

Unmasking Despair: Predicting Suicide Sentiment in Tweets for Early Intervention

A Data-Driven Approach Using NLP and Machine Learning

- Disclaimer -

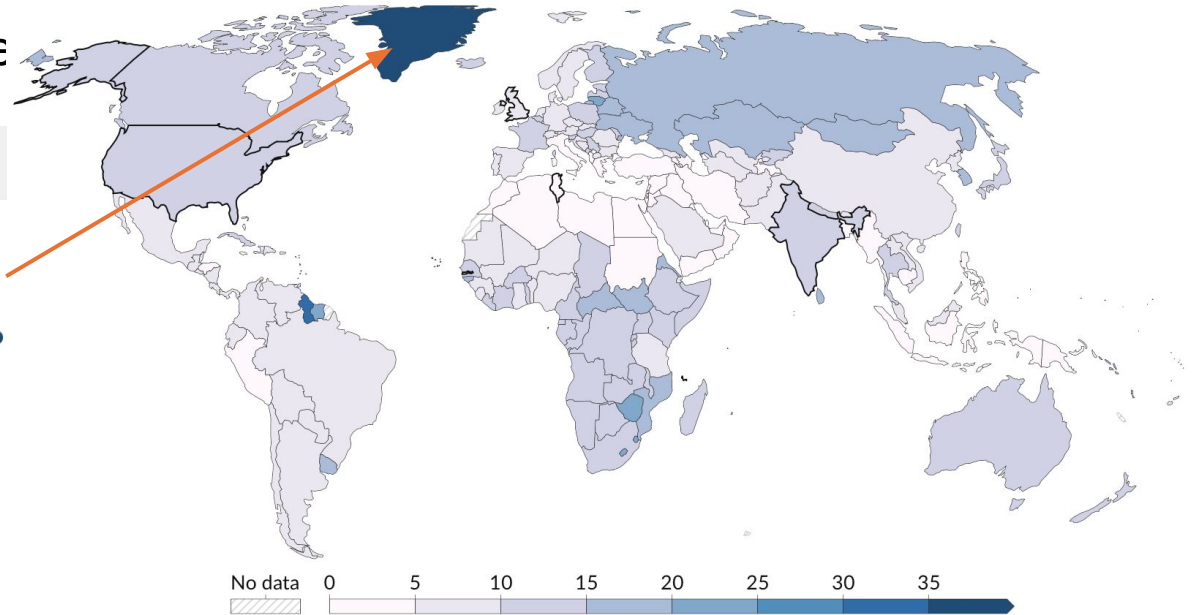
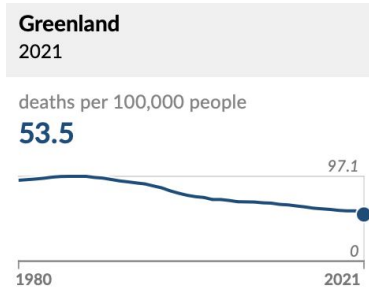
- Please be advised – This presentation includes discussions and data about suicide, which may be distressing to some viewers.

Agenda

1. Introduction
2. Value Proposition
3. Dataset
 - I. Data Visualisation
 - II. Feature Engineering
 - III. Unsupervised Learning
4. Model Training
5. Evaluation
6. Limitations and Areas for Improvement
7. Business Recommendations
8. Conclusion

Introduction

- Global suicide rate in 2021 is estimated at **10.5 per 100,000** people
 - Highest rates in Gre



Introduction

- Technology & Suicide

Social media platforms, such as Twitter,/X, have become significant venues for expression, which can be related to mental health and suicide.

The can be used as an avenue for:

1. Expression of distress
2. Seeking support

Introduction

- Traditional Detection
 - Clinical Assessment and Interviews
 - Observation by loved ones and professionals
 - Self-Reporting and Help-Seeking



Introduction

In the rapidly modernising world, there is a rising concern of mental health and suicide rates. It is important to be aware of potential victims and intervene.

Problem Statement

- To develop a model to predict suicide sentiment in tweets and provide actionable insights.

