

Subreddit Classification of Bipolarism vs Schizophrenia

STAKEHOLDERS

MOH/Psychiatry Clinical Society

CONTEXT

We are a small group of data scientists who are presenting our small use case model for identification/differentiation between 2 mental health conditions, for the purpose of requesting for sponsorship/funding to develop a wider use-case model to implement within the primary healthcare setting to detect mental health conditions

CONTENT PAGE

- Background Introduction
- Webscraping
- Exploratory Data Analysis
- Vectorize & Modelling
- Streamlit
- Conclusion/Recommendation/Future

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PROBLEM STATEMENT

HOW DO CLINICIANS DIAGNOSE MENTAL HEALTH CONDITIONS?

- To diagnose and assess mental health conditions, clinicians rely on:
 - F2F interactions
 - Non-verbal cues like body and affect
 - Other possible associated symptoms
 - Physical state of the patient
 - Family members to ask
 - Direct diagnostic questioning
 - Questions that get straight to the point
 - "How is your mood lately?"
 - "Do you ever feel like your thoughts can be heard?"



THE EMERGENCE OF TELEMEDICINE

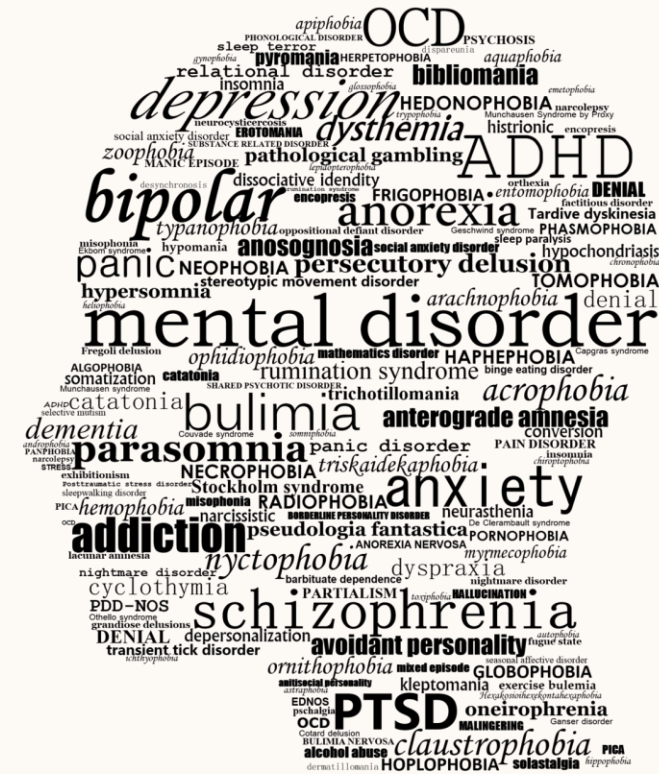
- Remote healthcare through technology
- Increased accessibility and convenience
- Challenges¹:
 - Lack of non-verbal cues
 - Limited rapport building
 - Potential for misdiagnosis



1 Hatami, H., Deravi, N., Danaei, B., Zangiabadian, M., Shahidi Bonjar, A. H., kheradmand, A., & Nasiri, M. J. (2022). Tele-medicine and improvement of mental health problems in COVID-19 pandemic: A systematic review. *International Journal of Methods in Psychiatric Research*, 31(3), e1924. <https://doi.org/10.1002/mpr.1924>

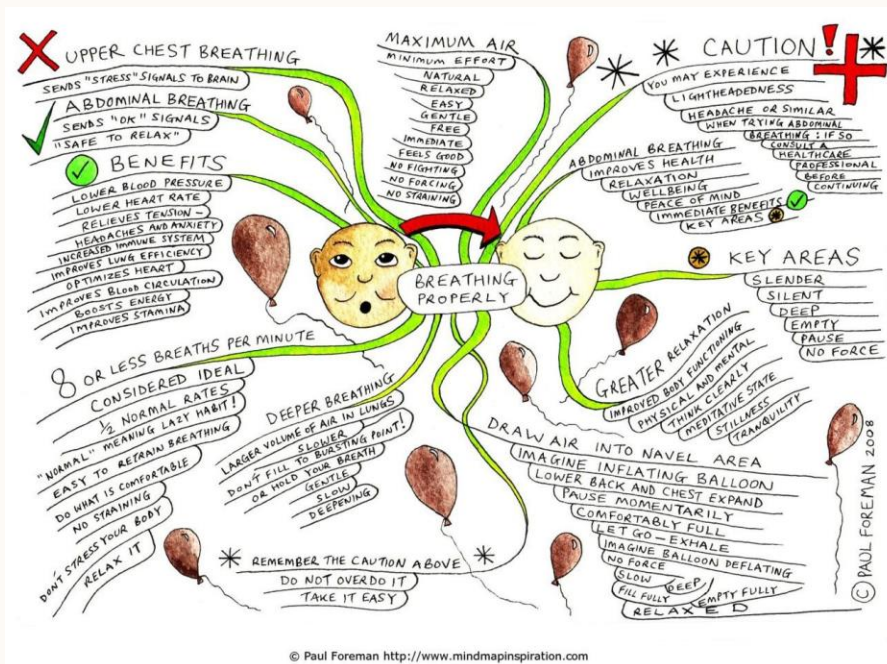
THE NEED FOR BETTER LINGUISTIC UNDERSTANDING OF MENTAL HEALTH CONDITIONS +

- Rise of telemedicine
 - Relook at alternative diagnostic tools
- Online communication
 - Patients may communicate health concerns via text
- Social Media
 - Patient-generated data is frequently online
- Current diagnostic methods are not perfect



OBJECTIVES AND SCOPE

- Evaluate effectiveness of Natural-Language Processing (NLP) technologies as a way of converting and understanding mental health conditions.
- To build a model that will assist clinicians in understanding how mental health can be diagnosed via non-contextual linguistic information.
- Will be testing the model on text data taken from online communities r/bipolar and r/schizophrenia



NEED FOR DIAGNOSTIC TOOL TO BE DEVELOPED

- Majority of mental health patients will remain undiagnosed
 - ~50% of all schizophrenia patients
 - ~70% of all bipolar patients
- The primary healthcare system would hence greatly benefit from a preliminary alert filtering tool that is anonymous and community based.

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BACKGROUND

SCHIZOPHRENIA

vs

BIPOLAR DISORDER

BIPOLAR DISORDER

- Mood disorder characterized by extreme mood swings, including manic and depressive episodes.
- Hypermania and Hypomania subtypes
- Affects ~3% of world population, 70% will remain undiagnosed.



SCHIZOPHRENIA

- Chronic psychiatric disorder characterized by distorted thoughts, emotions, and perceptions.
- Marked by extreme paranoia and hallucinations (auditory most common)
- Has Paranoid, Disorganised, Catatonic, Undifferentiated, and Residual subtypes
- Affects approximately 0.7% of the global population.



