PLAYING POKER USING NEURAL NETWORKS

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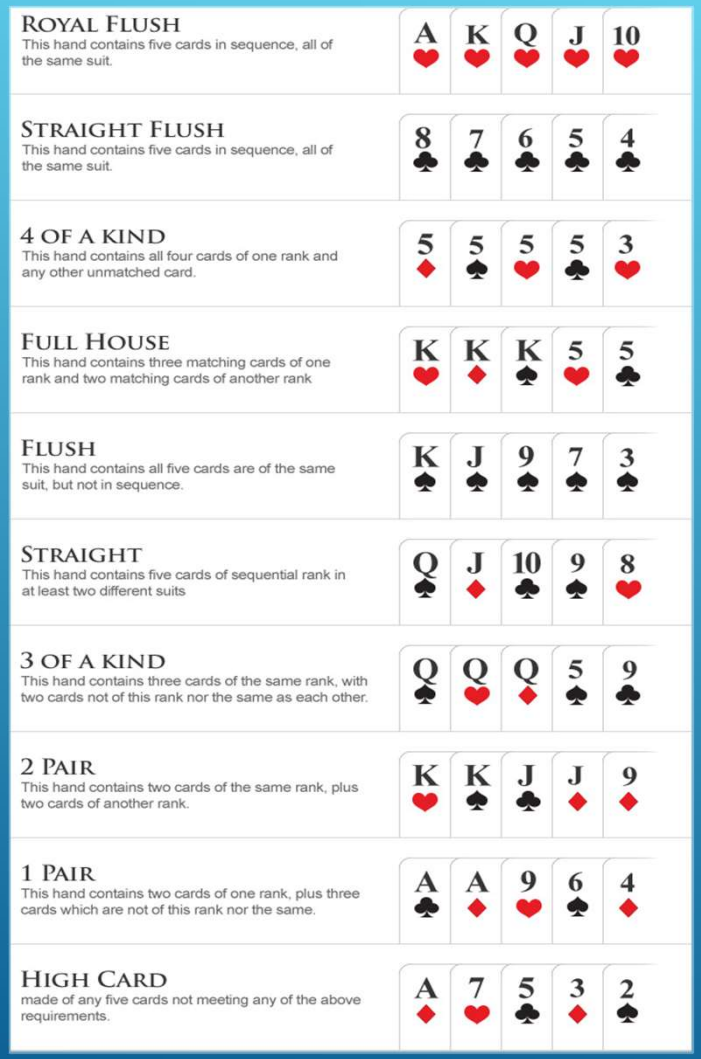
THE OBJECTIVE

- Our goal was to train two different kinds of neural networks to classify poker hands and test which kind of neural net is superior for the task.
  - Feed-Forward vs Convolutional
- In order to play poker, an agent must be able to recognize the hand that it has, otherwise it will be making poor choices.
- We wanted to make a driver that would allow a human user to play a simple 5-card draw game against the superior neural network.
  - We predicted that a feed forward neural network would out-perform the convolutional neural net.

DATA SET

- "Poker Hand Dataset" from UCI Machine Learning Repository
- http://archive.ics.uci.edu/ml/datasets/Poker+Hand
- A simple but robust data set that captures every possible permutation of a given 5 card hand (there are 480 possible Royal Flush hands as compared to 4)
- Cited to be a challenging data set for classification algorithms



POKER HANDS

Source: www.wsop.com/poker-hands

- Royal Flush: 0.000154%
- Straight Flush: 0.00139%
- Four of a Kind: 0.0240%
- Full House: 0.1441%
- Flush: 0.1965%
- Straight: 0.3925%
- Three of a Kind: 2.1128%
- Two Pair: 4.7539%
- One Pair: 42.2579%
- High Card: 50.1177%

TRUE ODDS

Differs from the training and data set.

Straight Flush & Royal Flush is oversampled in training (14 and 129 times more likely respectively)

Cumulative prob. above 1 pair is 7.62%

PROJECT MOTIVATIONS

- The idea of using a neural network to play a game is engaging
- Poker is a straightforward game to understand and play
- Poker provides a challenging task for traditional classification algorithms that seems well-suited for a neural network to solve
  - The reason is because the poker data set is "imbalanced" to favor lower ranked hands
- Our team wanted to find out if a convolutional neural net could successfully compete in this task against a traditional feed forward net

WHY USE A NEURAL NETWORK?

