

Magic Card Recommender

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Introduction

+ Motivation

- Provide deck builders with relevant alternatives to a given card

+ Objective

- Given a card, recommend top ten cards that have the closest similarity in text

+ Result

- Tuned several models capable of giving highly relevant recommendations

Info



Methodology

+ Data:

- 26,000+ Unique Cards
- 70+ Columns (Only interested in rules text column)
- 0-100+ Words per card
- <https://scryfall.com/docs/api/bulk-data>

+ Metrics:

- Intrinsic card rules text

+ Tools:

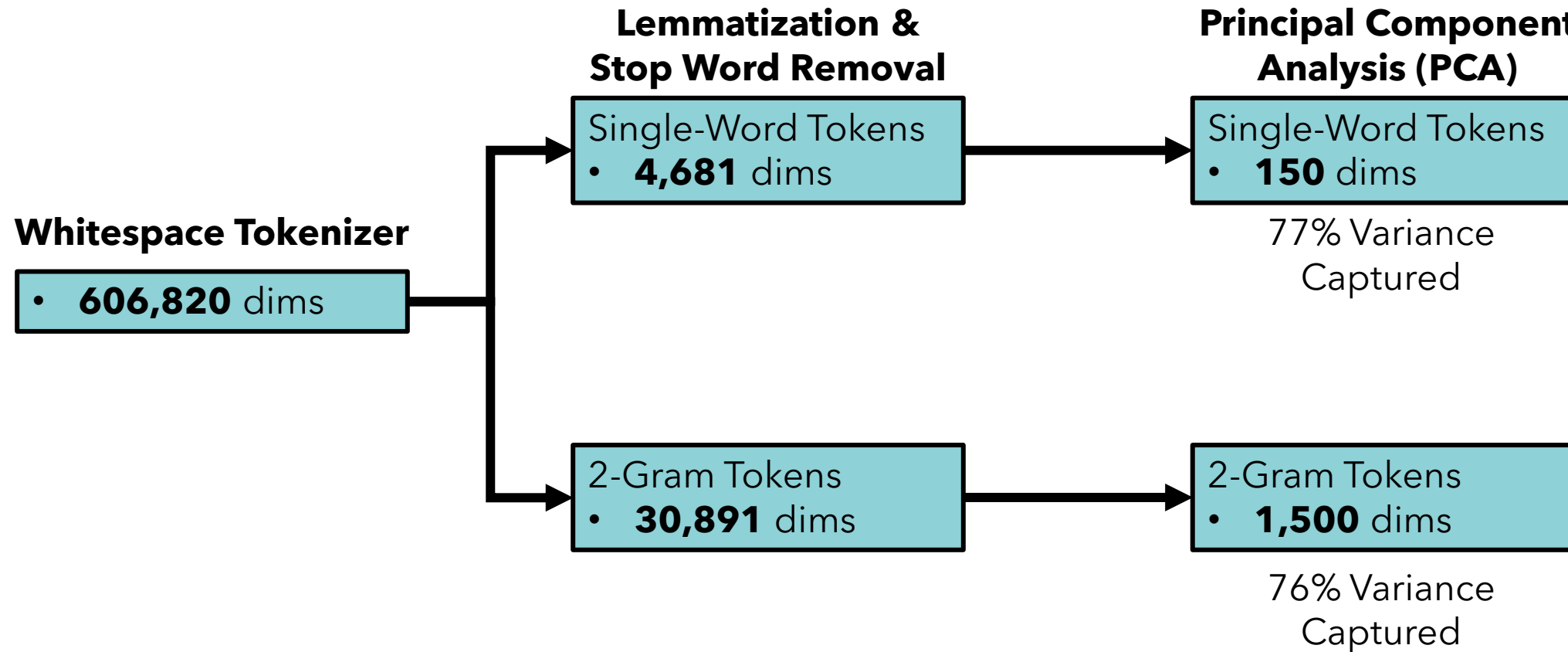
- Pandas, numpy, regex, sklearn (PCA, Kmeans, NMF, pairwise_distances), spacy, nltk, scattertext

Methodology Cont.

