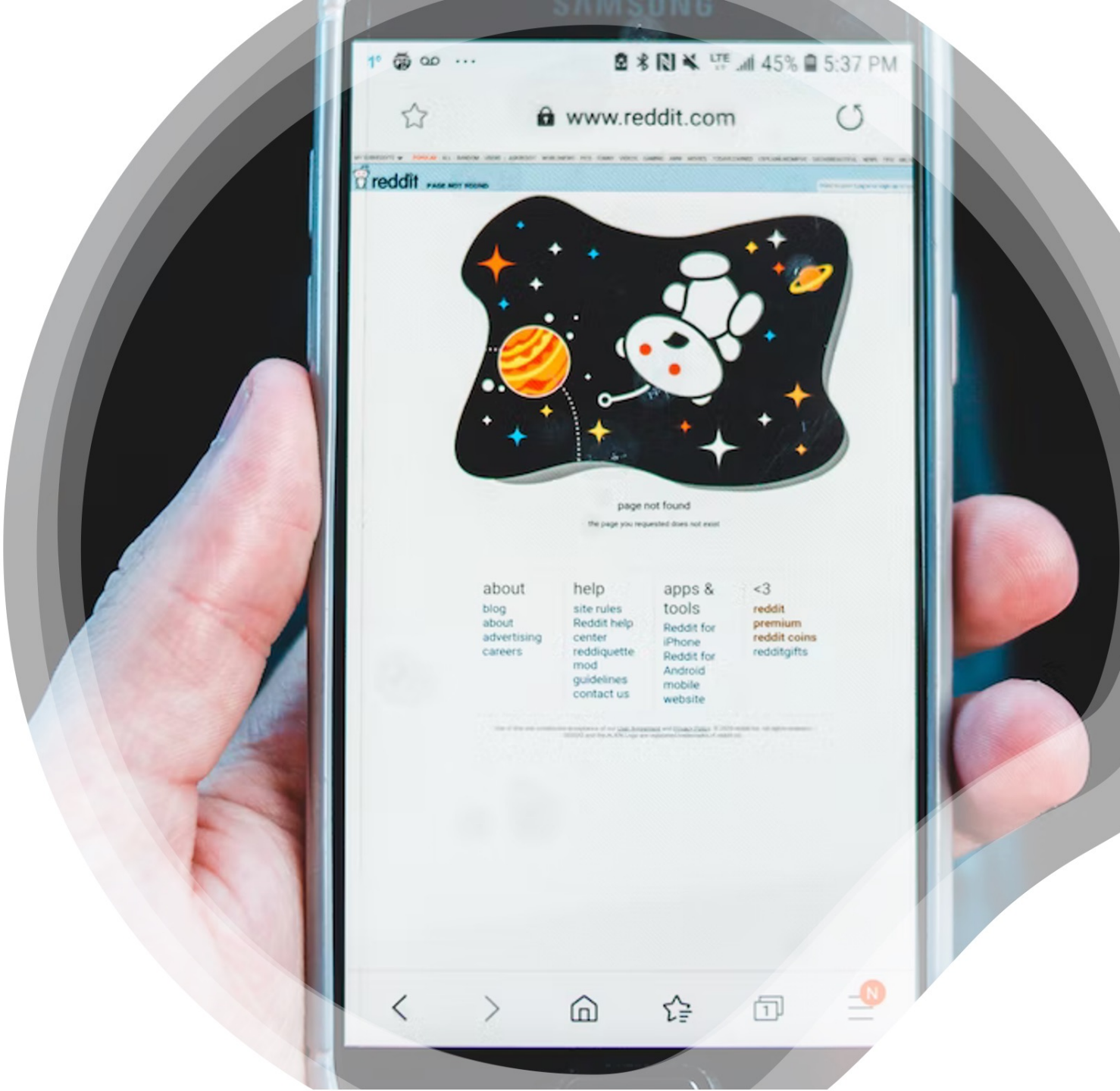
Binary Classification of Subreddits (r/anxiety and r/depression)

Presented by:
Nicholas Khoo



TRIGGER WARNING

The content of this presentation is based on mental health/illnesses. This includes depression, anxiety, panic attacks and dark thoughts that people face in the world.

Presentation Outline

- Background
- Goal
- Data Science Approach
- Demo

Background

- Reddit is a social networking site with subreddits, including r/depression and r/anxiety, focused on mental health support.
- Proper subreddit categorization is crucial to ensure that users receive appropriate support and guidance
- Moderators play a crucial role in maintaining a safe and helpful community.

Presentation Outline

- Background
- Goal
- Data Science Approach
- Demo

Goal

- To train a binary classifier to be able to accurately determine the classification of a post, belonging to ***r/depression*** or ***r/anxiety***, based on the texts within.

Presentation Outline

- Background
- Goal
- Data Science Approach
- Demo

Data Science Approach

Problem Statement | Data Collection | Data Cleaning & Exploratory Data Analysis | Pre-processing and Modelling | Conclusion & Recommendation

Problem Statement

How can the moderators of r/depression and r/anxiety improve the classification of users' posts to ensure their communities remain a safe and supportive space?

Data Science Approach

Problem Statement | **Data Collection** | Data Cleaning & Exploratory Data Analysis | Pre-processing and Modelling | Conclusion & Recommendation

Data Collection

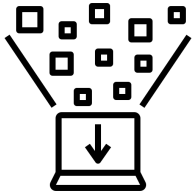
Python Reddit API Wrapper

- Top 1000 posts

Pushshift API

- 1000 posts
- 11th Nov 2022 – 28th Jan 2023

Data Collection



Feature	Description
id	Unique identifier of a particular post or comment within a subreddit
created_utc	The time the post or comment was created
title	The title of the post.
is_self	Indicates whether the post is a self-post or not.
selftext	The actual text content of a self-post
score	The upvotes minus the downvotes of the post.
upvote_ratio	The ratio of upvotes to total votes.
num_comments	The total number of comments on the post.
permalink	The permanent link to the post.
author	The username of the person who submitted the post.
distinguished	Indicates whether the post or comment has been distinguished by a moderator or admin.

