

Boardgame Recommender

For [Boardgamegeek.com](https://boardgamegeek.com)

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Why recommend boardgames?

How are they recommended today?

- Mostly by marketing

Rise in boardgame popularity:

\$9.3B to \$9.6 B from 2013 → 2016



BoardgameGeek.com

Most popular website and community for boardgames!

Parallel Selenium scrapers

Processed 115 GB

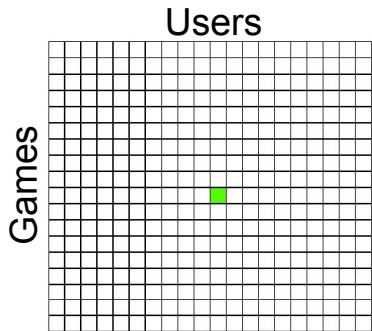
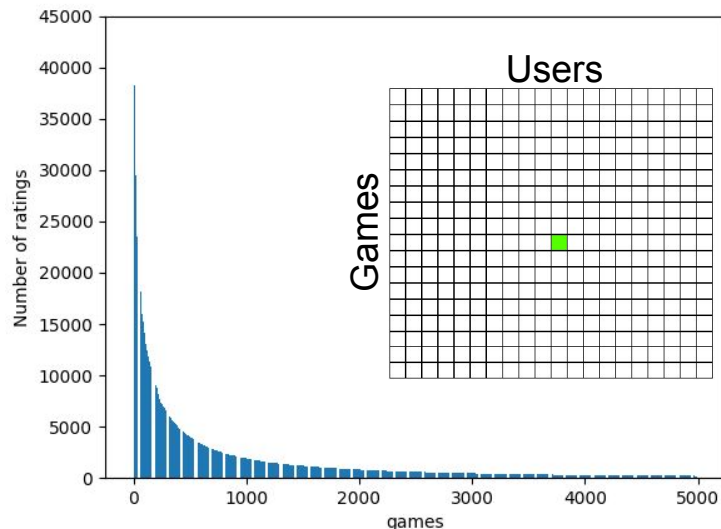
Extracted 0.5 billion ratings

5000 boardgames (with ratings only)