Value Proposition

Stake Holders

- Mental health professionals
- Social media platforms

Value Proposition

- Develop **intervention strategies** based on identified sentiment patterns
- Develop **real-time monitoring** tools for social media platforms
- Collaboration with mental health organizations for **support and outreach**

Dataset - Source

- **Data Source:** Suicide and Depression Detection dataset from Kaggle
- Sample Data
 - "Am I weird I don't get affected by compliments..."
 - "I'm so lostHello, my name is Adam (16) and I've been struggling..."
 - "Is it worth it?Is all the trouble, work and anxiety really worth living for"
- Data size – 200000+ rows
 - Sample size of 5000 is used

Dataset - Description

- Dataset

`df.describe()`

	text	class
count	5000	5000
unique	5000	2
top	I Don't know?? Months self harm free and the ...	non-suicide
freq	1	2537

`df.info()`

```
<class 'pandas.core.frame.DataFrame'>  
Index: 5000 entries, 74414 to 25048  
Data columns (total 2 columns):  
#   Column      Non-Null Count  Dtype  
---  ---  
0   text        5000 non-null   object  
1   class       5000 non-null   object
```

Dataset - Description

- Dataset

`df.head()`

	text	class
74414	I Don't know?? Months self harm free and the ...	suicide
149516	I HAVE TO START BECOMING RICH I HAVE TO START ...	non-suicide
12484	A poem (haiku) for u/Me-Game-Dev hi, hello hel...	non-suicide
14043	I've honestly got no idea what to do anymore.I...	suicide
30673	Do you ever just cry? Like you just think abou...	non-suicide

Dataset - Preprocessing

Text data **preprocessing**

- Lowercasing
- Removing non-alphabet characters
- Tokenization
- Lemmatization
- Stopwords removal

Dataset - Processed

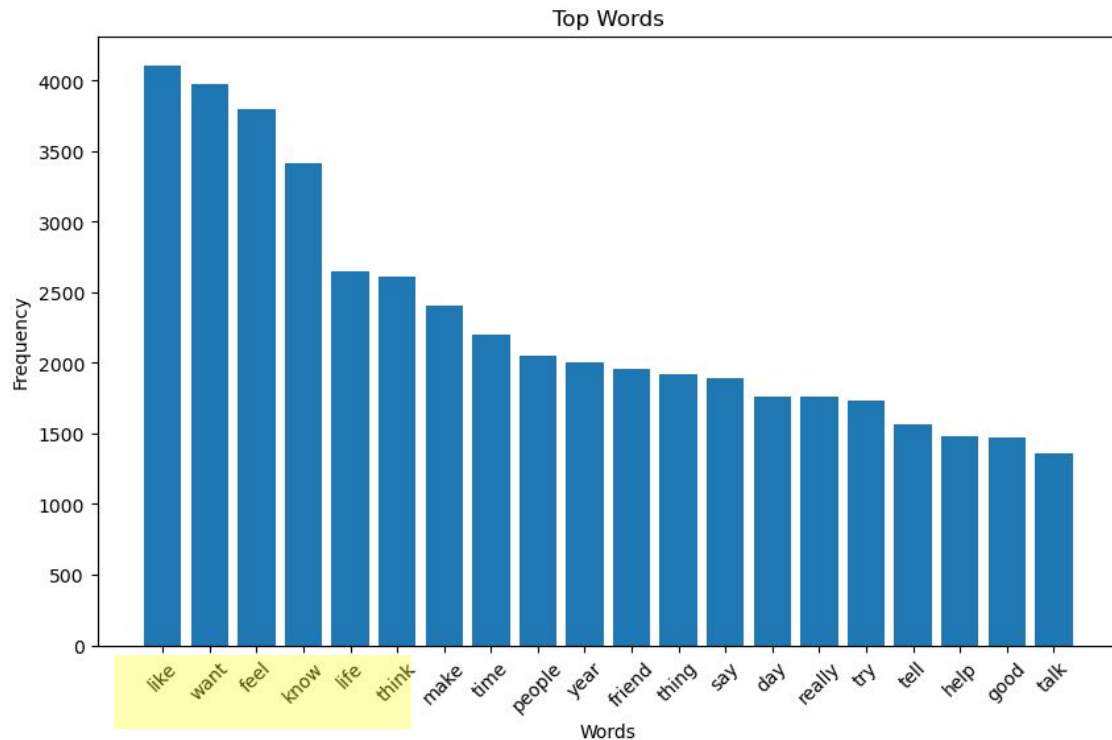
- Dataset

df.head()

	text	class
74414	I know month self harm free urge get strong st	suicide
149516	I start become rich I start company I become I...	non-suicide
12484	poem haiku umegamedev hi hello hello stop..	non-suicide
14043	I honestly get idea anymoreit feel everyone fa...	suicide
30673	ever cry like think unfair life cry cry ever s...	non-suicide