ETIOLOGY

Bipolar

- Strong genetic component, family history is relevant
- Background factors also a consideration (poor living conditions, abusive environment)
- Develops in late adolescence or early adulthood
- Significant life changes/events may trigger

Schizophrenia

- Environmental and genetic contribution generally equal
- Issue is often caused by neurochemical imbalances, particularly in dopamine and glutamate
- Infections, malnutrition, birth complication increases risk
- Psychoactive substance use

PRESENTATION

Bipolar

- Typically less severe
- Patients generally present with awareness (insight) of their mood disorder issues
- Usually issue is isolated and primary
- More functional in comparison – usually can work and still exist in society

Schizophrenia

- More severe presentation
- Less insight
- May present with other conditions (liver damage, sepsis, etc)
- Much less functional

TREATMENT

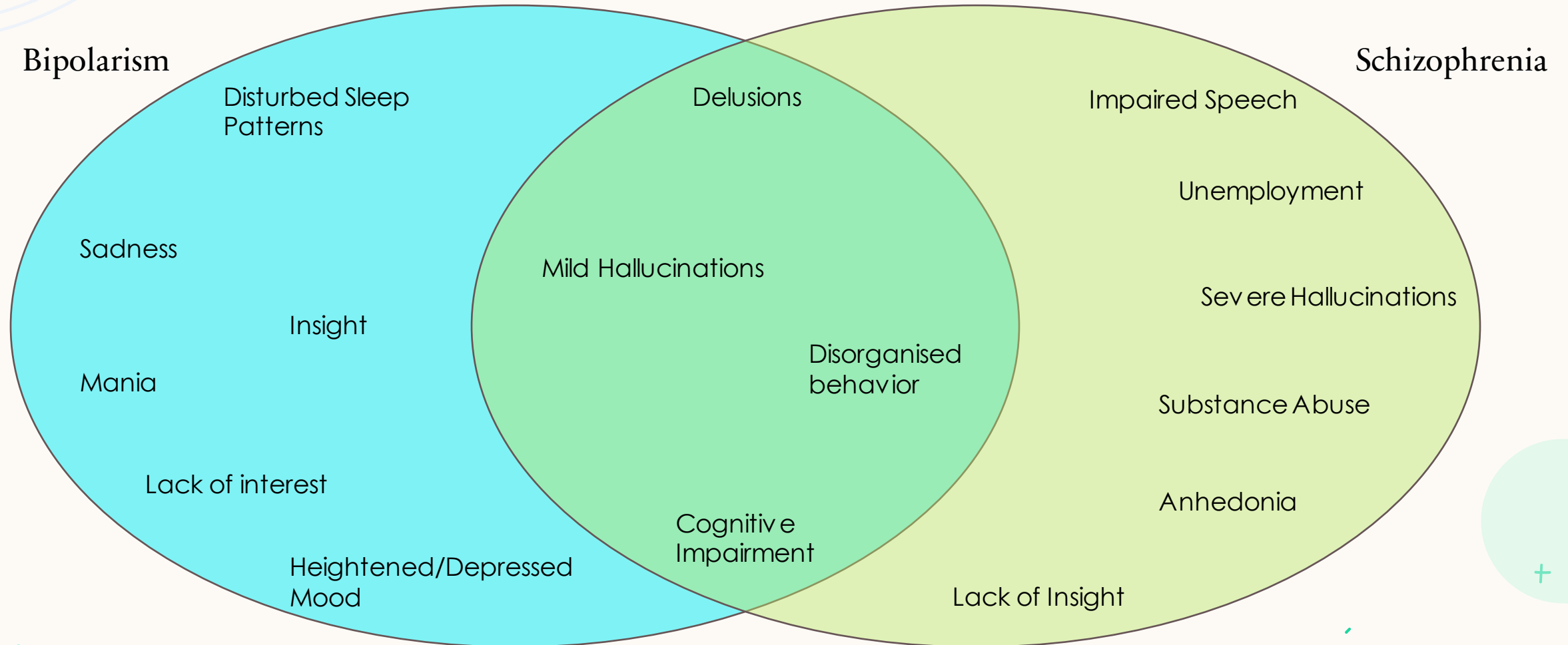
Bipolar

- Lithium
 - Anticonvulsants
 - Atypical Antipsychotics
-
- CBT
 - Family-focused therapy
 - Admission if suicide risk

Schizophrenia

- Antipsychotic Medication
-
- Social skills training
 - Supported employment

FEATURES





WEBSCRAPING

Webscraping on subreddits

SUBREDDITS SELECTION



r/bipolar

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rows**

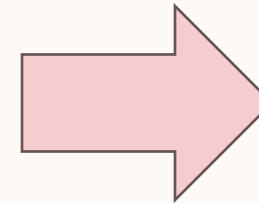
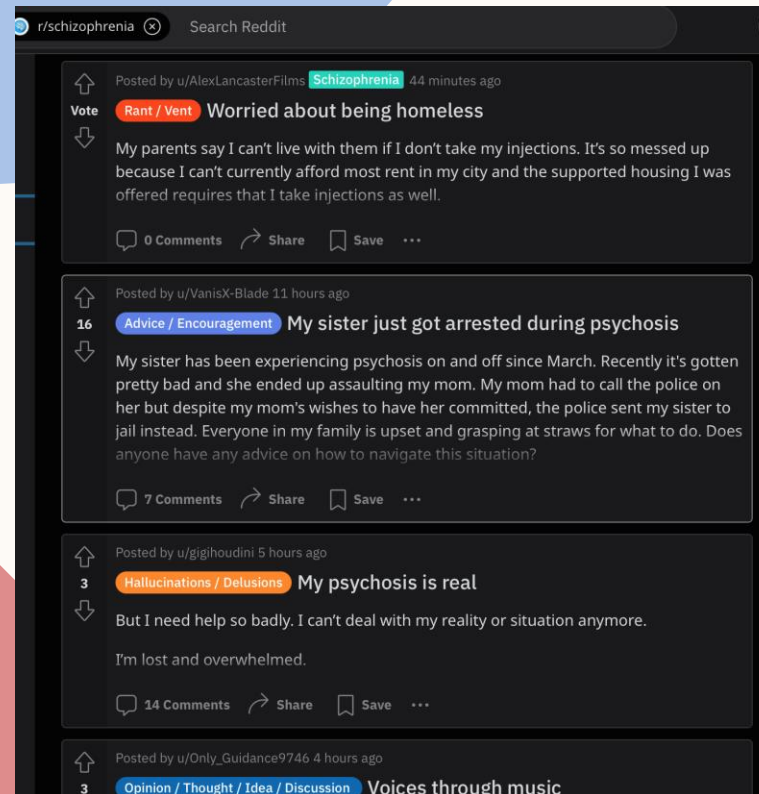
**Titles /
Text**

r/schizophrenia

**~1600
rows**

**Titles /
Text**

EXAMPLES



Id	Title	Text	Score
1409xqw	Mania Coping Skills	Many people experience increased mania during th	52
149j9jo	omfg guys I'm actually s		130
149pkfl	What are your telltale sig	I noticed today that I kept randomly laughing at stu	19
149odnt	How do you cope when	I have been manic for two weeks and then yesterd	14
1497cwv	Quit my job last week du	School teacher. Love my class, but I have a couple	133
		Took a week off for my mental health because I fel	
		Against any sort of protocol (the union is now furic	
		Really regretting my decision. Love my students ar	
		Edit: talking to the union would be a good option b	
149a229	Relationships?	Does anyone feel like they will be a lone forever? I	63
149iww3	How did you learn to acc	Because I feel like I cannot and I've been researchi	20
		I'm going through my last 12 years of life (I'm 29) a	
		I'm rummaging all corners of the internet to see wh	
		Edit: I was diagnosed officially (for the 4th time) w	
149q3xf	A lot happening	I had a girlfriend/ maybe still have a girlfriend, And	4
149rx38	Why do I think I have the	Like I have one good lawsuit going how ever, since	5
14984os	I'm Manic!	For the younger community in this group, do you g	35
		Younger people literally started using the word jus	
		I'm so tired of mental health conditions being joke	

