards not helpful during the pegging process

Pegging

- Perform best move given cards laid on table
- Must also try predicting the opponent's hand as he/she reveals more cards of their hand

Goals and Methods

Throwing away is a supervised problem that uses a neural network to determine what cards be best suited for throwing away.

For pegging, we first began by trying to teach the algorithm how to hit a sum of 15 or 21, or to get a pair. We decided to not worry about other point combos in order to reduce the dimensionality greatly. Pegging is a reinforcement learning problem. Pegging uses a q-learning algorithm to solve the problem

Description of Data

Throwing away

- Features: Current dealer, six cards encoded as integers from 0 to 51
- Classes: Two indices from zero to five indicating which two cards to throw away

Pegging

- The state for the Q-learning algorithm are defined by each card in the players hand, the last card on the pile, the current total, and the legal actions for the player
- Discarding each individual card counts as an action
- Reward function determines whether the action resulted in a pair, 15, or 31, all of which have an equal reward

Results/Insights

- Cannot beat Ryan consistently
- Better than random

Throwing away

- Currently throw away classifier uses a neural network, but we suspect there are better classifiers that we haven't tried on the dataset

Pegging

- The Q-learning algorithm did not always result in logical policy for the given state, so it could clearly be improved here. Also, the table defining the policy is 5.5GB, which is not practice and should be reduced. In the future, we would want to reduce the table defining the policy, since there exist many redundant states.