Sparse matrix

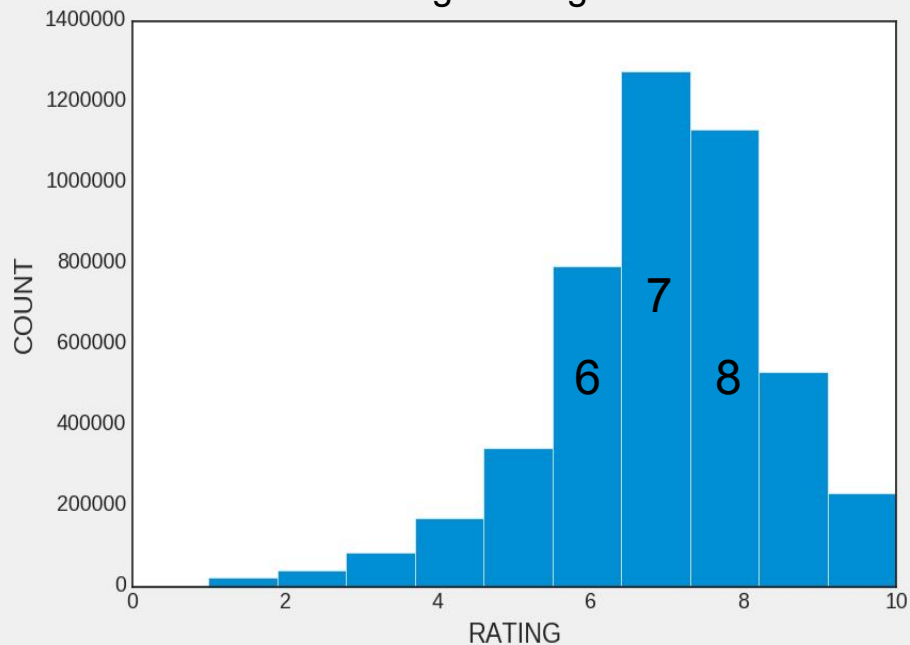
165k users x 5000 games

1/200 sparse matrix

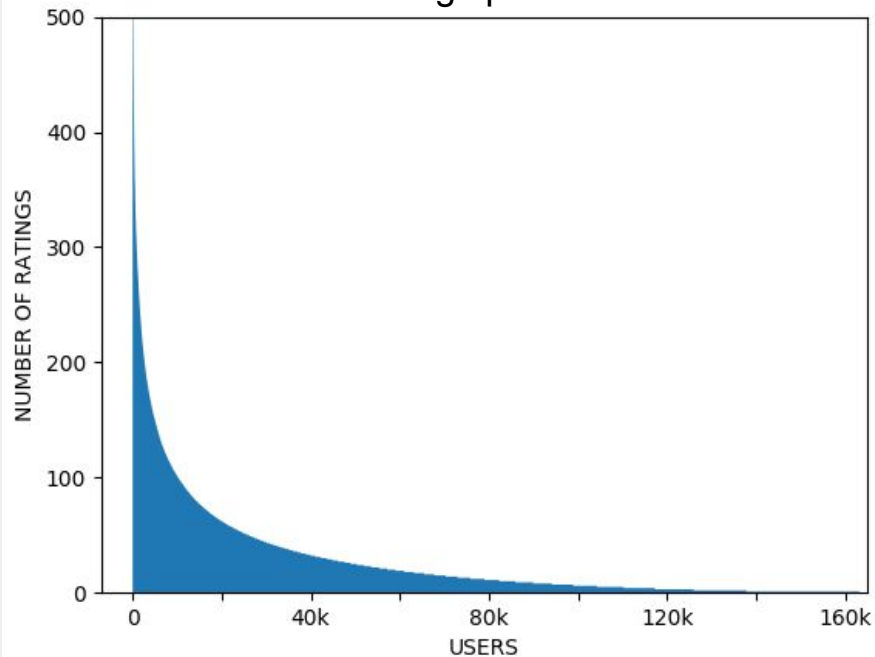


Data

Ratings Histogram

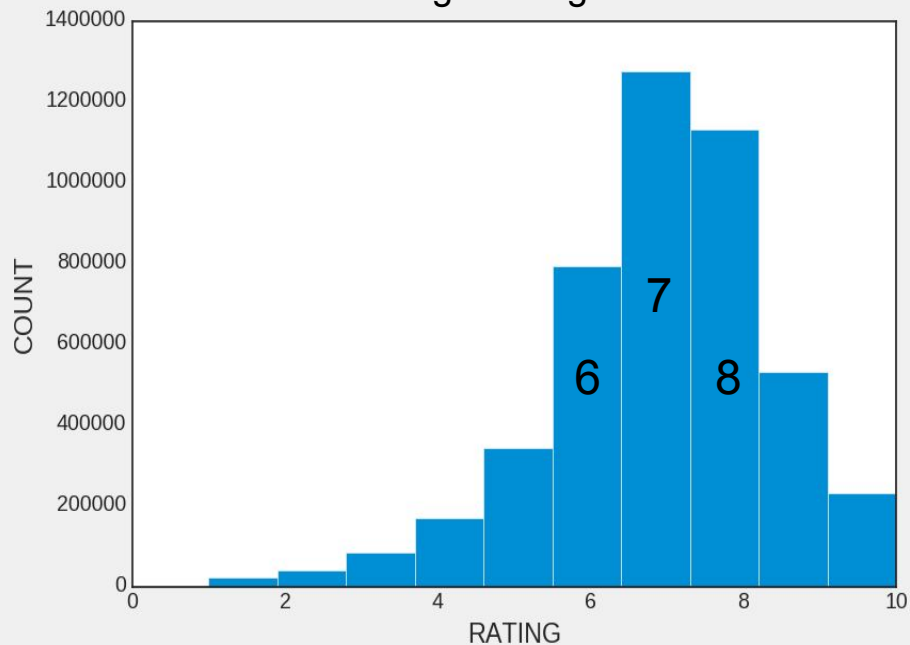


