

[illegible]

## Project Goal

Can we use data from existing board games to predict whether a new game design will be successful?

# Data Source

Source: Kaggle Dataset of BoardGameGeek website, which includes 81+ features of 90,400 board games and expansions

## Sample & Feature Selection:

Selected only base board games with more than 10 user ratings  
(removed video games, role-playing books, and game expansions)

Selected features that are under the control of the designer

*Max players*

*Year published*

*Category / theme*

*Min players*

*Playing time*

*Mechanics*

*Min age*

# Preprocessing: Features

Filtered some features for “reasonableness”  *$[\pm 3\sigma]$  from the mean*

- N players: 1 to 49
- Playtime: 1 to 1499 minutes (25 hours)

Filtered some features for relevance

- Publishing year: 1900 to present
- Owned by at least 30 people (Reported on BGG)

Transformed “Game mechanics” and “Categories” (themes) from comma-separated lists to binary features

- 51 binary mechanics features; 84 binary theme features

# Preprocessing: Outcome Variables

The “success” of each game was represented by player rating, from 1-10 stars

- Continuous variable (ex. 4.2 stars average)
- Binned to integer stars (1,2,3... stars)
- Binary: “success” (7+ stars) or “failure” (6- stars)



# Data Sets

**New Games:** published from 2000 to present

- 10,084 games split into 70% training / 10% dev / 20% test

**Old Games:** published from 1980 to 1995

- 2,260 games split into 70% training / 30% test

**141 features**

**3 outcome measures**

# kNN Models

Imitates the way we naturally judge games, by comparing to similar titles we have played

**Binary Success Model:** 80.6% accuracy on test data

The ratings misclassified by the binary classifier were:

```
[ 6.  7.  7.  6.  6.  7.  6.  7.  6.  7.  6.  7.  6.  7.  7.]-- actual values
```

**Binned Integer Model:** 93.5% accuracy on test data (with  $\pm 1$  star margin)

The ratings misclassified by the binned 0-10 classifier were:

```
[ 6.  5.  7.  6.  7.  5.  6.  5.  8.  6.  7.  8.  6.  5.  6.]-- actual values
```

```
[ 5.  4.  6.  7.  6.  6.  7.  6.  7.  5.  6.  7.  5.  6.  7.]-- predicted values
```

# Naive Bayes Models

Generative model, capable of building a game with the “best” features

**Binary Success Model:** 76.4% accuracy on test data

**Binned Integer Model:** 84.9% accuracy on test data (with  $\pm 1$  star margin)

Output the themes and mechanics most likely to lead to success

- Themes: Wargame, Card Game, Fantasy, Economic, & Science Fiction
- Mechanics: Dice Rolling, Hand Management, Variable Player Powers, Area Control, Card Drafting (aka Deck Building)



# Linear Regression Model

Uses the full, continuous 1-10 star output scale

**Model Performance:**  $R^2 = 0.44$  on test data

Prediction within 0.5 stars on average; Maximum error was 4.9 stars

Explored the features that *decrease* satisfaction (negative coefficients)

Movies / TV / Radio theme

Roll / Spin and Move mechanic

Mature / Adult theme

Singing mechanic

Zombies theme

Trading mechanic

# A Shift in Game Design

Generated a list of themes and mechanics popular in older games using the Naive Bayes model on the “old games” data set

**1980-1995**

**2000-present**

Wargame  
World War II  
Science Fiction  
Miniatures  
Modern Warfare

Wargame  
Card Game  
Fantasy  
Economic  
Science Fiction

***Themes***

Hex-and-Counter  
Dice Rolling  
Simulation  
Variable Player Powers  
Action Point Allowance

Dice Rolling  
Hand Management  
Variable Player Powers  
Area Control  
Card Drafting (Deck Building)

***Mechanics***

# Notebook

[people.ischool.berkeley.edu/~krissy/BoardGameML.ipynb](https://people.ischool.berkeley.edu/~krissy/BoardGameML.ipynb)