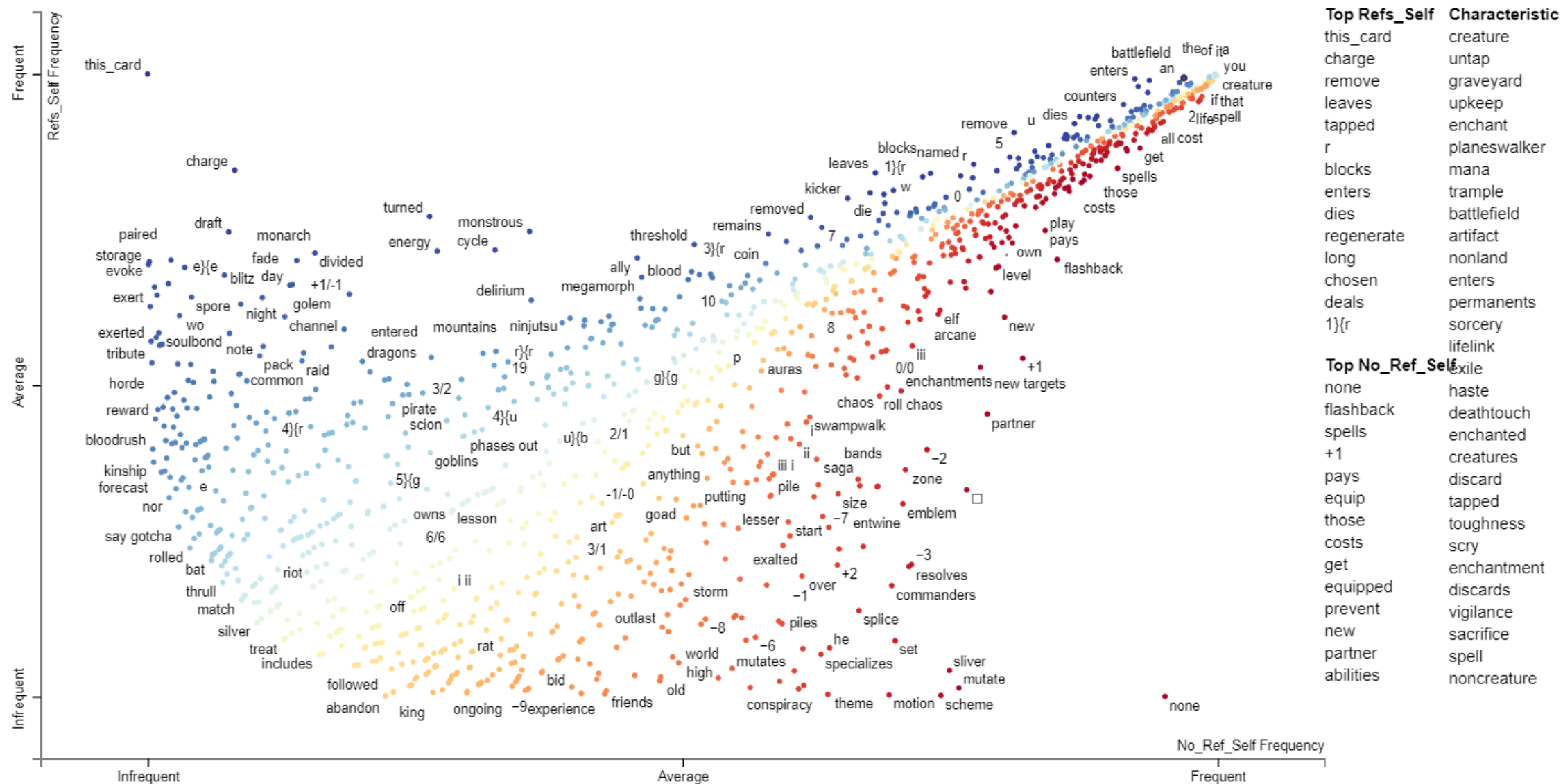
- + Dimensionality Reduction Process:
 - Spacy lemmatization & stop word removal
 - Principal Component Analysis (PCA)
 - Found minimum components to capture >70% EVR
- + Trade Study Procedure:
 - **Models:** TFIDF, NMF, Kmeans Clustering
 - **Hyperparameters:**
 - Single word vs. 2-gram
 - Cosine vs. Euclidean distance
 - **Testing Process:**
 - Requested recommendations for “Kess, Dissident Mage” from each model
 - Manually inspected recommendations for false positives
 - Models with fewer false positives provide more relevant recommendations