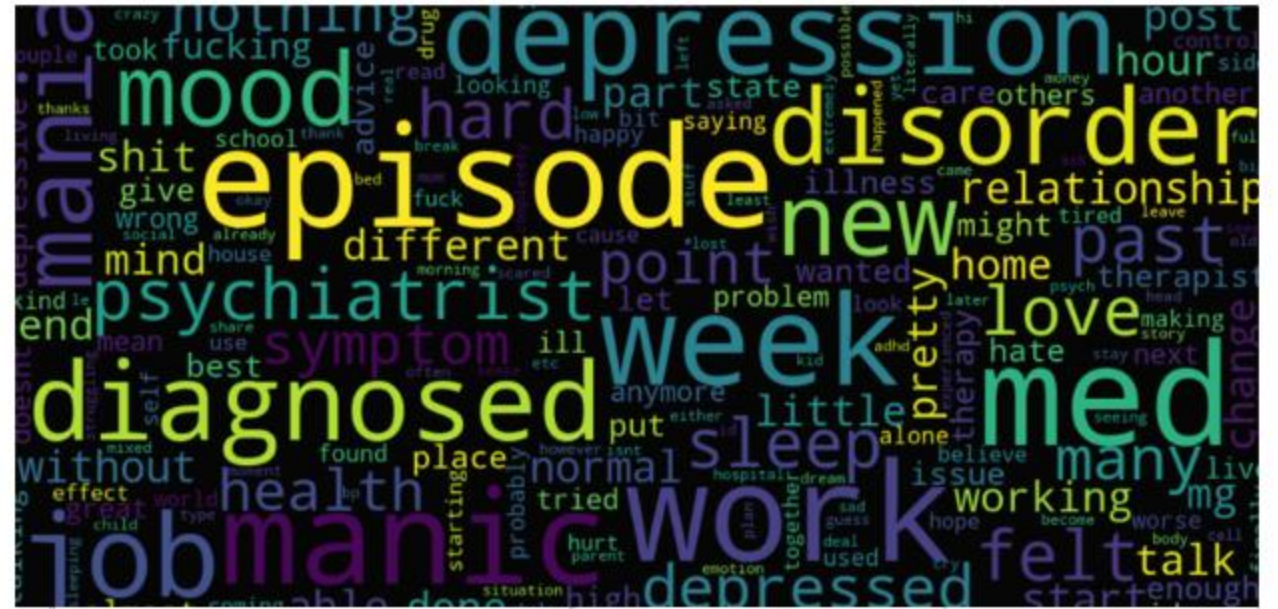
Post to CSV file



EXPLORATORY DATA ANALYSIS

A look at the information provided

Bipolar

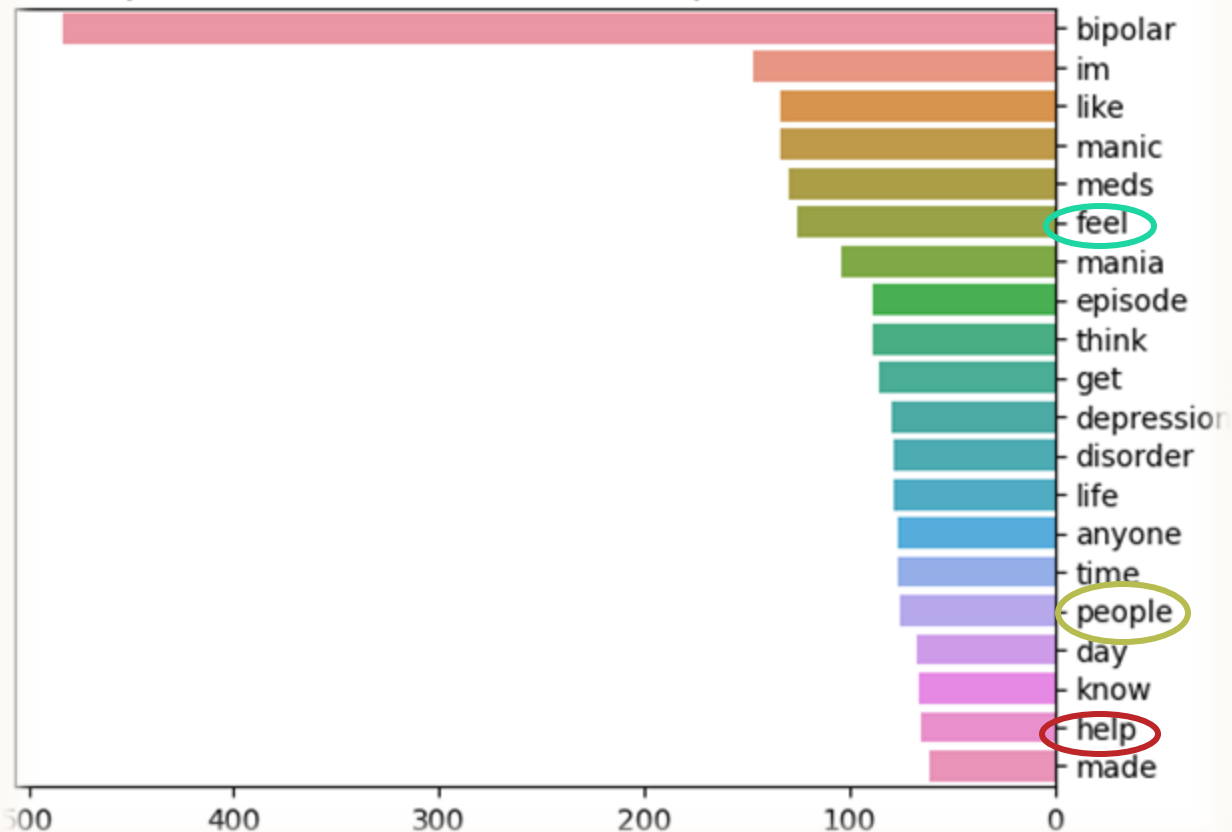