Ratings per User

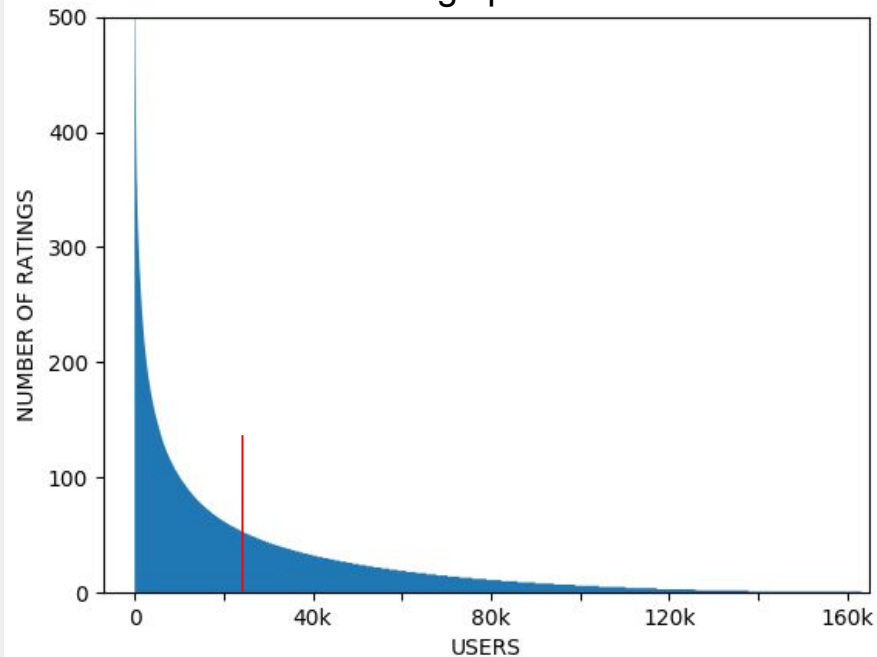


Data

Ratings Histogram

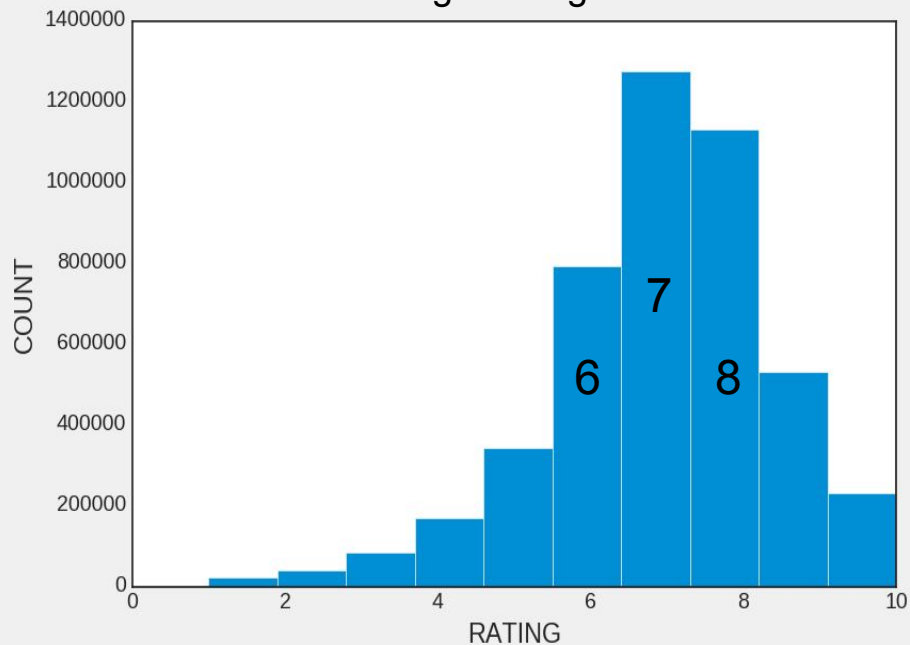


Ratings per User

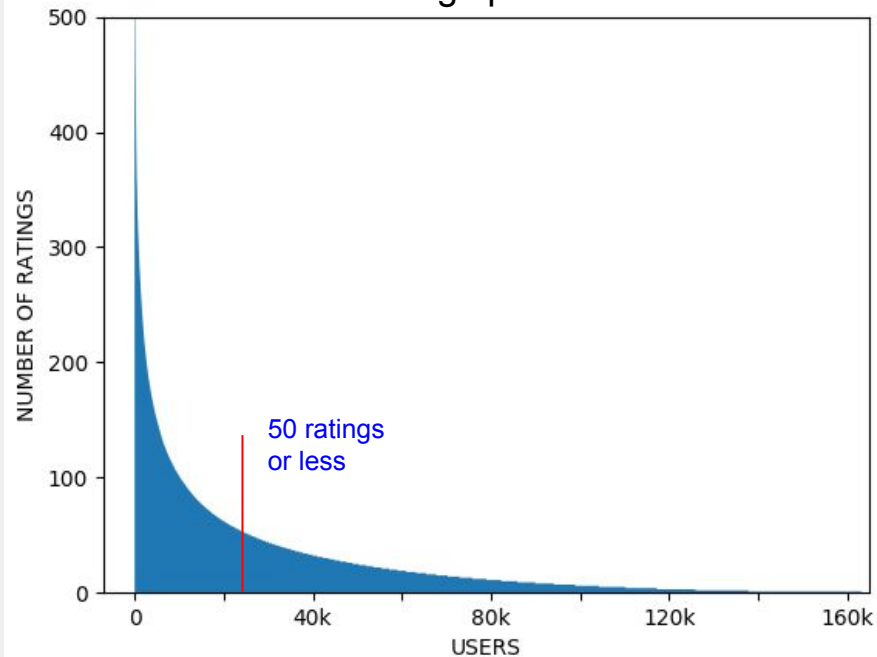


Data

Ratings Histogram