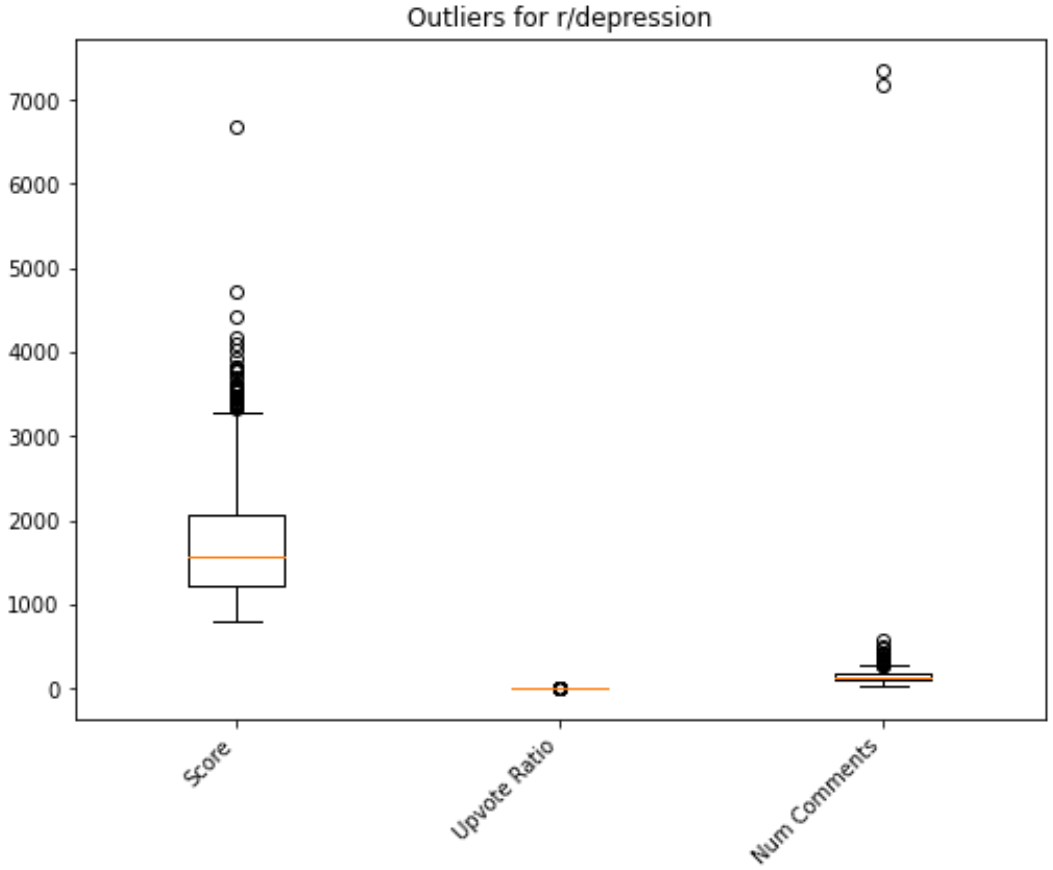
Data Science Approach

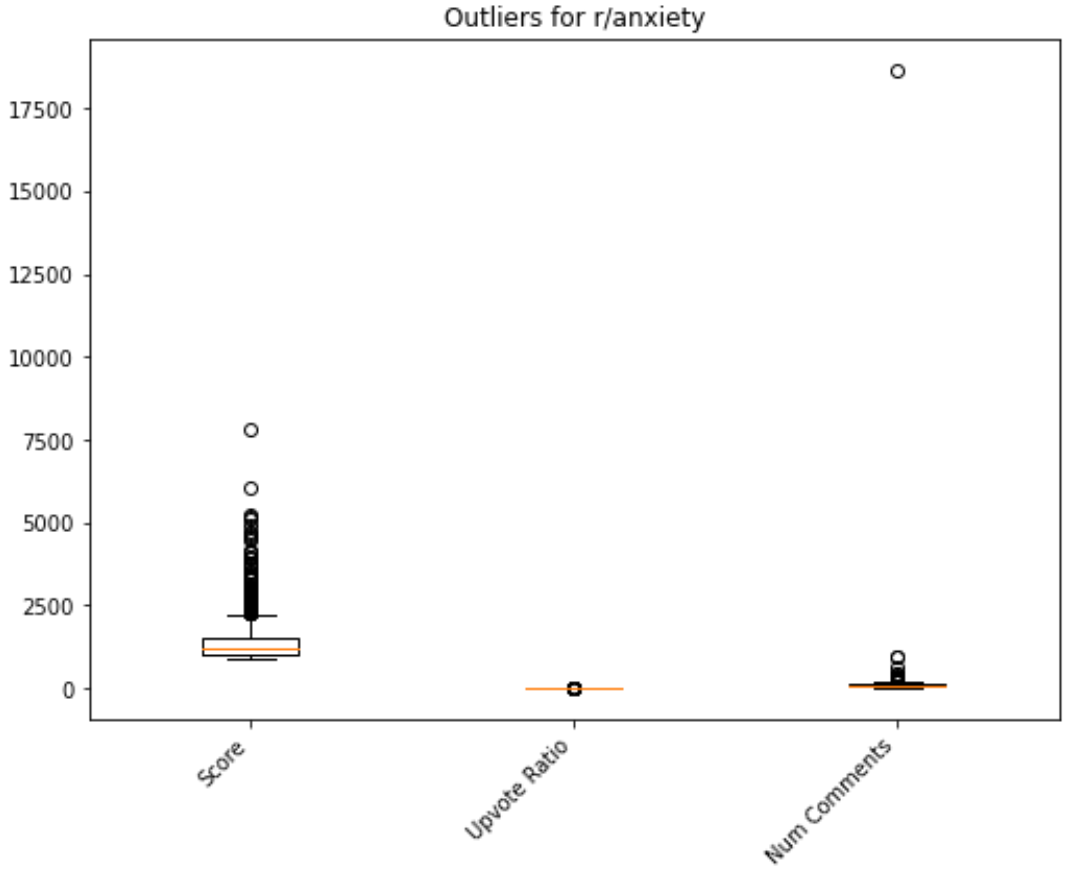
Problem Statement → Data Collection → **Data Cleaning & Exploratory Data Analysis** → Pre-processing and Modelling → Conclusion & Recommendation

Data Cleaning

- Dealing with null values
- Dropping moderator posts
- Cleaning and lemmatising texts

Outliers


Outliers for r/depression
7000
6000
5000
4000
3000
2000
1000
0
Score
Upvote Ratio
Num Comments


Outliers for r/anxiety
17500
15000
12500
10000
7500
5000
2500
0
Score
Upvote Ratio
Num Comments

Outliers (Score)

r/depression

Title: Shout out to the particular hell that is functional depression.
Content: This is me. Don't get me wrong, it's better than don't-leave-my-bed-for-a-week depression. I am grateful I can be an independent person. But there is something uniquely horrible about being able to go to work every day, occasionally clean up after yourself, pay your bills, generally put yourself together enough to look like a human being... but that's it. Nothing else. No social life. No hobbies. Constantly battling your mind. And being absolutely fucking exhausted all the time.

r/anxiety

Title: Despite the anxiety, despite the depression, despite all my self criticism and imperfections - I was a beautiful bride this Saturday! Content:

Outliers (Num_comments)

r/depression

Title: Regular Check-In Post

Content: Welcome to /r/depression's check-in post - a place to take a moment and share what is going on and how you are doing. If you have an accomplishment you want to talk about (these shouldn't be standalone posts in the sub as they violate the "role model" rule, but are welcome here), or are having a tough time but prefer not to make your own post, this is a place you can share. We try our best to keep this space as safe and supportive as possible on reddit's wide-open anonymity-friendly platform…

