



# PROJECT 4

STEAM GAME REVIEWS – NATURAL LANGUAGE PROCESSING

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# BACKGROUND - CONTEXT

- Classification of text reviews is a useful tool for many different fields and is an ideal application of Natural Language Processing (NLP) techniques within Machine Learning/Deep Learning.
- We investigate reviews of video games on the Steam platform (a digital distribution service and storefront developed by Valve). Launched in 2003, users can view ratings and reviews, and purchase and download games.
- In 2017, Steam earned \$4.3 billion in sales.
- As of March 29, 2022, Steam reports over 27 million concurrent users at peak logged in to their service, with over 120 million total users.

# BACKGROUND - STAKEHOLDERS

- Stakeholders in this process include (but aren't limited to)
  - Valve (or other digital distributors, e.g. Epic Games, Xbox Games Store, Apple App Store, Google Play),
  - video game developers/publishers,
  - video game consumers, computer hardware manufacturers, cultural linguists

# BACKGROUND – DATA

- Kaggle – Steam Game Review by Luiz Martins; sourced from Steam Digital Distribution
- [Link to data](#)



# MODELS

- 32 NLP models developed, including 14 different deep learning models
- The highest accuracy model and most interpretable model will be explored further

# GOALS

- Applications
  - Validate new ratings (i.e. checking consistency between user text and user binary rating).
  - Notify distributor of potential abuse/manipulation of the rating system
  - Generate non-binary rating or new rating for unlabeled reviews

# METHODOLOGY DETAILS

- 1) I performed Exploratory Data Analysis to identify characteristics of the data
- 2) I created numerous models, optimized them, and compared their performance on several metrics (f1, log-loss, AUC, accuracy)
- 3) I identified one of the high performing, interpretable models for word features of high importance
- 4) I identified the models with overall best performance on accuracy
- 5) I created a pickled version of the best model for portability and ease of future use
- 6) The conclusions: Logistic Regression on Lemmatized data categorized reviews best, with accuracy of 87%



## VISUALIZATIONS 1 – WORD CLOUD OF FREQUENTLY USED WORDS

- Highly used words for both positive and negative reviews are shown
- Commonly used words to describe games appear in both positive and negative reviews, but when there is difference, this can help develop insight

Wordcloud for negative reviews



Wordcloud for positive reviews



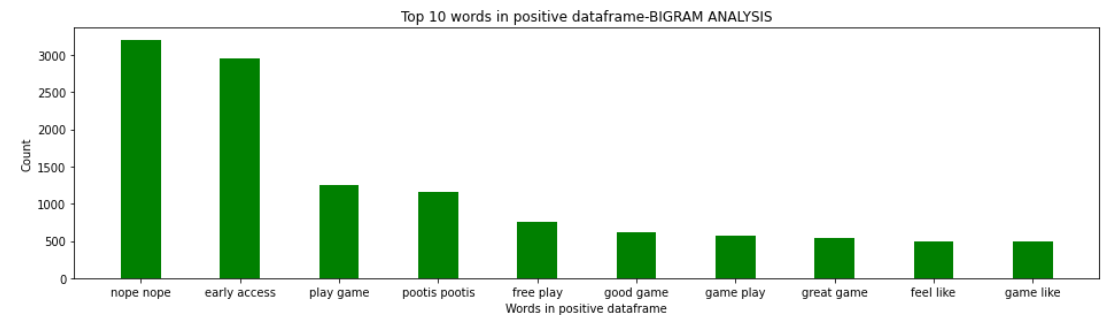
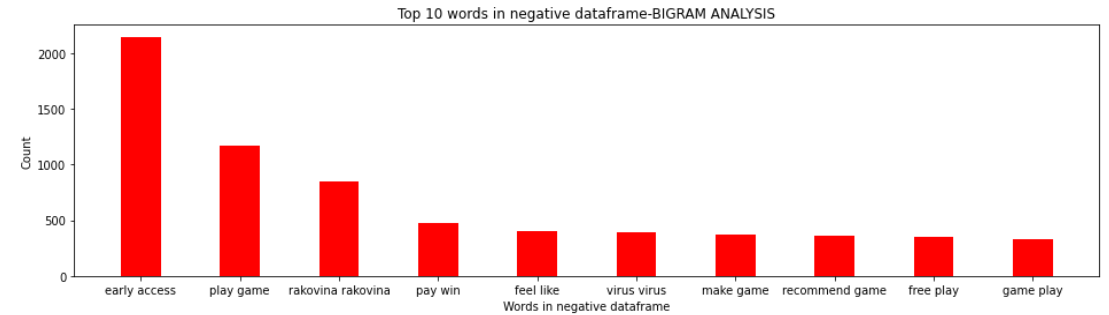