Schizophrenia

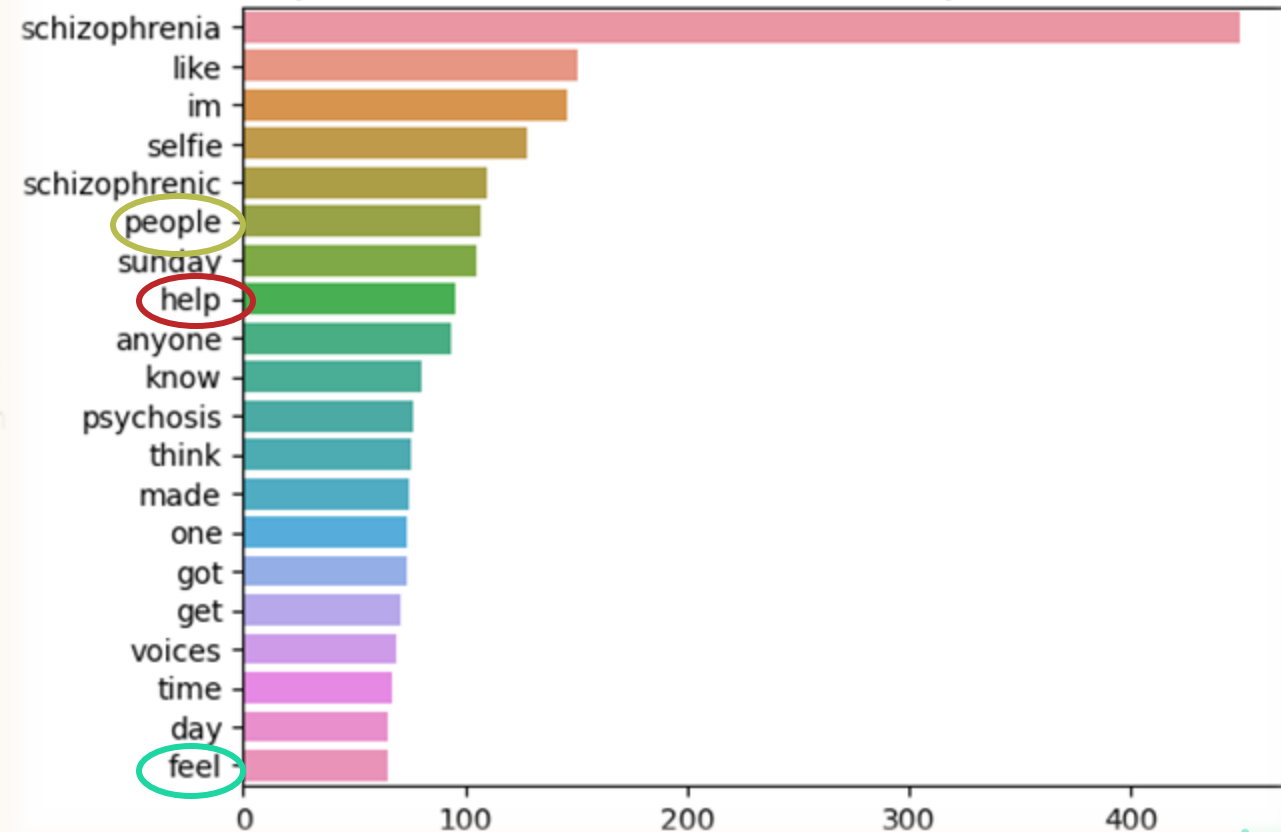


TOP WORDS

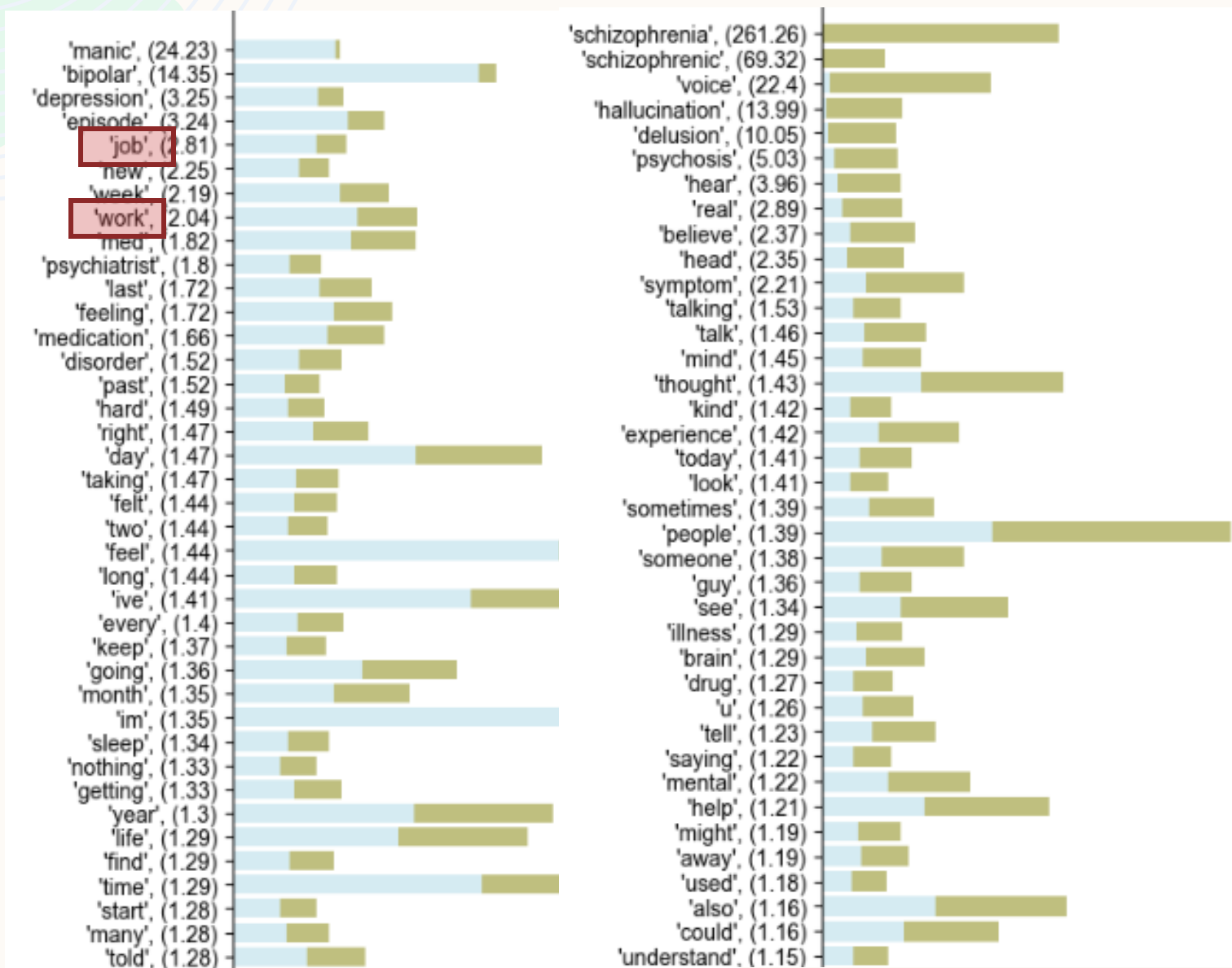
Top 20 most common words in r/Bipolar Posts' Title