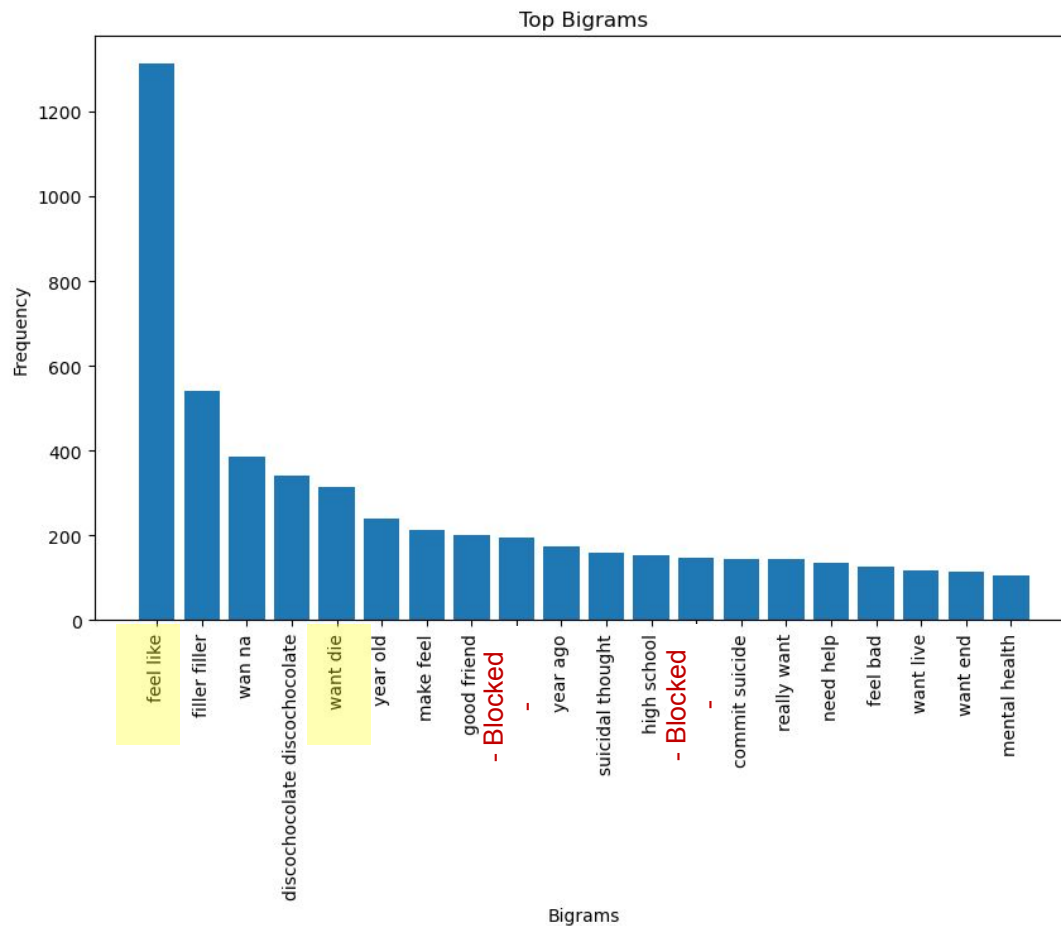
Data Visualisation

- Top Words



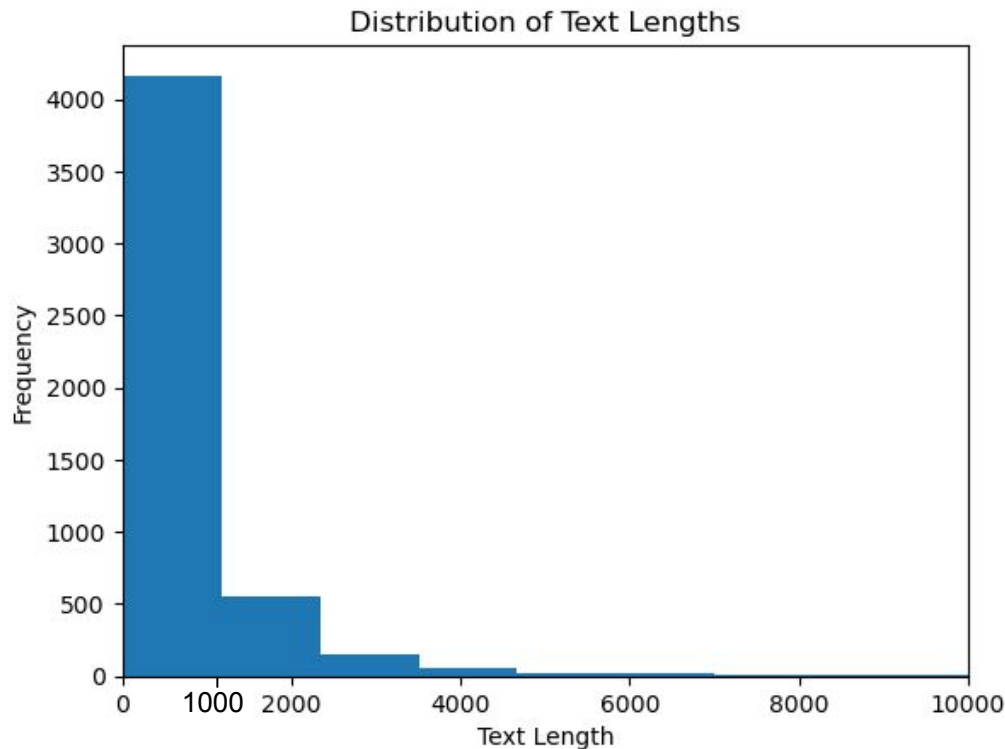
Data Visualisation

- Top Bigrams