- Saves time thinking of and implementing an appropriate classification algorithm to exhaust all possibilities of a hand
- Given a good enough classifier, the same neural network can be used for more than one variant of poker
- The same network can also be used for multiple different drivers as long as the software supports the same framework (i.e. Keras)
- If the goal is to make a poker-playing agent that *acts* like a human, then it would be most accurate to have an agent that does not perfectly classify the hands that are presented (mis-read)

LOL JUST CODE IT EXPLICITLY

NO

KEY AIMS

- Develop and train the two distinct neural networks
- Run a sample of 1000 games between the two of them
- Determine which of the neural networks is superior from this data
- Develop an interactive demonstration to pit a human player against the superior neural network.

STRATEGY

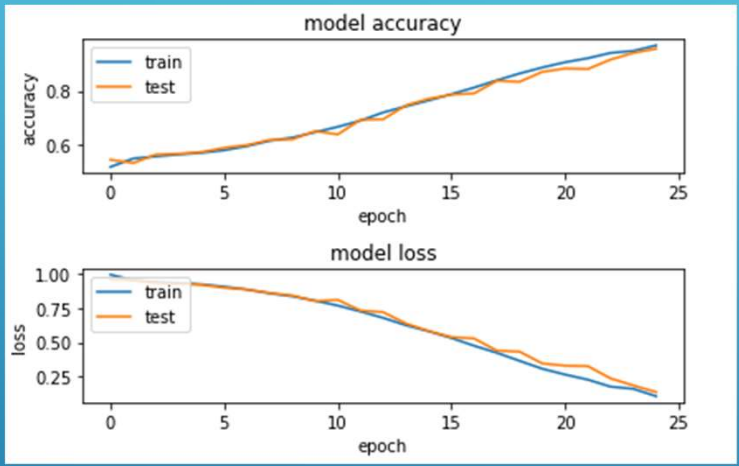
- Jeremy and Delkhaz went to work preparing the neural networks, training them and testing them
- Brandon constructed a driver program on top of a Python poker library called “Treys”
  - This library allowed for “pretty printing” the suits of the hand and an evaluation mechanism to determine who wins
- Loraina kept in contact with the team and began working on the paper to collate and publish the results

RESULTS

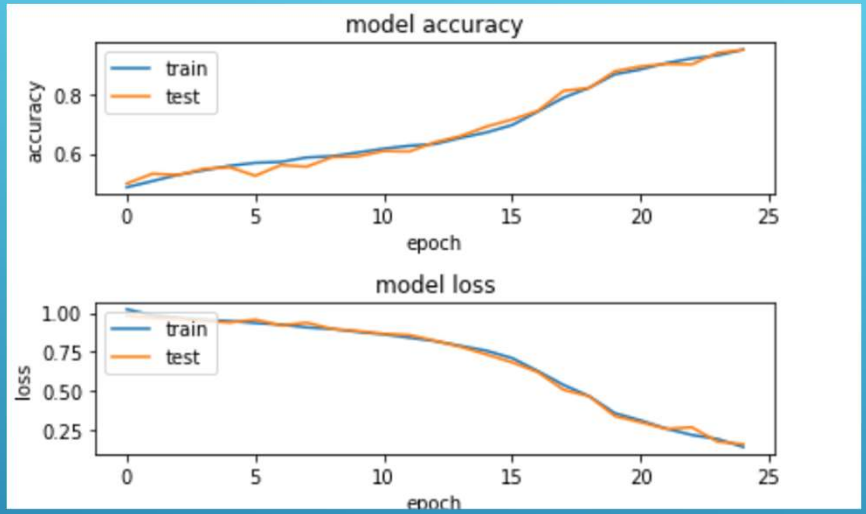
- A convolutional neural network and a feedforward neural network were produced with comparable accuracy (96% vs 98%)
- A finished driver was created that could test the two networks to find the "real world" difference between the two given their difference in accurately classifying a presented poker hand
  - Additionally, a human player can interact and play against the Neural Network
- The result of this testing seemed to reinforce the original hypothesis that the feed forward neural network would be superior (FF wins 52.1% of the time)
- The methodology of the experiment with the corresponding results were published in the paper.

RESULTS

Feed-forward



Convolutional

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FFNN wins: 52.1% of the time.
CNN wins: 47.6% of the time.
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CONTRIBUTIONS

DEMO