Top 20 most common words in r/Schizophrenia Posts' Title

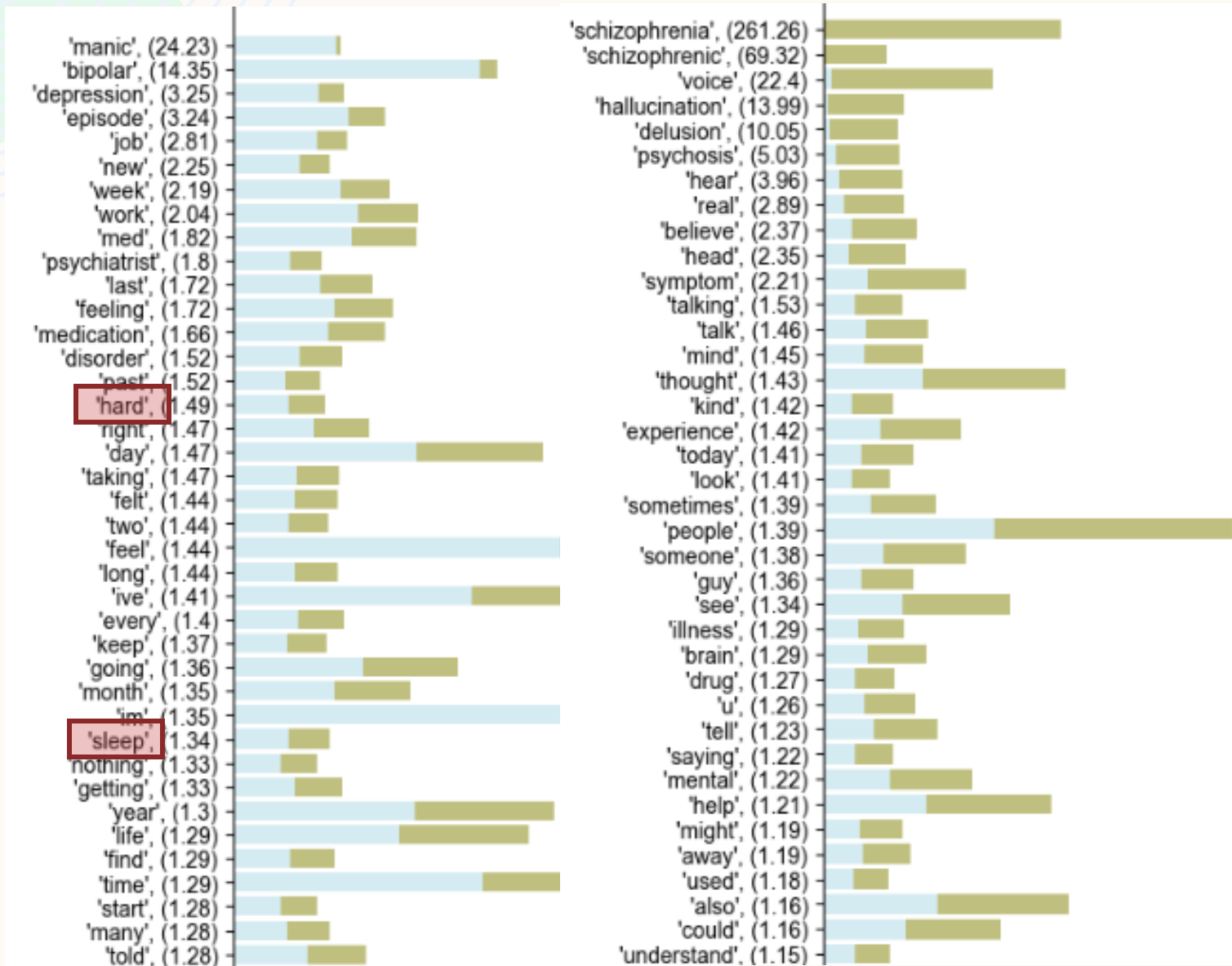


COMPARING WORD OCCURRENCE



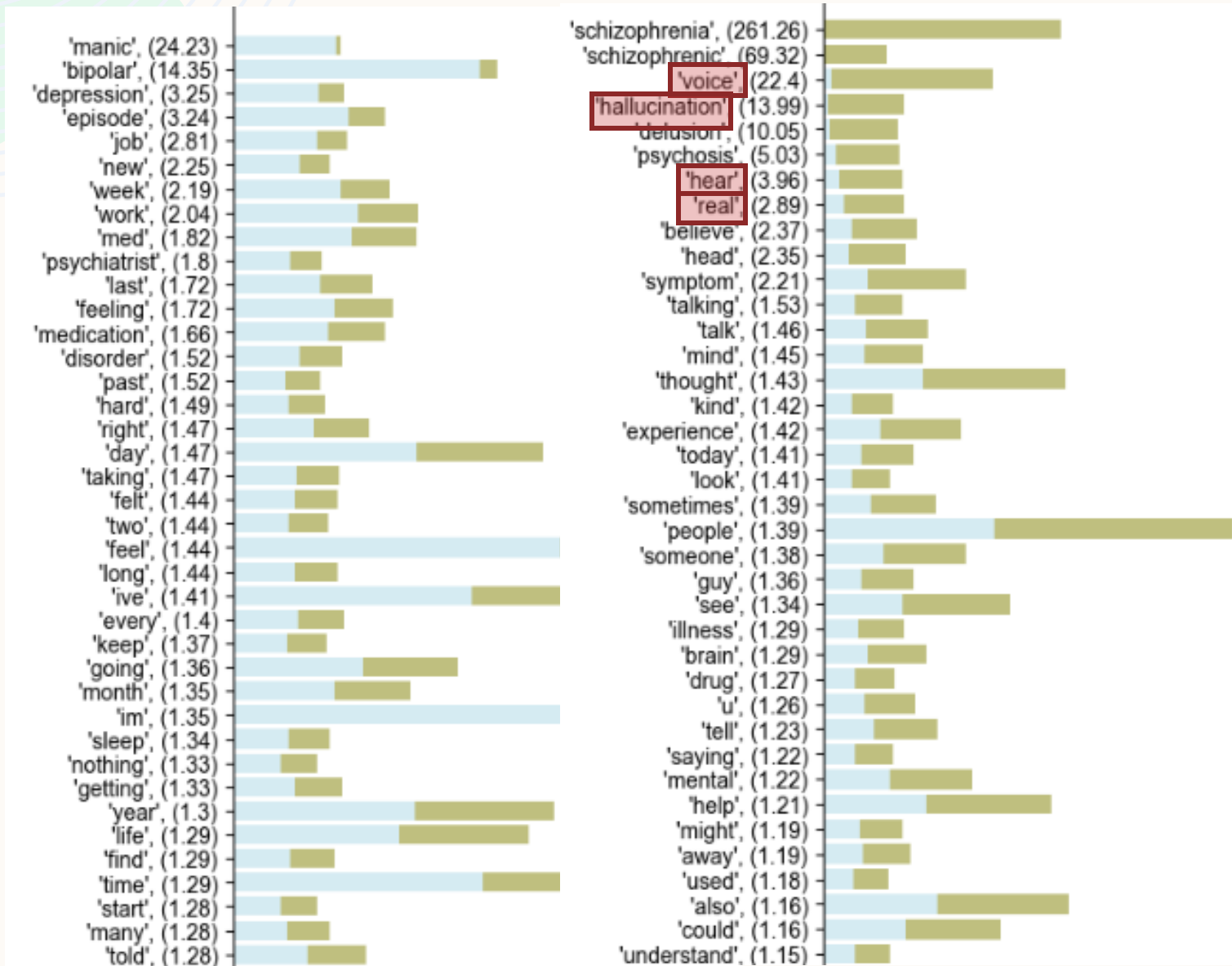
Bipolar patients are usually more employable.

COMPARING WORD OCCURRENCE



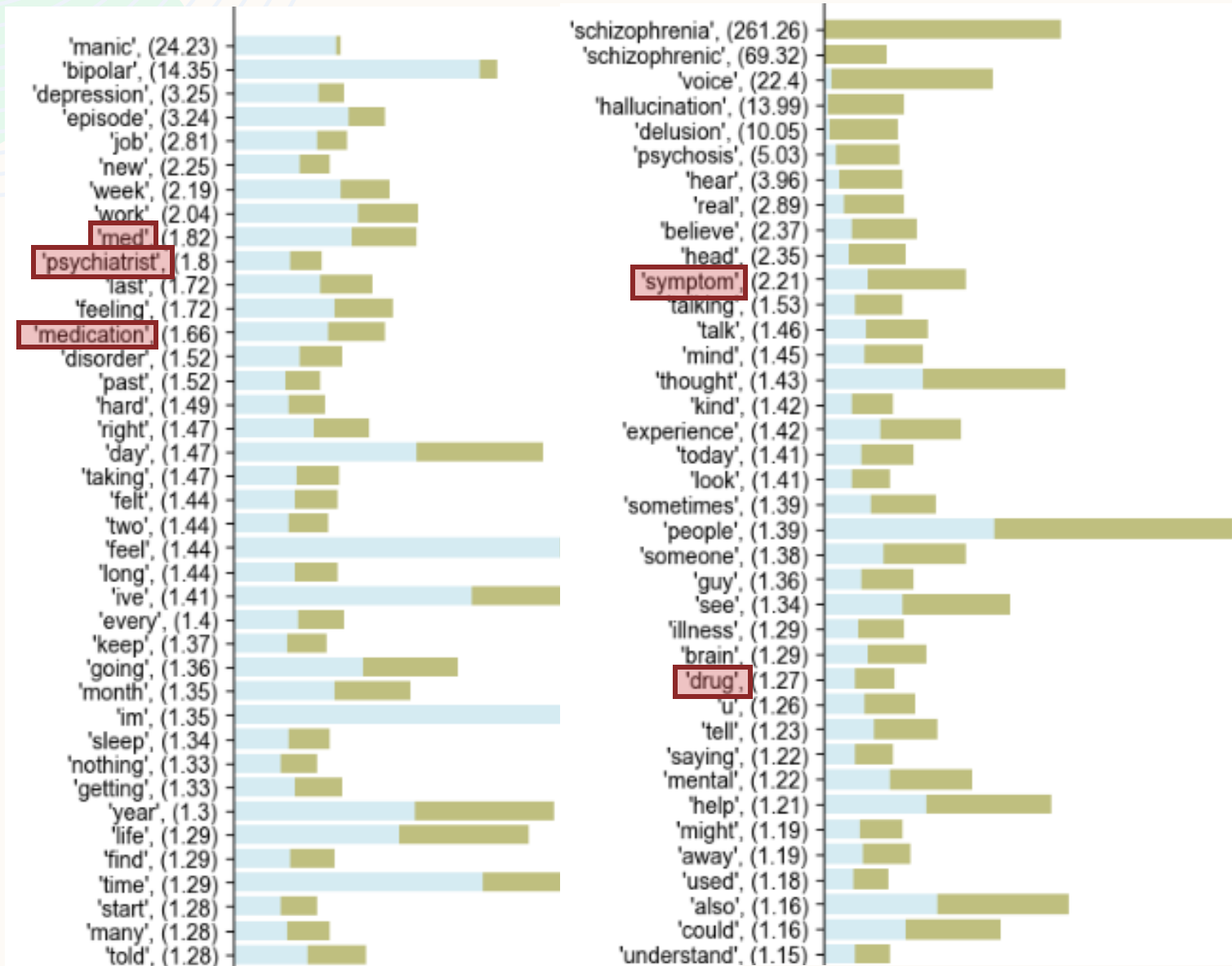
Bipolar patients often experience low mood and tiredness.