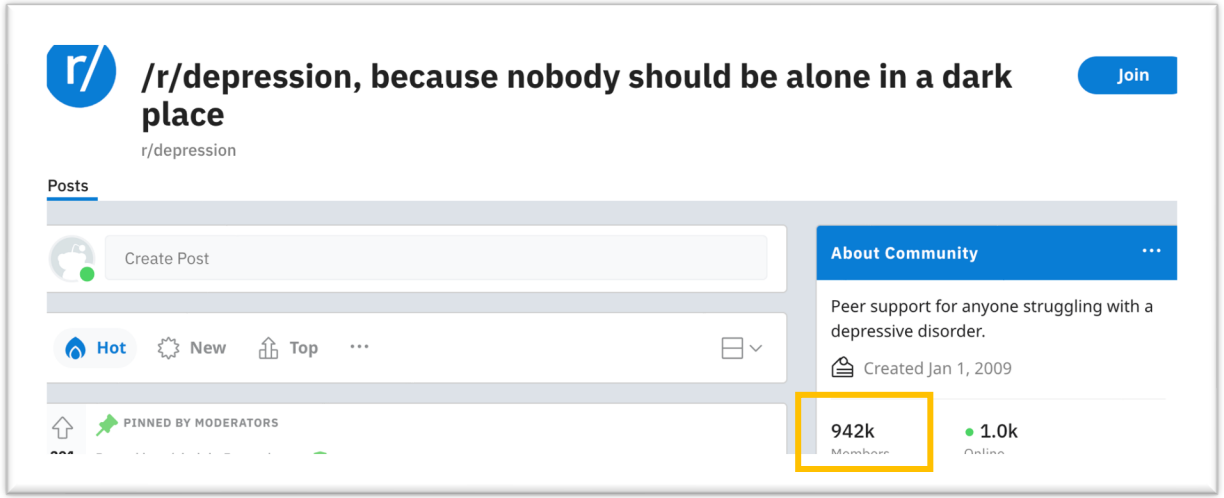
r/anxiety

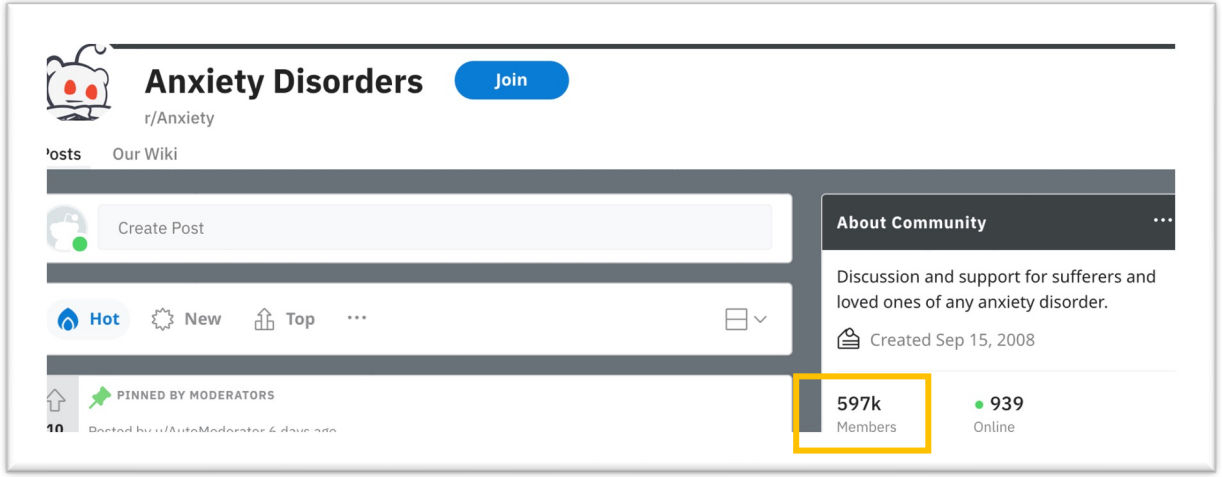
Title: Let's post good news on the coronavirus here.

Content: A place where only good news is posted, please keep this a positive thread. a place we can go for some reassurance that everything will be okay. We WILL get through this. edit: the link for this thread will be posted in the main thread, I will keep updating so save this thread to keep checking ❤️ stay healthy and wash those hands 😊 guys for the love of god stay away from twitter, fb and all the big news outlets …

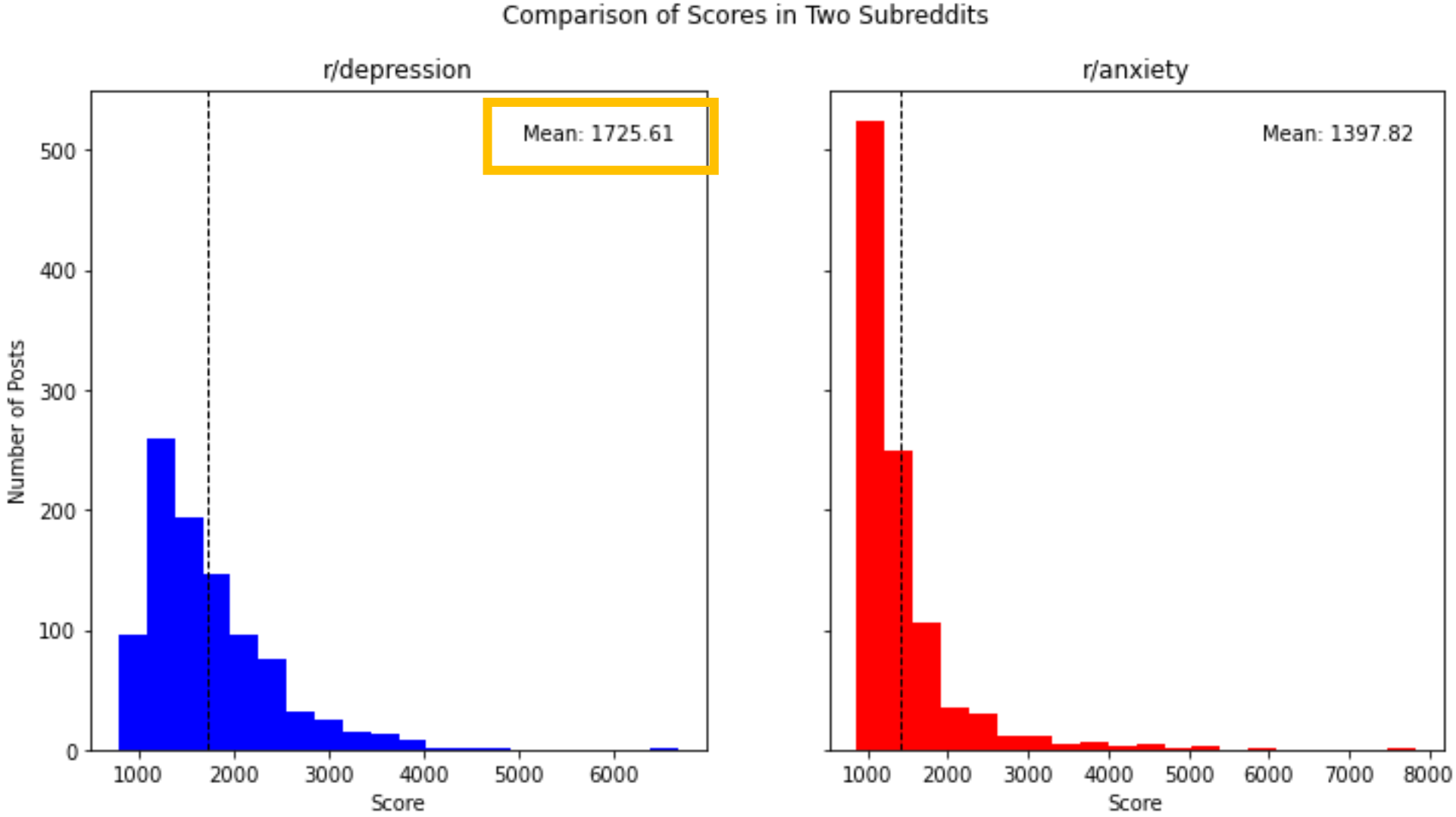
Preliminary Analysis

What were the engagement and activity levels for both subreddits?

