Predicting Winning Dota 2 Teams Based on Heroes

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Outline

1. Background and motivation
2. Data collection process
3. Modeling
4. Hero Recommender
5. Conclusions

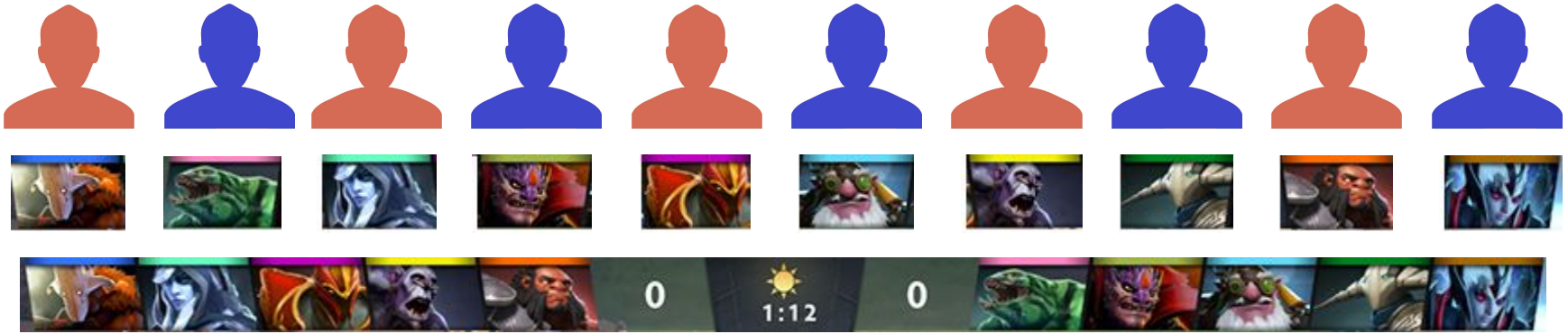
https://store.steampowered.com/app/570/Dota_2/

Background

- Dota 2 is a multiplayer computer game
  - On average there are 400,000 people playing at any time
  - Over the course of a year, professional teams compete for in excess of $ 50 million in prize money
- An individual match is two teams competing to win, **Radiant** and **Dire**
  - Each team has 5 players
  - These players on each team try and work together to achieve a bunch of little tasks, building strength until one team is stronger than the other and wins the game

Background - Hero Selection

- A match starts with players selecting unique characters (heroes) to play



Each hero has 4 unique skills

Problem Statement

- As each unique hero has 4 unique skills, some of these skills will be more effective against certain heroes than other
- Because of these positive (or negative) matchups, one team should be favored to win just based on which heroes are chosen

The goal was to creating an algorithm to which could predict the probability of winning a game of Dota 2 based exclusively on which heroes were chosen.

Small caveat, so much more than just hero choice goes into determining who wins a Dota2 game, therefore another part of the project is to determine how good of model can actually be created

Data Collection

- Steam Web API
  - The Steam API can actually be used to collect data for an game played on Steam or provide user statistics
  - It can collect everything from mouse movements to user inputs
    - I only used a fraction of its total capabilities
  - Used to train OpenAI bots - which became virtually unbeatable

- Collected 100,000 Dota 2 matches that had 10 players
  - Needed to remove over 10,000 matches which were too short

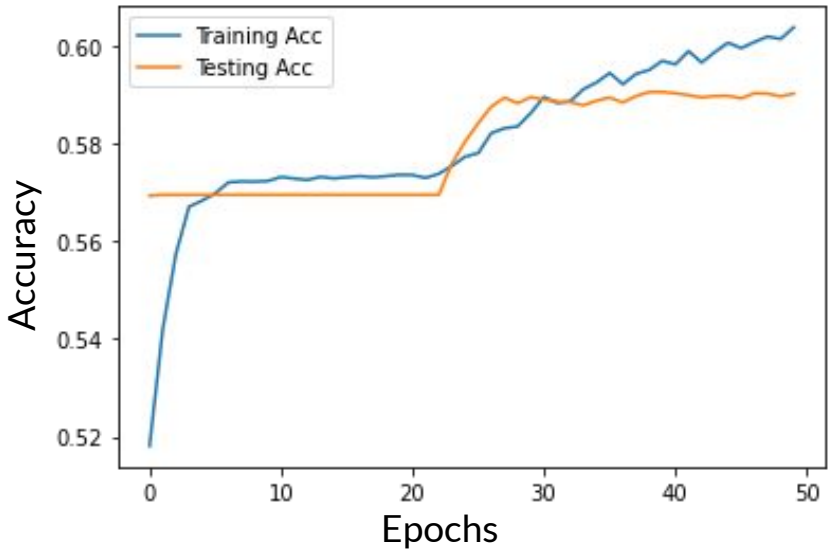
Modeling

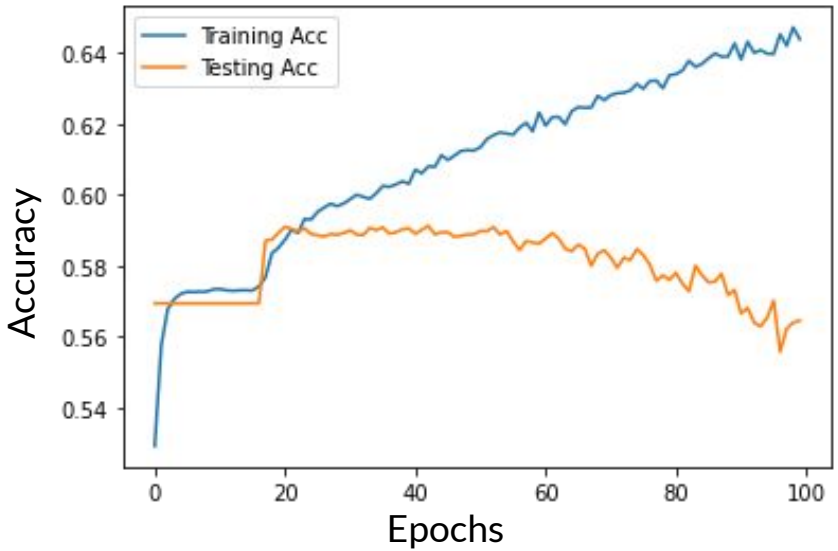
- There are 119 unique Dota 2 heroes to choose from each game
  - There can't be duplicates however
  - Each team hero combinations were vectorized to create the input for the modeling - a total of 238 features