COMPARING WORD OCCURRENCE



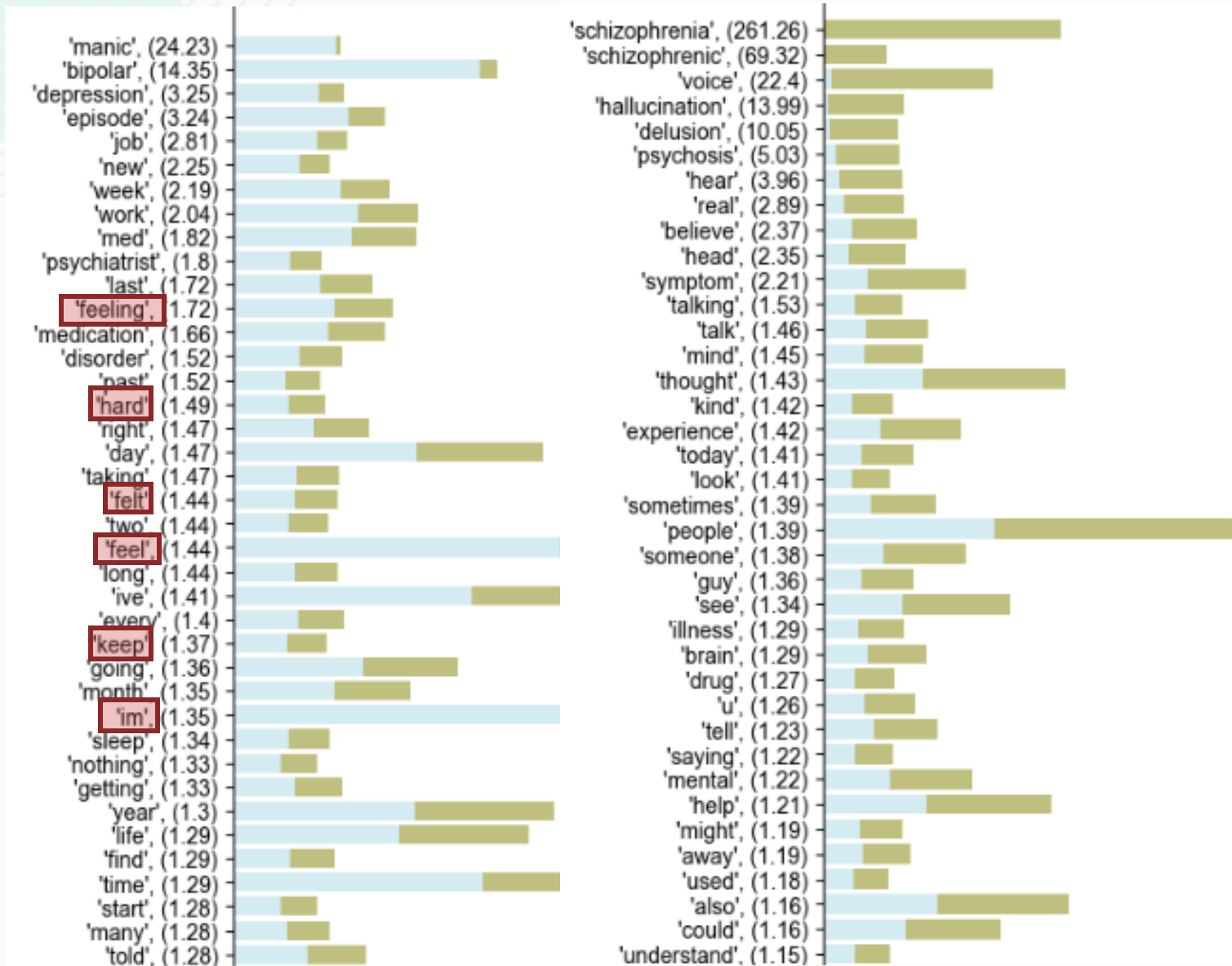
Schizophrenic patients commonly experience delusions or hallucinations, often auditory.

COMPARING WORD OCCURRENCE



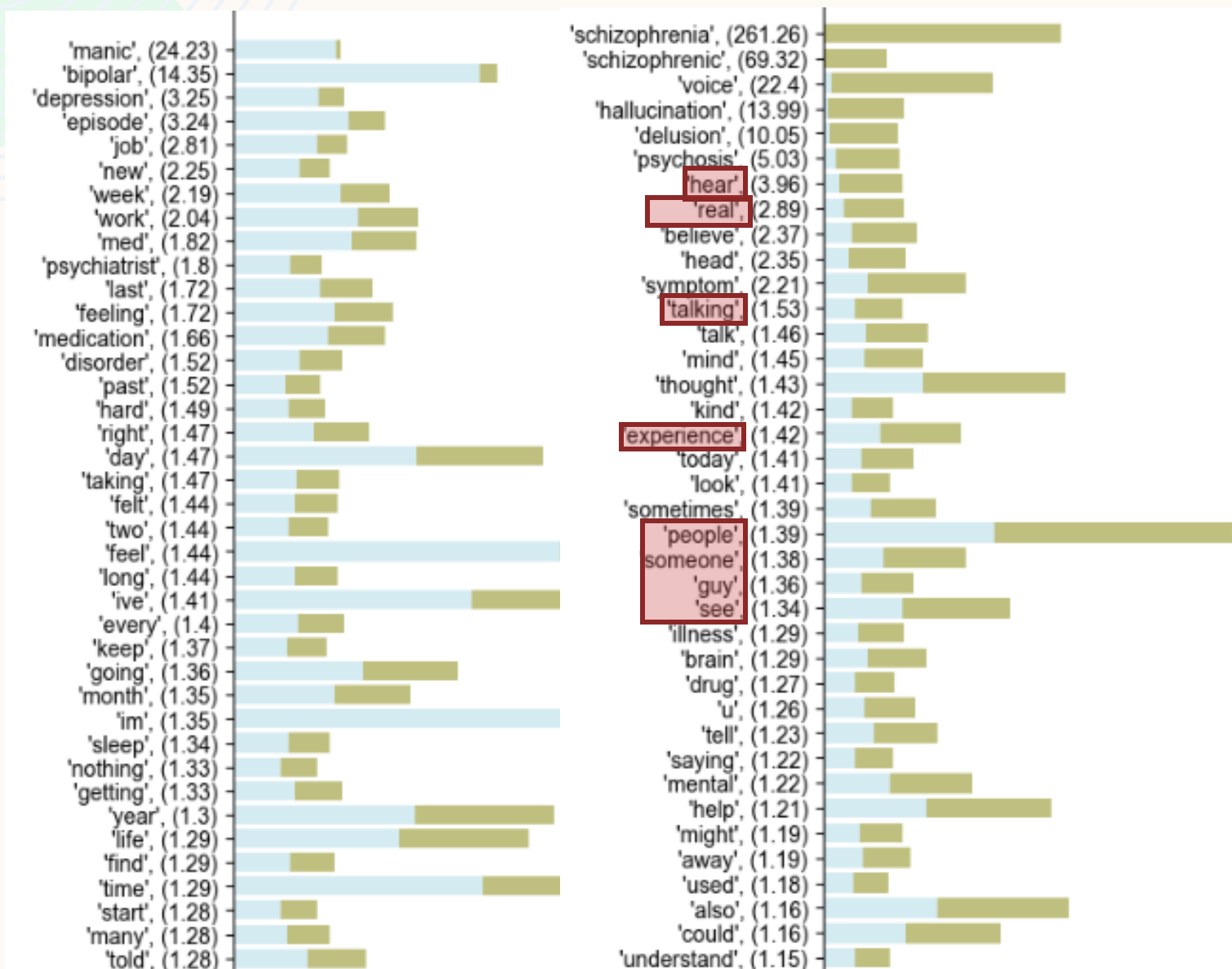
Bipolar patients are more accustomed to formal healthcare settings

COMPARING WORD OCCURRENCE



Bipolar patients often ask for advice/talk about their own feelings (showcases insight).