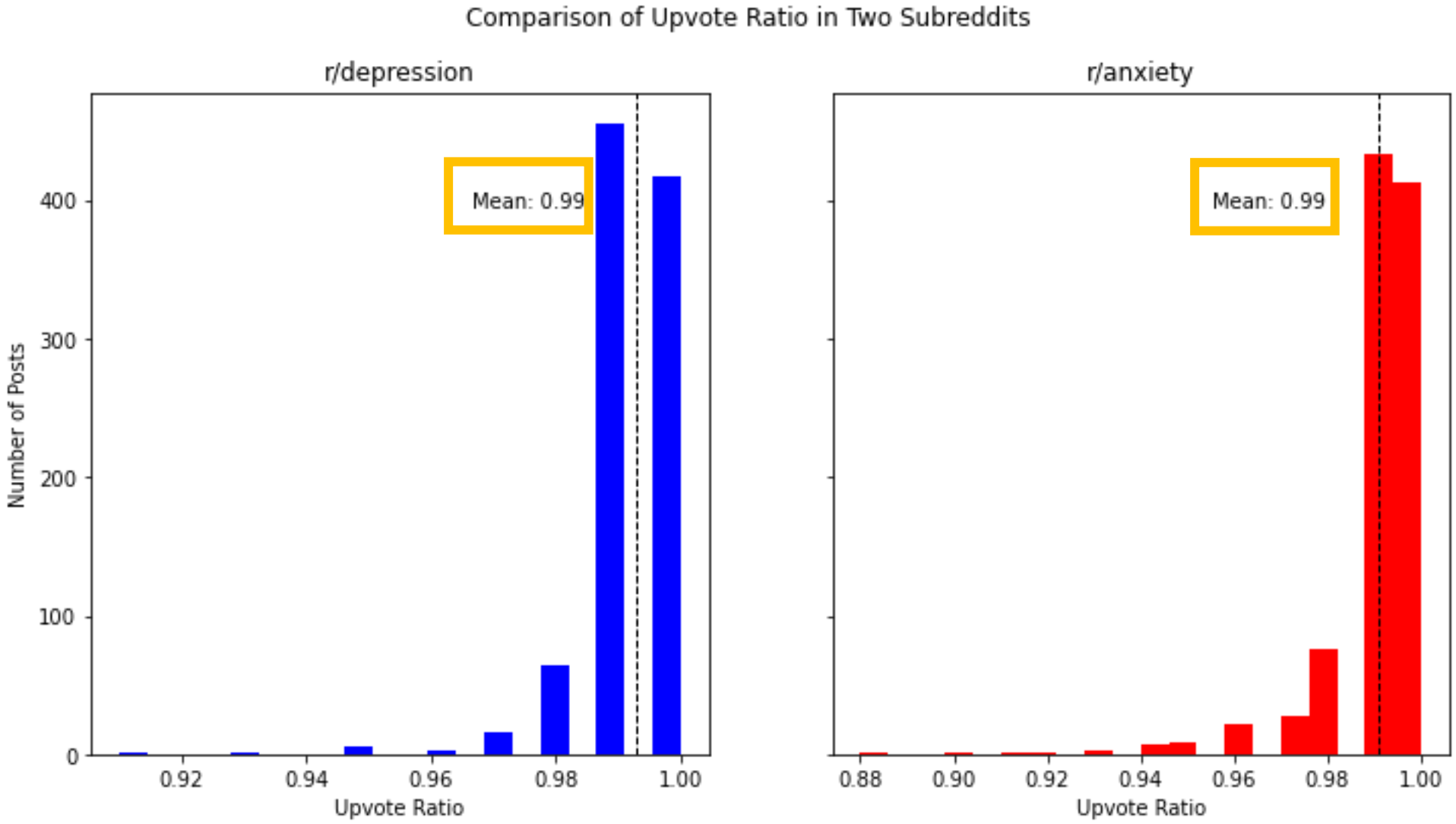




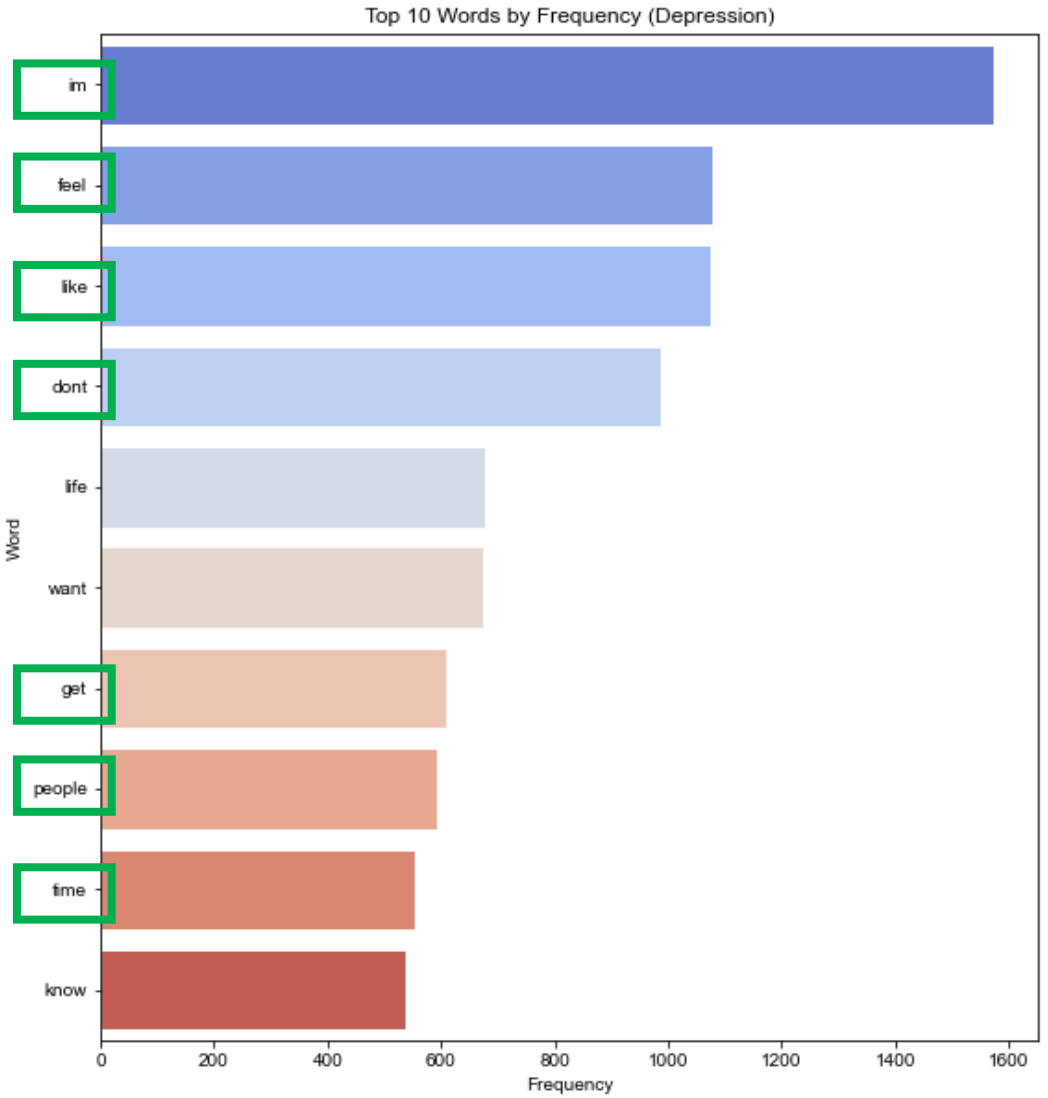
Engagement and Activity Levels

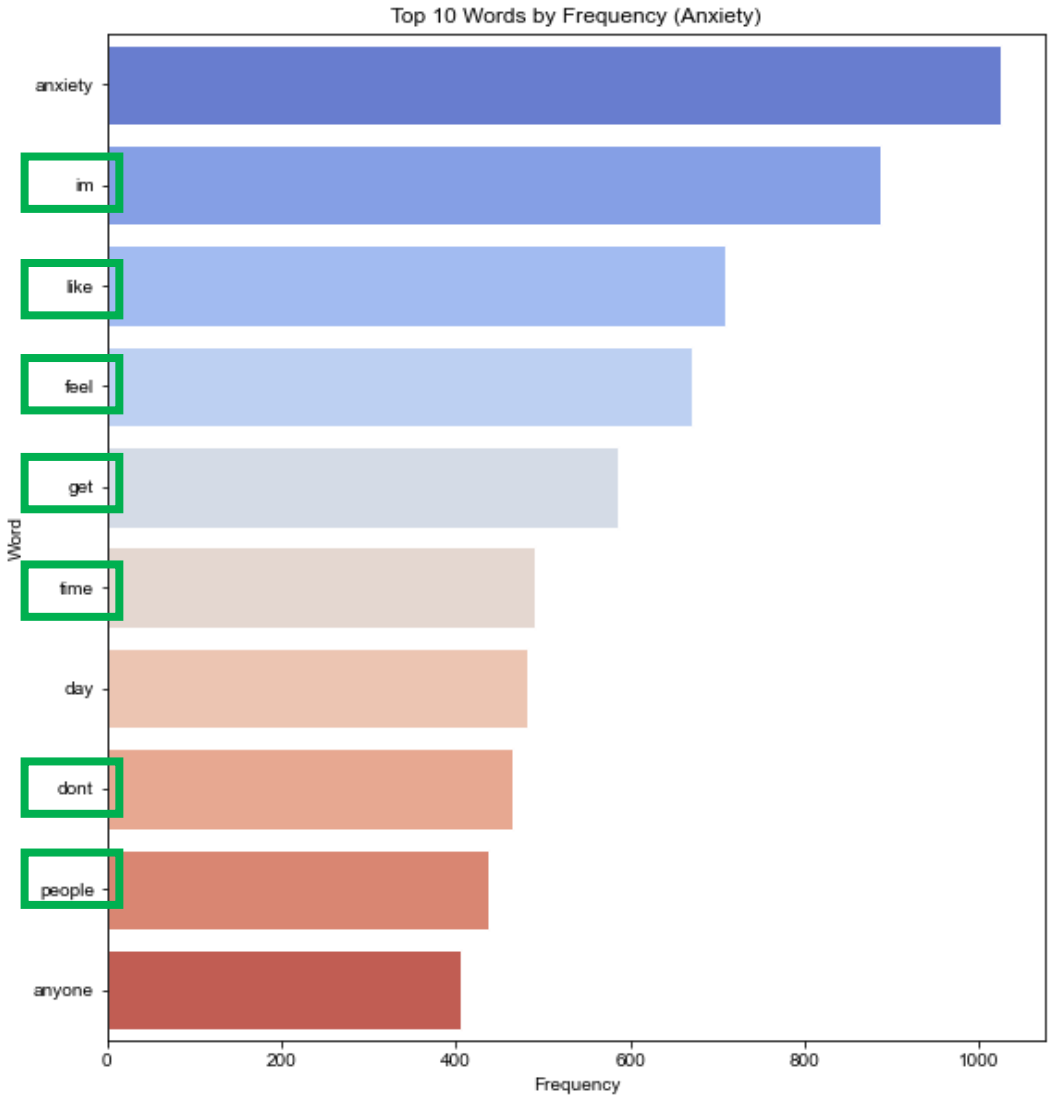


Engagement and Activity Levels