- Logistic Regression, Naive Bayes, K-Nearest Neighbors, and Neural Net models were created
- The feed-forward Neural Network provided the best accuracy
  - Correctly predicted the winning team 60% of the time
  - However, the Radiant wins 57% of the time so the model provides 3% increase over the baseline

Modeling

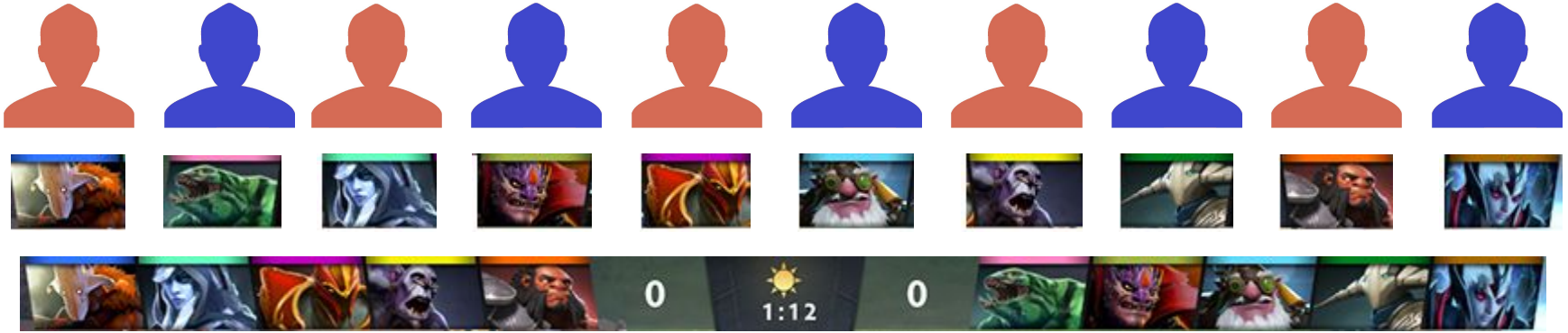
- Overfitting is a major issue for this NN
  - Large amounts of dropout and early stopping were needed





Hero Recommender

- A typical completed draft is shown below

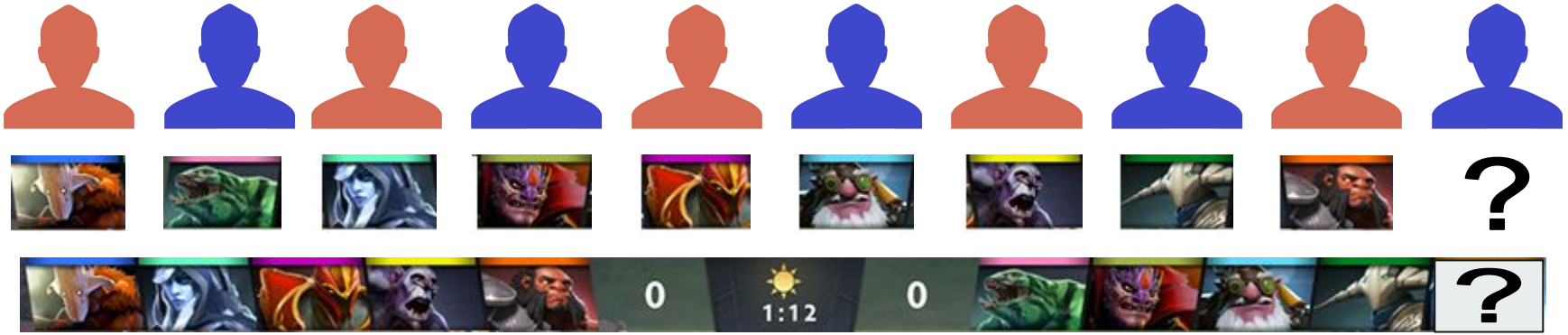


Radiant **Dire**

- The model predicts Radiant will win about 65% of the time

Hero Recommender

- But what if we're looking for the best hero to draft to give our team the best chance



- The model recommends Abyssal Underlord
  - With this hero Dire's chance of winning goes from 35% to 43%

Hero Recommender

Radiant **Dire**

65% Radiant

Model Recommendations

- Abyssal Underlord - 43%
- Broodmother - 42%
- Clinkz - 41%
- Dark Seer - 41%
- Chaos Knight - 40%
  - 25th highest win rate, good matchup vs other team

https://www.dotabuff.com/heroes/winning?date=week

Conclusions

- A fNN model was created that successfully predicts which Dota 2 team will win based on hero selection, 60% of the time
- Which heroes are pick is an important part of a Dota 2 game, however many other things are just as important to winning
- No game is unwinnable, most lopsided game predicted was 83%
- The model does take into account hero matchups and doesn't just provide the highest overall win rate heroes

Future Plans

- Collect additional match data to try and provide a more complete hero matchup dictionary

Thank you

Questions?