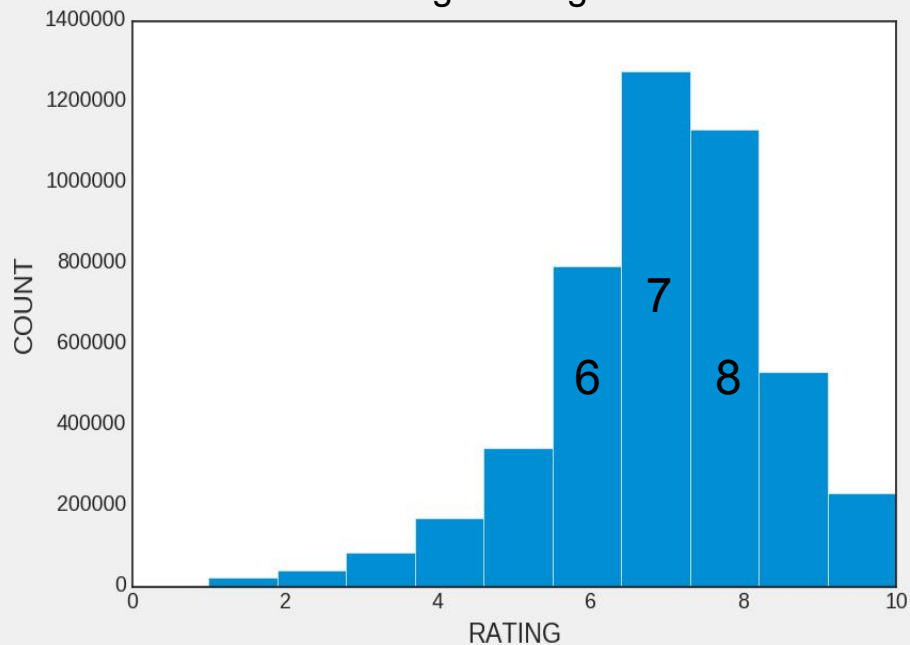


Ratings per User

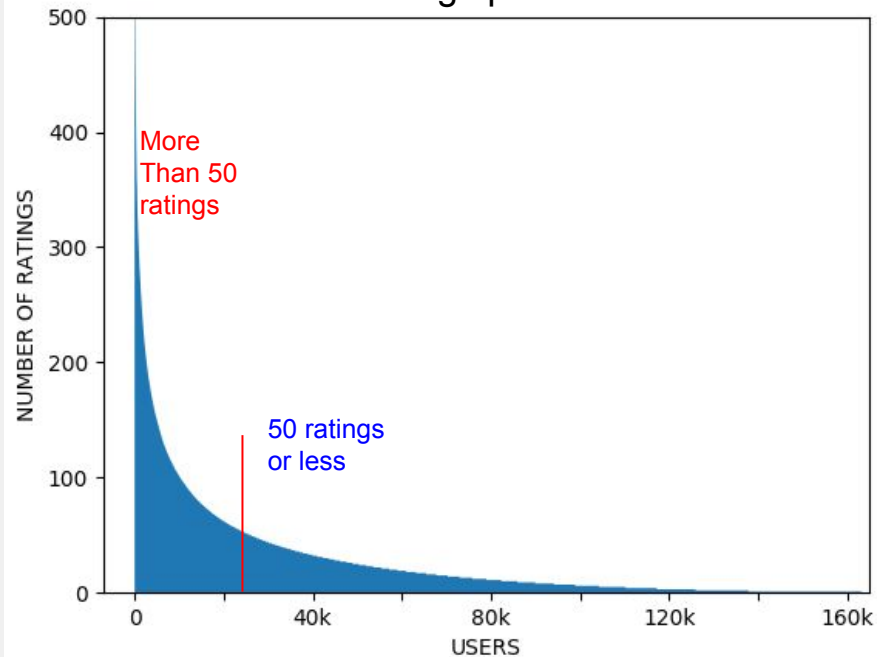


Data

Ratings Histogram



Ratings per User



Framework

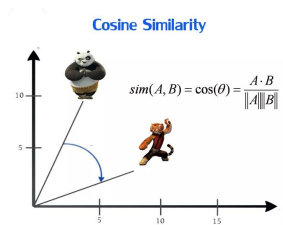
Results Metric:

RMSE

Model: Item--Item recommender

Cosine similarity → great for regressing

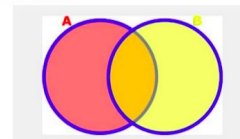
LIGHT USERS



Jaccard similarity → great for binary comparison

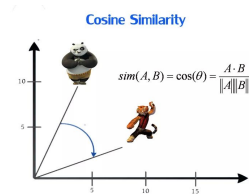
LIGHT USERS

$$J(A, B) = \frac{|A \cap B|}{|A \cup B|}$$



Pearson → great for regressing & taking the mean into account

HEAVY USERS



— Mean rating of game

Light Users

Cosine Similarity

Jaccard Similarity

Predict 10 for
everything

RMSE:	Known: Dominion, Seven Wonders (user = 'infinite descent')		
7.142	Pandemic Small World Puerto Rico Love Letter	Carcassonne Ticket to Ride Dominion: Intrigue	Catan Agricola Power Grid
7.423	Pandemic Small World Puerto Rico Love Letter	Carcassonne Ticket to Ride Power Grid	Catan Agricola King of Tokyo
3.105	El Grande Big Box Rattus Sheriff of Nottingham DAK2 Titan Race	Forbidden Island Manhattan Black Fleet Gloomhaven Fresco	

Heavy Users

Pearson Similarity

Predict 10 for
everything

RMSE:	Known: Wings of War, Castle Risk, Feudal, World in Flames..... (user = 'Long John Silver')	
1.164	Mythic Battles: Pantheon Too Many Bones Pandemic Legacy: Season 1 Kingdom Death: Monster Star Wars: Rebellion	Gloomhaven Puerto Rico: Limited Edition Sword & Sorcery Through the Ages War of the Ring (Second Edition)
3.555	El Grande Big Box Mythic Battles: Pantheon Too Many Bones DAK2 Orléans: Deluxe Edition	Firepower Manhattan Black Fleet Gloomhaven Fresco

Future Work

Make a Webapp

Validation pipeline

Thank you

Aamir Shaikh

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RMSE comparison ALL_Users vs Light/Heavy

Baseline - Light

Baseline - ALL USERS

Baseline - Heavy

RMSE:	Known: Wings of War, Castle Risk, Feudal, World in Flames..... (user = 'Long John Silver')	
3.105	El Grande Big Box Rattus Sheriff of Nottingham DAK2 Titan Race	Forbidden Island Manhattan Black Fleet Gloomhaven Fresco
3.392	El Grande Big Box Mythic Battles: Pantheon Too Many Bones DAK2 Orléans: Deluxe Edition	Through the Ages Manhattan Black Fleet Gloomhaven Fresco
3.555	El Grande Big Box Mythic Battles: Pantheon Too Many Bones DAK2 Orléans: Deluxe Edition	Firepower Manhattan Black Fleet Gloomhaven Fresco

Appendix A

$$y_{uj} = \frac{\sum_{i \in I_u} \text{SIM}(i, j)}{|I_u|}$$

If no rating ^

Cosine Similarity

$$\text{CS}(i, j) = \frac{\sum_{u \in U_{ij}} r_{ui} r_{uj}}{\sqrt{\sum_{u \in U_i} r_{ui}^2} \sqrt{\sum_{u \in U_j} r_{uj}^2}}$$

If rating: $y_{uj} = \frac{\sum_{i \in I_u} \text{SIM}(i, j) r_{ui}}{\sum_{i \in I_u} \text{SIM}(i, j)}$

Jaccard Similarity

$$\text{JS}(i, j) = \frac{|U_i \cap U_j|}{|U_i \cup U_j|}$$

If rating: $y_{uj} = \frac{\sum_{i \in I_u} \text{SIM}(i, j) r_{ui}}{\sum_{i \in I_u} \text{SIM}(i, j)}$

Pearson Similarity

$$\text{PS}(i, j) = \frac{\sum_{u \in U_{ij}} (r_{ui} - \bar{r}_i)(r_{uj} - \bar{r}_j)}{\sqrt{\sum_{u \in U_{ij}} (r_{ui} - \bar{r}_i)^2} \sqrt{\sum_{u \in U_{ij}} (r_{uj} - \bar{r}_j)^2}}$$

If rating: $y_{uj} = \bar{r}_j + \frac{\sum_{i \in I_u} \text{SIM}(i, j)(r_{ui} - \bar{r}_i)}{\sum_{i \in I_u} \text{SIM}(i, j)}$