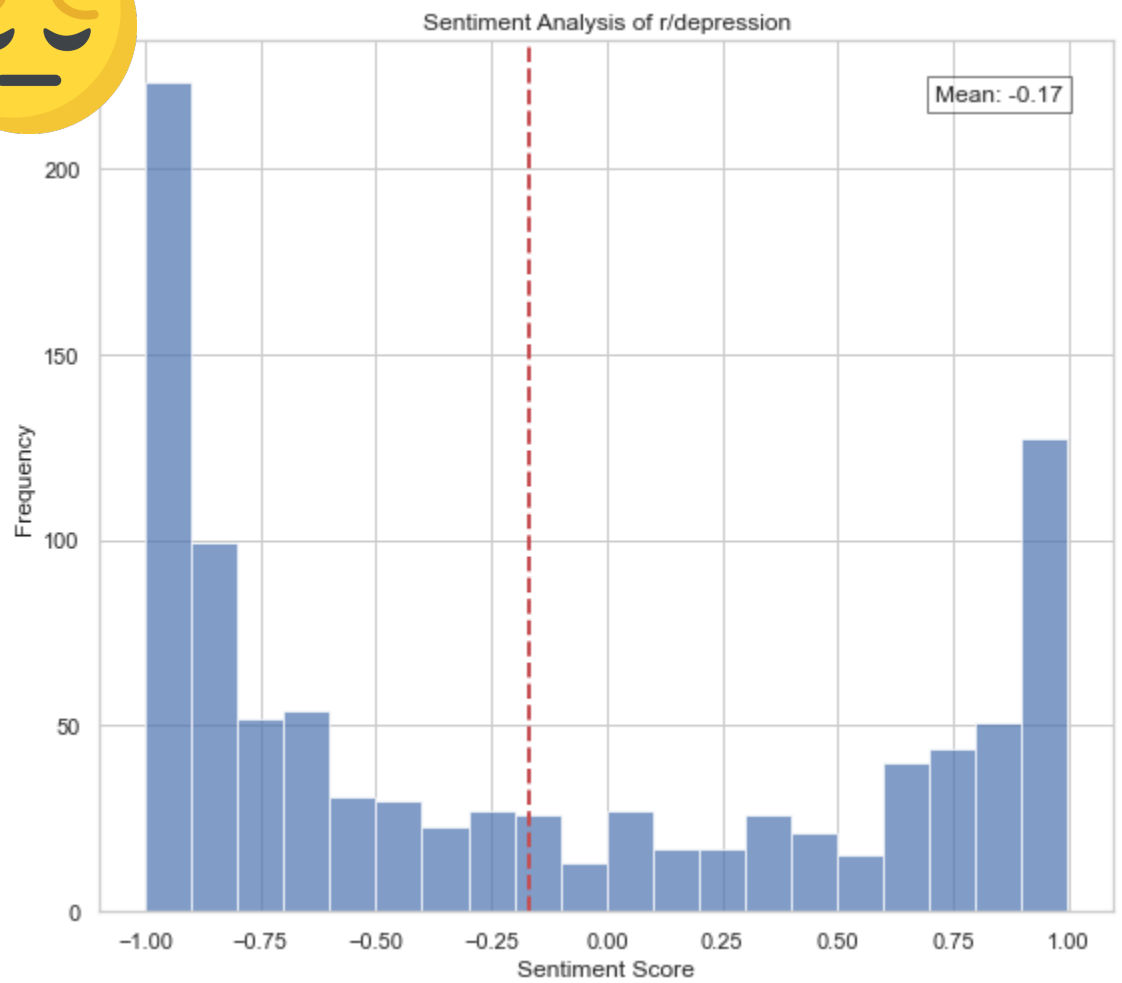


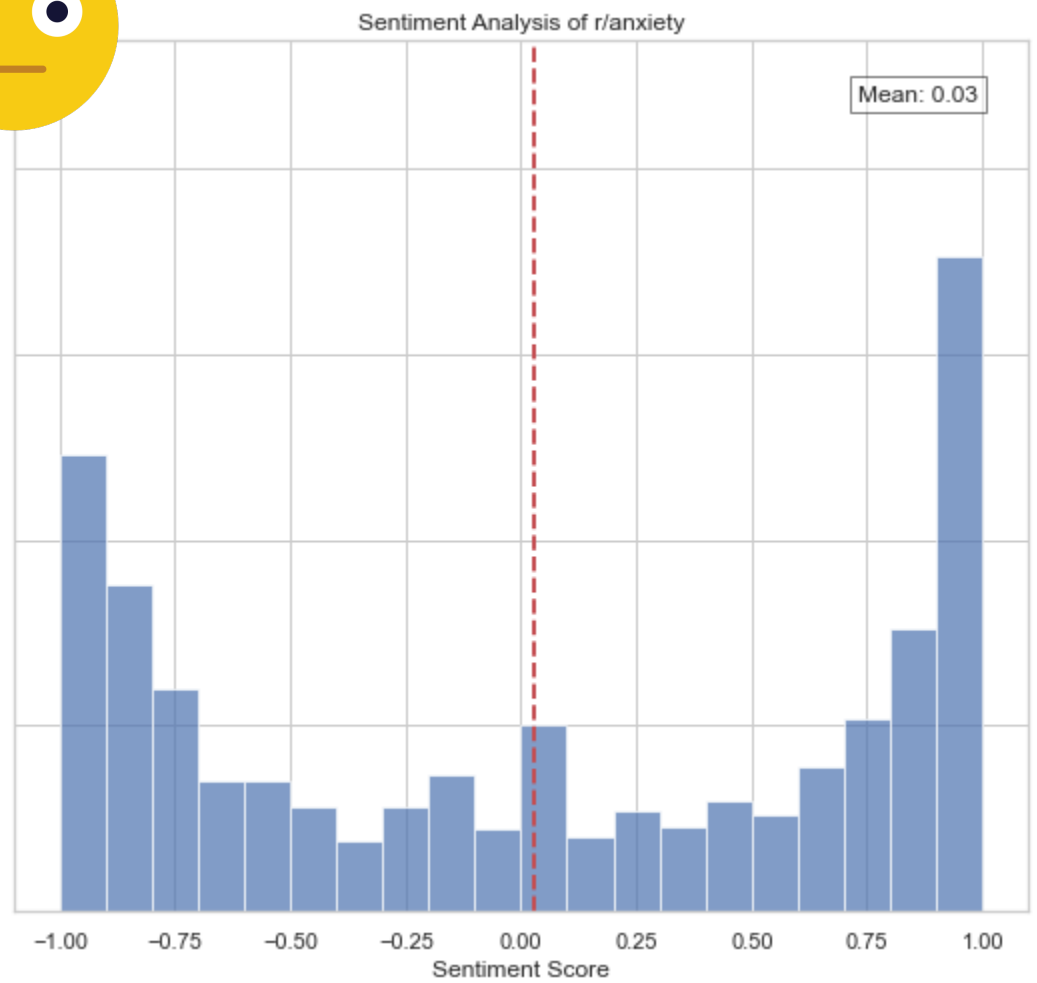
Frequency of Top Words





Sentiment Analysis





Data Science Approach

Problem Statement | Data Collection | Data Cleaning & Exploratory Data Analysis | **Pre-processing and Modelling** | Conclusion & Recommendation

Model Training and Comparison

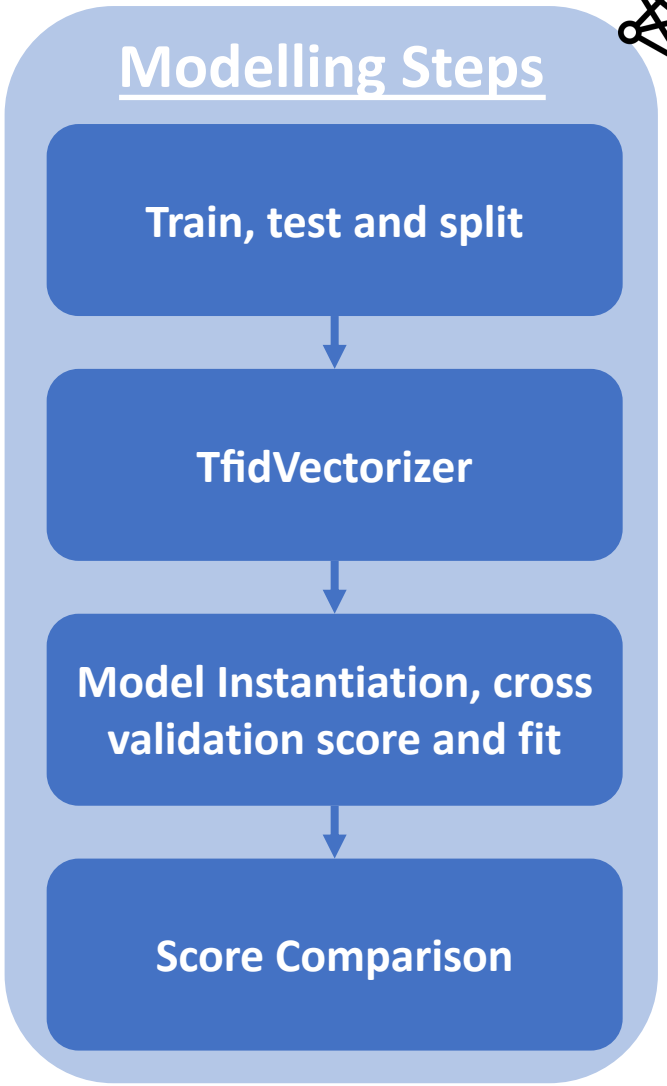
Models Trained:

- Naïve Bayes (MultinomialNB) Model
- Logistic Regression

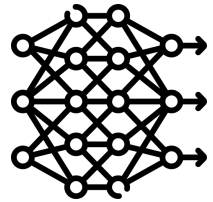
Baseline Score

50.39%

Modelling Steps



Score Comparison

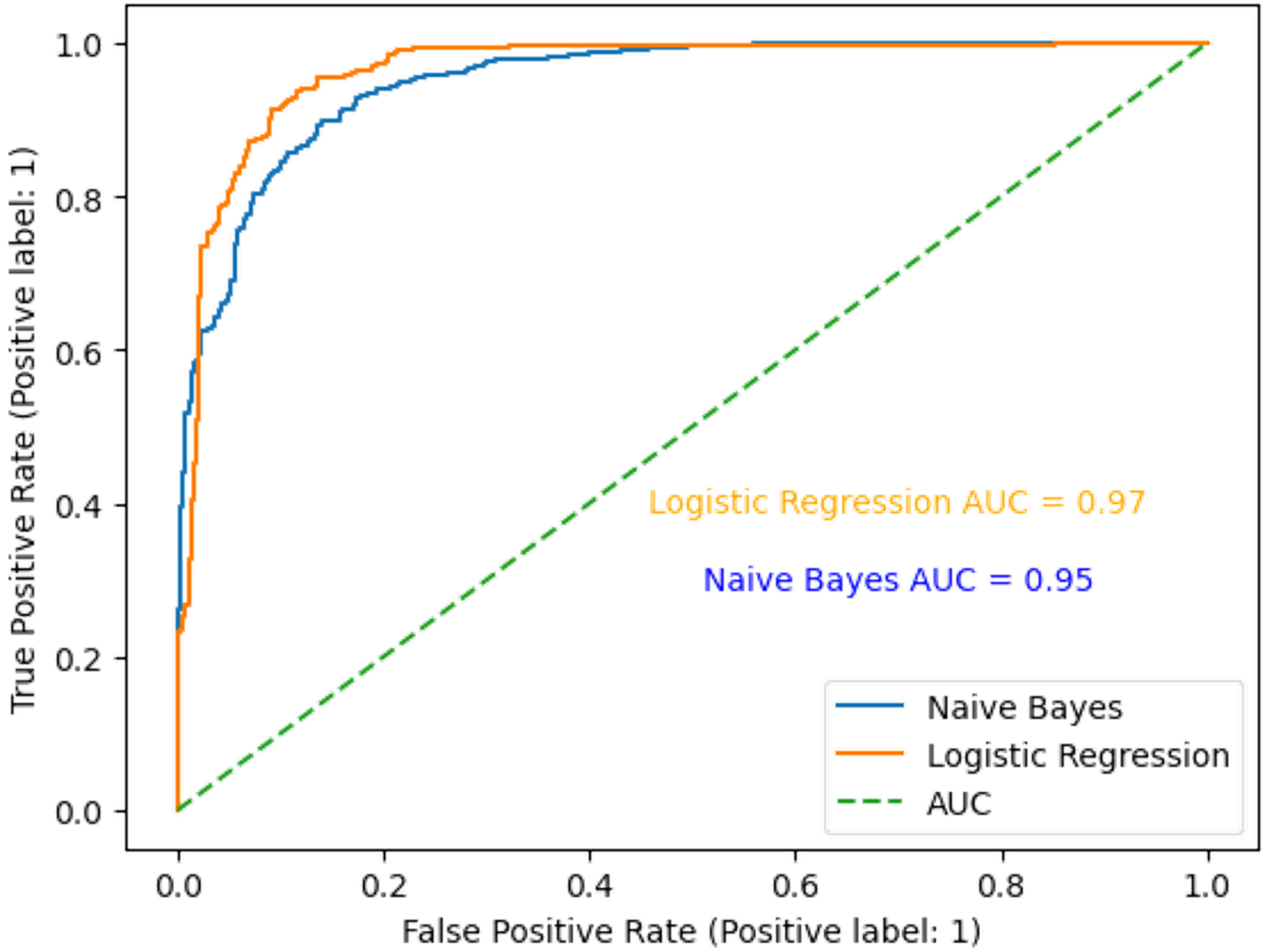


In the context of mental health classification between r/depression and r/anxiety with the goal of helping individuals receive appropriate help and support from the community, both **recall (sensitivity)** and **precision** are equally important.

Metrics*	Naïve Bayes	Logistic Regression
Mean Cross-validation score	0.8565560821484992	0.878041074249605
Accuracy	0.8775252525252525	0.9090909090909091
Precision	0.8416289592760181	0.9077306733167082
Recall	0.9323308270676691	0.9122807017543859
F1 Score	0.8846611177170036	0.9099999999999999

**** Please refer to Annex A for the Confusion Matrix for both models***

ROC Curve



Logistic Regression

90.9%

Data Science Approach

Problem Statement → Data Collection → Data Cleaning & Exploratory Data Analysis → Pre-processing and Modelling → Conclusion & Recommendation

Conclusion and Recommendation

- r/depression has a more negative sentiments as compared to r/anxiety which highlights the need for proper classification of posts such that users' posts will be categorised to the appropriate subreddit to receive the support they require.

- Moderators of both subreddits can utilise the trained model to have a preliminary classification of users' posts. However, as both anxiety and depression are serious mental health issues that require close attention to, there is a need to scrutinise the content to have a second evaluation.