COMPARING WORD OCCURRENCE

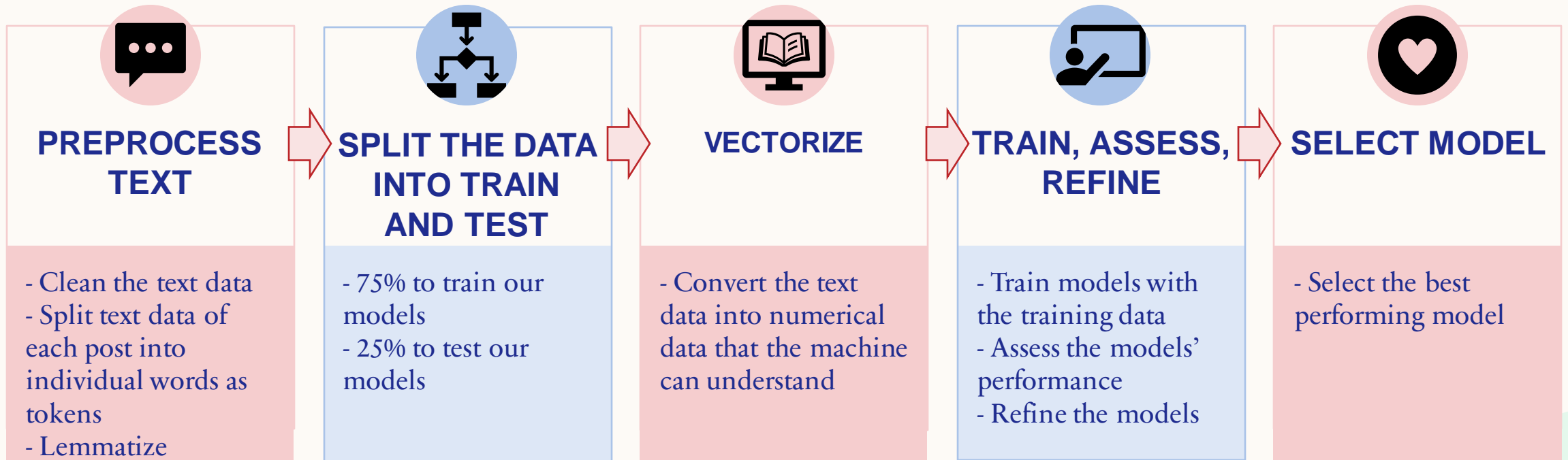


Schizophrenic patients tend to talk more about their experiences (suggests less insight)

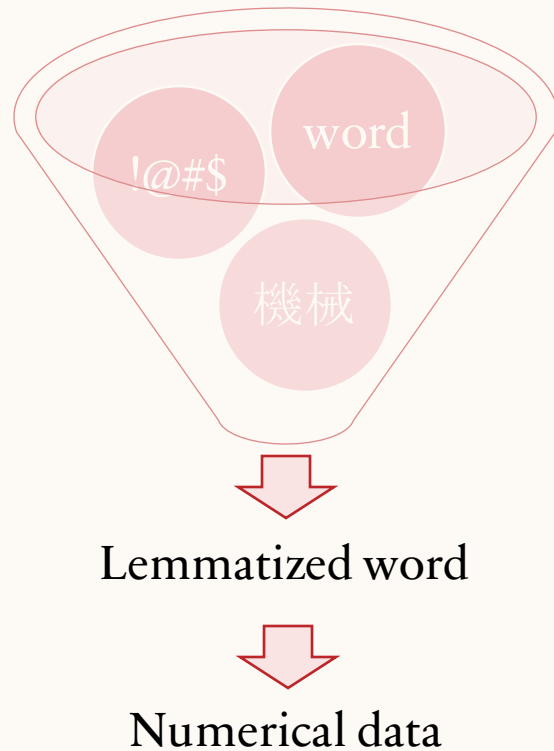
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MODELLING

HOW THE MODEL IS BUILT



PREPROCESSING TEXT



1. Remove duplicate Reddit posts
2. Remove punctuations
3. Lower case and tokenizing the text
4. Remove stopwords (*e.g.*, and, the)
5. Remove numbers
6. Remove non-English words
7. Lemmatize words (*e.g.*, guys -> guy, feet -> foot)
8. Convert words into numerical data

WORD SELECTION



1. Inclusion List

- Words that are unique to either the schizophrenia or bipolar subreddit

2. Exclusion List

- The “schizophrenia and “bipolar” words themselves
- Some common words that have potentially low impact, e.g. “i”, “im”, “u”, “also”, “one” etc.
- Some words that appear frequently in both subreddits, e.g. “doctor”, “brain”
- Words that appear very rarely, and not in inclusion list

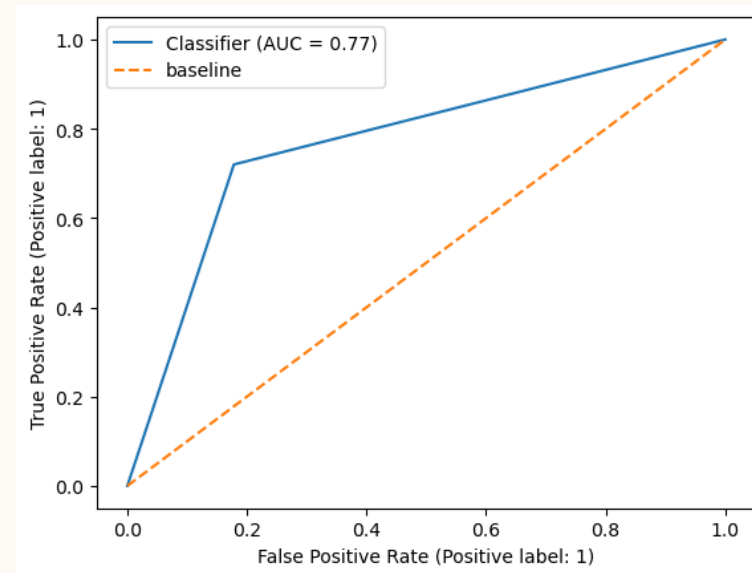
MODELS USED

Vectorizer Method	Classification Type	Train Score	Test Score
Count Vectorizer	Naïve Bayes Bernouli	0.8700	0.8101
Count Vectorizer	Naïve Bayes Multinomial	0.8881	0.7904
Count Vectorizer	Logistic Regression	0.9914	0.7855
Count Vectorizer	Random Forest	0.9992	0.8372
Count Vectorizer	Adaptive Boosting	0.8548	0.7707
Count Vectorizer	Gradient Boosting	0.9227	0.8163
TF-IDF	Naïve Bayes Bernouli	0.8939	0.7916
TF-IDF	Naïve Bayes Multinomial	0.9029	0.7916
TF-IDF	Logistic Regression	0.9264	0.8015
TF-IDF	Random Forest	0.9992	0.8212
TF-IDF	Adaptive Boosting	0.8248	0.7867
TF-IDF	Gradient Boosting	0.8836	0.7953