# VISUALIZATIONS

## 2 – BIGRAM

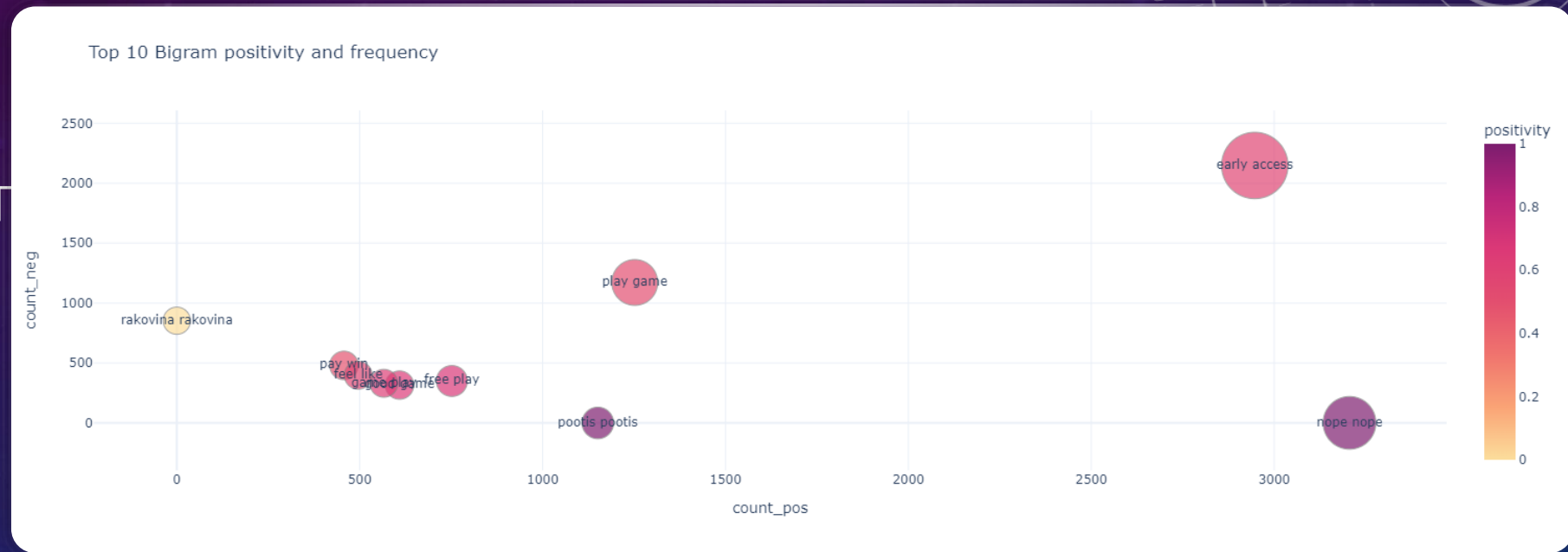
### HISTOGRAM

MOST FREQUENT BI-GRAMS SHOWN IN HISTOGRAM FORM



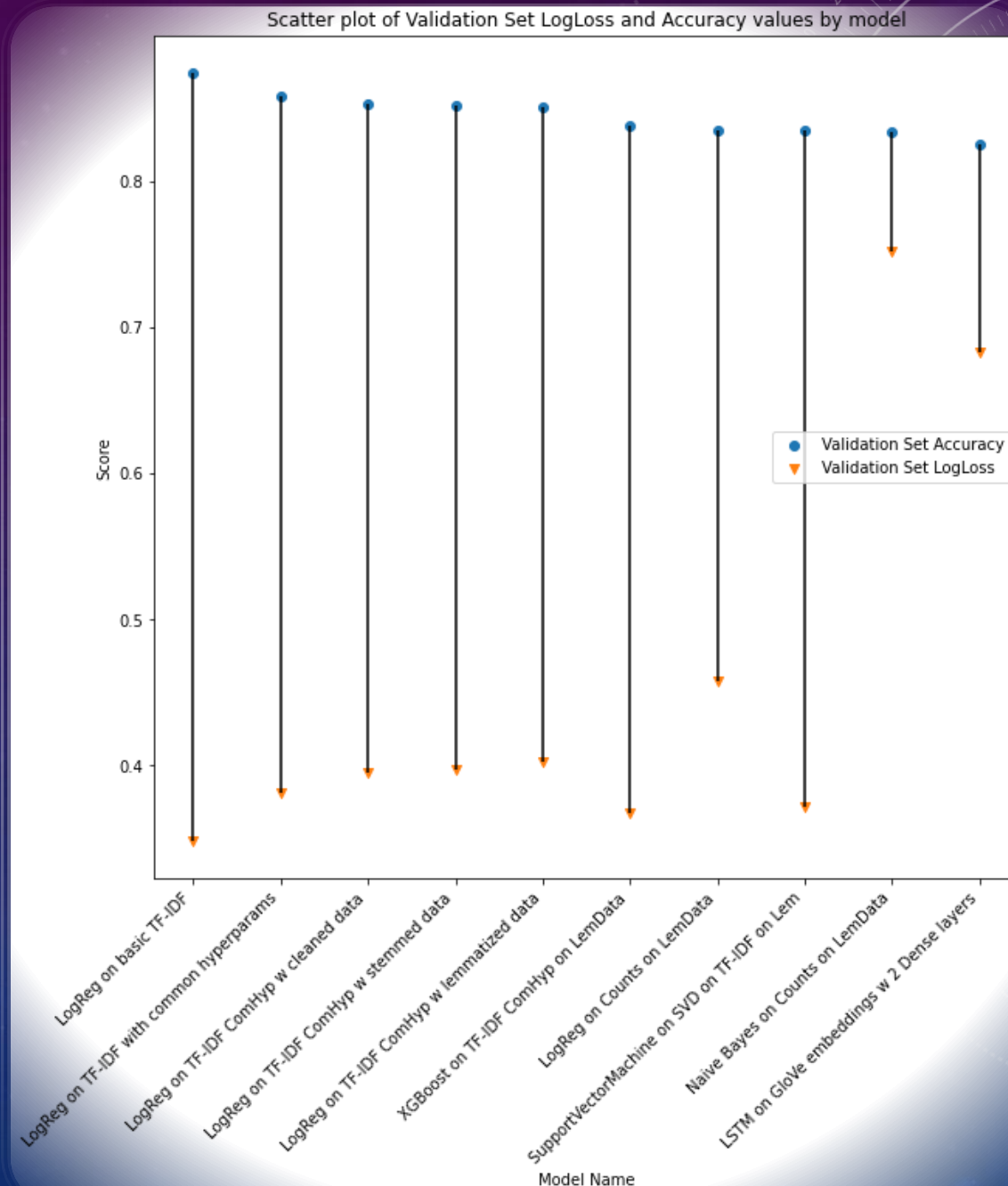
## VISUALIZATIONS 3 – BIGRAM BUBBLEPLOT

- Positive count on x-axis
- Negative count on y-axis
- Overall frequency is size
- Color shows positivity
- Interactive version available



# MODEL RESULTS

- 32 Models were produced
- Of these, the top 10 highest-accuracy (on validation set) models are presented
- Highest Accuracy Model is Logistic Regression on TF-IDF, with score of 87%
- (Industry best is mid-90%, but that doesn't factor in so much slang/vernacular)
- Naïve Bayes is also investigated further for its interpretability





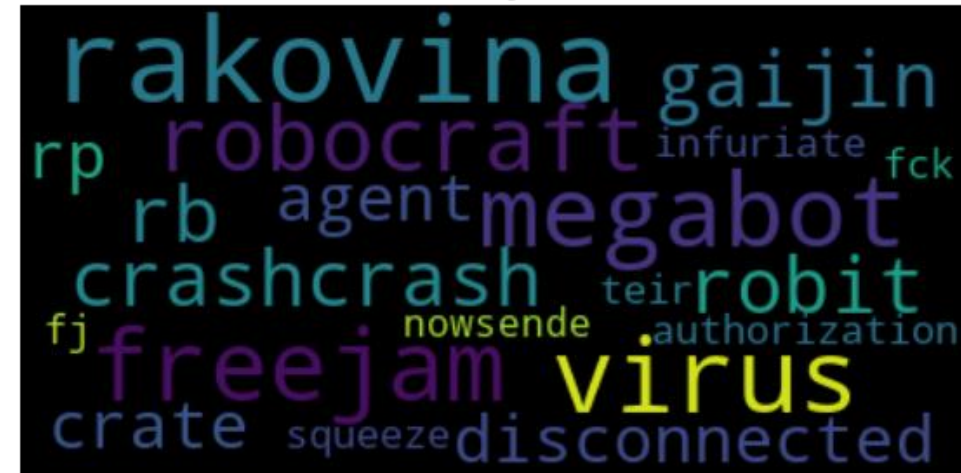
# NAÏVE BAYES: WORD SALIENCE

- The model that performed Naïve Bayes prediction on count vectorized data had respectable accuracy, but also is notable because the word weights are accessible and interpretable
- Upon word salience investigation, relative word importance sheds some illumination
- “Pootis” has a high correlation with positive reviews. It is a phrase from a game called Team Fortress; this is a phrase very localized to video gaming.
- “Rakovina” (a Slavic word for cancer) has a strong correlation with negative review. This word is unlikely to appear in “usual” or pretrained models
- Unusual structure probably had impact on pre-trained and ML models

Wordcloud for positive reviews



Wordcloud for negative reviews



# CONCLUSIONS/QUESTIONS

- Steam reviews can be classified positive/negative with ~87% accuracy.
- NLP analysis of video game reviews is nuanced due to specific vernacular to that community
- Model could be extended to produce continuous “positivity” sentiment score, rather than just binary

# CONCLUSIONS/QUESTIONS

- Actionable items using this model:
  - Validate user-generated scores
  - Bolster fraud/abuse checking
  - Incorporate generated scores into game ratings
    - Include off-platform reviews for more comprehensive score



# CONCLUSIONS/QUESTIONS

- Potential further steps:
  - acquire more labeled data to further train models
  - use extracted observations about word frequencies over time to investigate emergent language behavior

# CONCLUSIONS/QUESTIONS

- Questions?

# CONCLUSIONS/QUESTIONS

- Thank you!