Presentation Outline

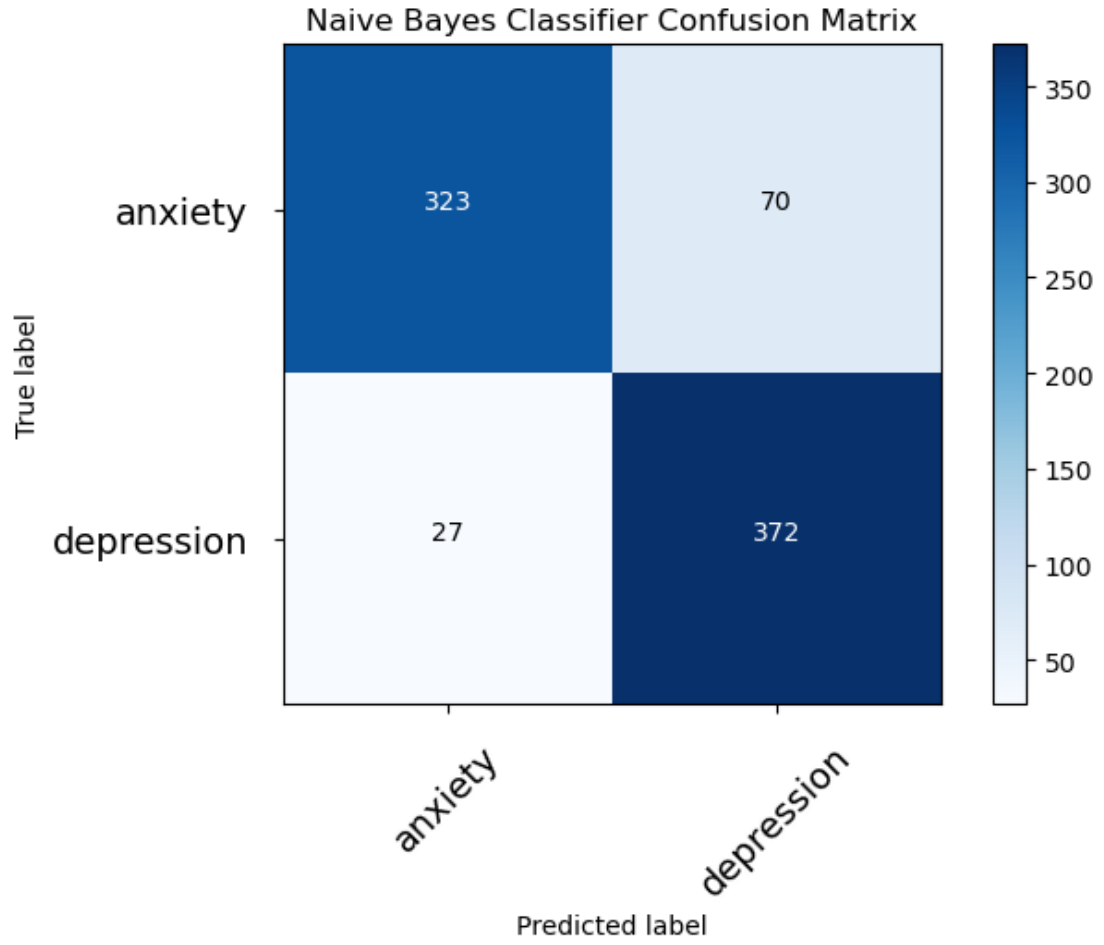
- Background
- Goal
- Data Science Approach
- Demo

Demo

Annex A

- **Confusion Matrix**

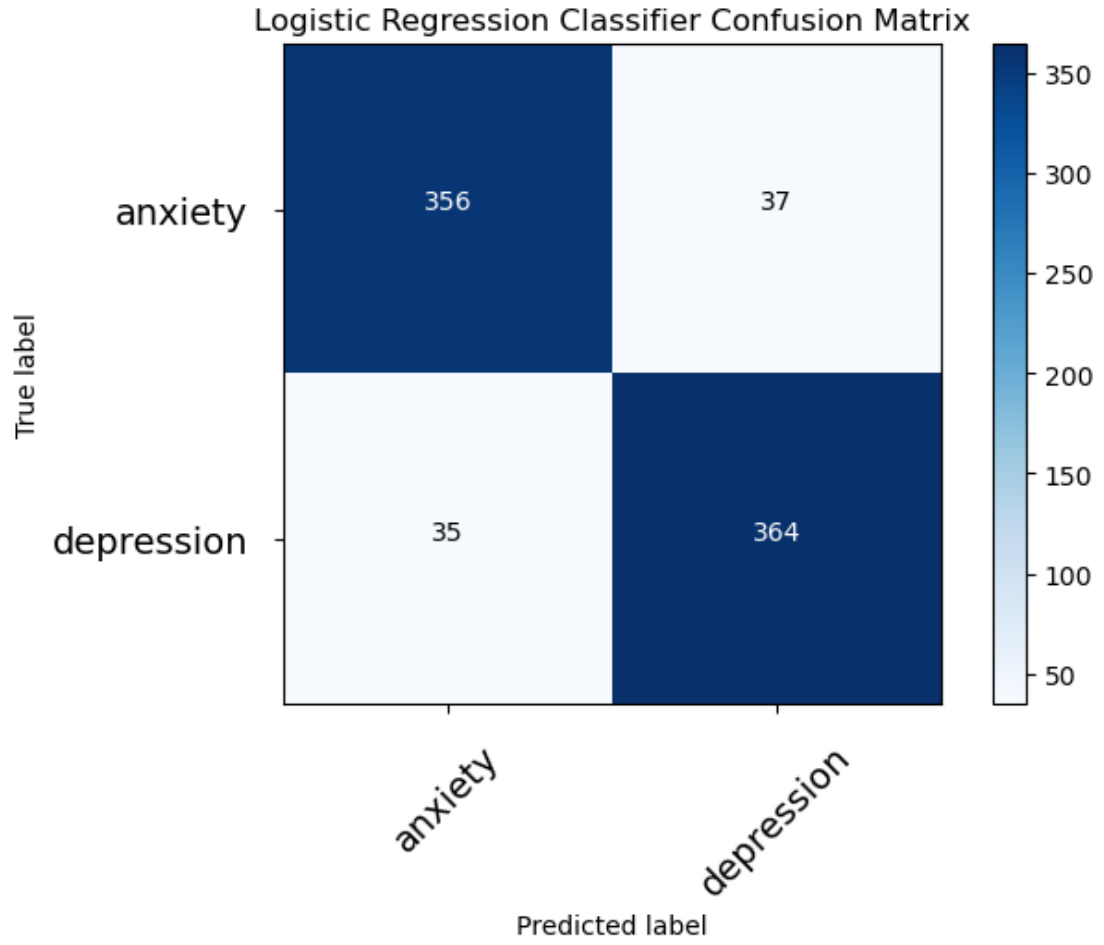
Naïve Bayes Model Confusion Matrix



Confusion Matrix

	Actually Positive (1)	Actually Negative (0)
Predicted Positive (1)	True Positives (TPs)	False Positives (FPs)
Predicted Negative (0)	False Negatives (FNs)	True Negatives (TNs)

Logistic Regression Model Confusion Matrix



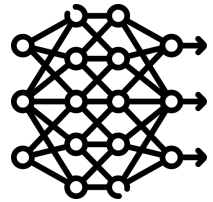
Confusion Matrix

	Actually Positive (1)	Actually Negative (0)
Predicted Positive (1)	True Positives (TPs)	False Positives (FPs)
Predicted Negative (0)	False Negatives (FNs)	True Negatives (TNs)

Annex B

- **Feature Importance for Logistic Regression**

Feature Importance



Top 10 Features	Importance
anxiety	-10.2146
depression	6.3353
removed	5.0625
anxious	-4.6802
depressed	4.1259
life	3.7131
panic	-2.7902
attack	-2.7340
kill	2.4345
tired	2.2143