MODEL PERFORMANCE - BASELINE

Baseline Model: Count Vectorizer - Adaptive Boosting

	Predict Schizophrenia	Predict Bipolar
Actual Schizophrenia	332	72
Actual Bipolar	114	293

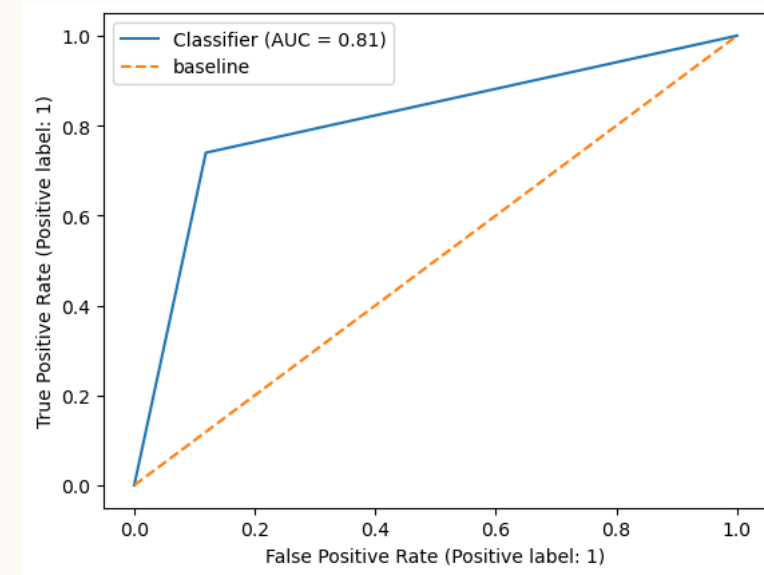


	Precision	Recall	f1-score	Support
Schizophrenia	0.74	0.82	0.78	404
Bipolar	0.80	0.72	0.76	407
Accuracy		0.77	Train Score	0.8548
			Test Score	0.7707

MODEL PERFORMANCE - BEST

Best Model: Count Vectorizer – Naïve Bayes Bernoulli

	Predict Schizophrenia	Predict Bipolar
Actual Schizophrenia	356 ↑ +24	48 ↓ - 24
Actual Bipolar	106 ↓ - 8	301 ↑ +8



	Precision	Recall	f1-score	Support
Schizophrenia	0.77 ↑ +0.03	0.88 ↑ +0.06	0.82 ↑ +0.04	404
Bipolar	0.86 ↑ +0.06	0.74 ↑ +0.02	0.80 ↑ +0.04	407
Accuracy	0.81 ↑ +0.04			Train Score
				0.8700 ↑ +0.0152
				Test Score
				0.8101 ↑ +0.0394

FEATURE IMPORTANCE (SCHIZOPHRENIA)

Top Words	Importance
voice	0.177924
symptom	0.154036
schizophrenic	0.138386
diagnosed	0.126853
hallucination	0.123558
med	0.121911
talk	0.115321
delusion	0.114498
psychosis	0.109555
hear	0.107908
work	0.103789
believe	0.101318
real	0.094728

FEATURE IMPORTANCE (BIPOLAR)

Top Words	Importance
episode	0.217035
med	0.212121
week	0.199017
manic	0.197379
work	0.195741
diagnosed	0.166257
depression	0.150696
disorder	0.132678
new	0.124488
mania	0.122850
mood	0.122850
psychiatrist	0.117117
job	0.116298

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MODEL DEMO

A look at the prototype and how we plan to evolve it into a functional aid for telemedicine

FUTURE WORK

- Further train the model to be able to recognize a wider spectrum of mental health conditions
- AI will analyze the conversation with patient to help doctors get insights of their condition before the appointment



Hello, John Doe! I am Patient Prep AI. Before your appointment, I'd like to ask you some questions to help your doctor understand your situation better. Is that okay with you?

Yeah, sure thing.



Great, thank you. Could you describe what brought you to seek help today?

It's a bit weird, but I've been hearing stuff. Like, voices. I know they're not real, but it's pretty freaky. Plus, I can't stop these strange thoughts that pop into my head.



I'm sorry you're going through this, John. Do these voices talk to you or about you?

Yeah, they talk directly to me. They kinda boss me around or comment on what I'm doing. It's like I'm in a weird reality show.





That sounds challenging. Have you experienced any similar episodes in the past?

Nah, nothing like this has ever happened before.



Have you ever been diagnosed with a psychiatric condition or seen a mental health professional before this?

Nope, never had to see a shrink or anything.



I understand. Are you currently taking any medications, for any reason?

No, I'm not on anything.



Thank you for that information, John. How have these symptoms affected your daily life?

It's been rough. I can't focus on my work, and I've been avoiding my friends cause I'm scared they'll think I'm going crazy.



I can imagine that's quite tough for you, John. Do you have any family history of mental health issues?

I think my aunt had some mental health stuff going on. My parents used to say she was super paranoid but that's about all I know.




That's helpful to know. Thank you. Based on what you've told me, I'll prepare a summary for your doctor. Is there anything else you would like your doctor to know?

Nah, that's pretty much it.



Thank you, John. Your responses will help your doctor provide the best care possible. If you feel your condition is worsening or you need immediate help, don't hesitate to reach out to someone you trust or our clinic at +65 1234-5678.

SAMPLE REPORT

 John Doe Report

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File

Edit

View



Patient Name: John
Patient ID: 00123
Age: 20
Next Appointment Date: July 15, 2023
Doctor's Name: Dr. Jane Smith

Conversation Summary:

Auditory hallucinations, hearing voices that are not there -> give him commands or comment on his actions

Intrusive, unusual thoughts that he can't shake off.

First time he's experienced such symptoms. He has no prior psychiatric diagnosis or treatment history.

He's not currently taking any medications.

Affected his daily life significantly, impacting his ability to concentrate on work and leading him to isolate himself from his friends out of fear of judgment.

Potential family history of mental health issues -> aunt: "very paranoid."

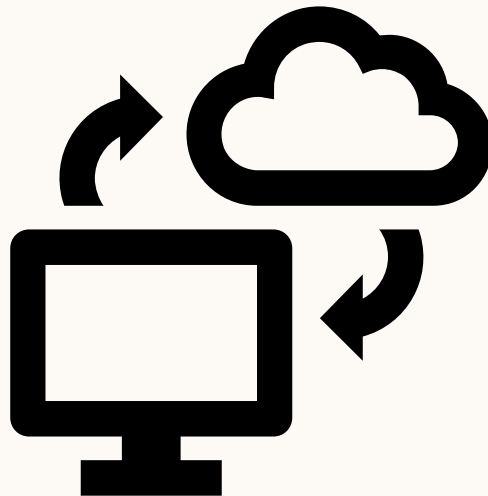
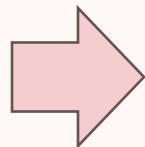
Possible Diagnoses Based on Keywords and Symptoms:

Schizophrenia

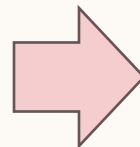
Schizoaffective Disorder

Psychotic Disorder Not Otherwise Specified (NOS)

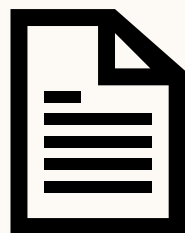
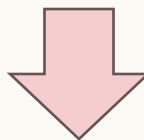
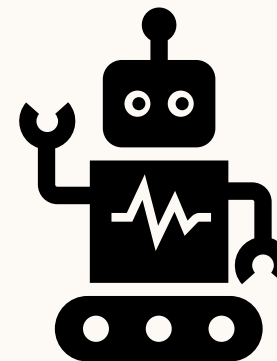
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NLU Engine



I'm sorry you're going through this, John. Do these voices talk to you or about you?



Report for the doctor



THANK YOU!

Do you have any questions?