Methodology Cont. – Dimensionality Reduction Flow-Chart



Preliminary EDA: Word Frequency of Self vs. Non-Self-Referential Cards



Refs_Self document count: 11,325; word count: 294,548
 No_Ref_Self document count: 14,279; word count: 312,264

Results – Best Model: TFIDF (2-Gram, Cosine)



Results Cont. – Worst Model: KMeans (2-Gram, Euclidean)



Results – Interesting Finding



Conclusions

Given Card: Kess, Dissident Mage

	Number of False Positives			
	Cosine		Euclidean	
	Single Word	2 Gram	Single Word	2 Gram
TFIDF	2	0	0	2
NMF	7	7	6	7
KMeans	1	7	5	9

Given Card: Merfolk Looter

	Number of False Positives			
	Cosine		Euclidean	
	Single Word	2 Gram	Single Word	2 Gram
TFIDF	1	0	2	0
NMF	6	0	6	0
KMeans	4	2	5	0

- + TFIDF performed best across the board
- + 2-Gram worked best when phrase order mattered
- + No clear advantage for cosine vs. Euclidean

Future Work

- + Using CorEx to improve topic modeling
 - (NMF sometimes produced redundant and/or unclear topics)
- + Experiment with MWE tokens to identify key phrases
- + Experiment more with DBSCAN & other advanced clustering
 - (Preliminary hyperparameter tuning resulted in confused results, likely due to high dimensionality)
- + Turn an optimized model into a Streamlit application
- + Investigate non-bag-of-words type models

Appendix

Kess, Dissident Mage Recommendations				
	Names of False Positives			
	Cosine		Euclidean	
	Single Word	2 Gram	Single Word	2 Gram
TFIDF	Possessed Skaab, Saiba Syphoner	x	x	Squee the Immortal, Ebondeath Dracolich
NMF	Aurora Phoenix, Galvanic Iteration, Demilich, Wild-Magic Sorcerer, Coveted Prize, The First Sliver, Dual Strike	Omniscience, Into the Fray, Shifting Borders, Dampen Thought, Stalwart Valkyrie, Harness the Storm, Stream of Thought	Aurora Phoenix, Galvanic Iteration, Demilich, Wild-Magic Sorcerer, Coveted Prize, The First Sliver	Into the Fray, Omniscience, Shifting Borders, Dampen Thought, Stream of Thought, Stalwart Valkyrie, Harness the Storm
KMeans	Force of Negation	Xander's Pact, Patrician's Scorn, Demonic Attorney, Galvanic Iteration, Cabal Therapy, Forbid, Omniscience	Crucible of Worlds, Ramunap Excavator, Harness the Storm, Zombie Apocalypse, Sever the Bloodline	Ojutai's Summons, Scourge of Nel Toth, Daring Buccaneer, Ignorant Bliss, Tasigur the Golden Fang, Cabal Therapy, Horobi's Whisper, Cosmos Charger, Cenn's Enlistment

Appendix Cont.

Merfolk Looter Recommendations				
	Names of False Positives			
	Cosine		Euclidean	
	Single Word	2 Gram	Single Word	2 Gram
TFIDF	Rummaging Goblin	x	Rummaging Goblin, Selhoff Entomber	x
NMF	Rummaging Goblin, Mad Prophet, Selhoff Entomber, Krovikan Sorcerer, Mental Discipline, Oread of Mountain's Blaze	x	Rummaging Goblin, Mad Prophet, Selhoff Entomber, Krovikan Sorcerer, Mental Discipline, Oread of Mountain's Blaze	x
KMeans	Krovikan Sorcerer, Rummaging Goblin, Selhoff Entomber, Mad Prophet	Archers' Parapet, Temple Bell	Rummaging Goblin, Mad Prophet, Selhoff Entomber, Unburden, Drowned Rusalka	x