Collaborative and Content Based Approaches to Recommendation Systems

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Problem Statement and Data

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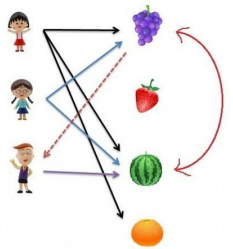
- Over 100,000 board games, searching for a game can feel exhausting
- Existing platforms rely on general popularity of manual filters

Data

- 22,000 games and 411,000 users with 19 million ratings
- Over 4000 features including name, description, # of players, rating distribution, themes, mechanics, subcategories, artist information, designer information, and publisher information

Item-Item Collaborative Filtering

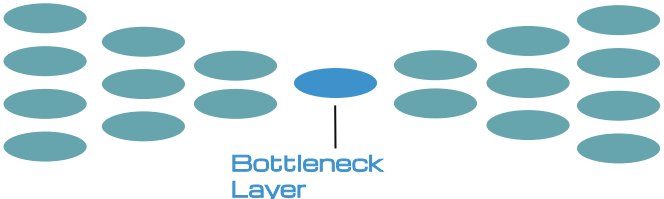
- User Inputs: # of players, game category, game sub-category, games they enjoy, games they don't enjoy
- Create User-Item matrix
- Create Train/Test Split for each user (80/20)
- Calculate cosine similarities between games
- Predict ratings of candidate games using a weighted average
- Return Top 5 Games



$$\cos(\theta) = \frac{\mathbf{A} \cdot \mathbf{B}}{\|\mathbf{A}\|\|\mathbf{B}\|}$$

Content Based Filtering with Denoising Autoencoder

- Denoising autoencoder to embed game features into a 64 dimension space
- Content based filtering to leverage the embeddings to predict how users would rate games



Results

- Collaborative item-item filtering had an average RMSE of 1.3 and a slight tendency to overpredict compared to underpredict Hybrid w/Autoencoder
- Denoising autoencoder captured useful latent game features that the content based filtering leveraged to predict user ratings. Despite some regression to the mean, rank order of game ratings was preserved, making this sufficiently performant for a recommender system