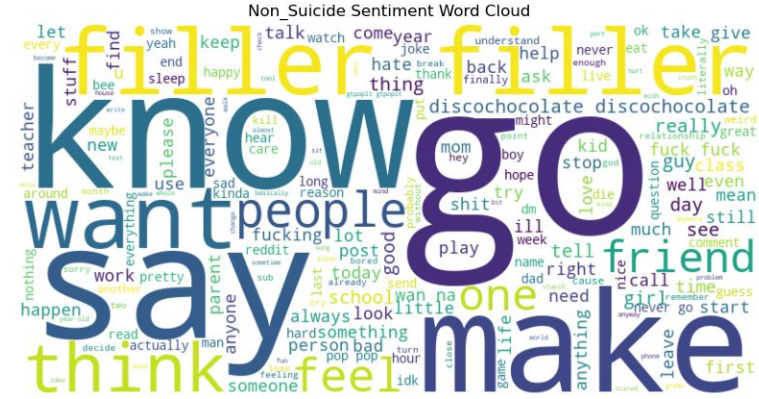
Data Visualisation

- Text Lengths
 - Mostly within 1000 words

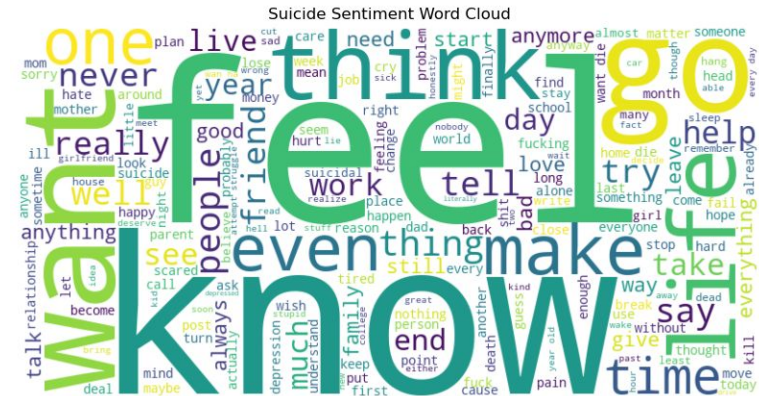


Data Visualisation

- Word Cloud
 - Non-Suicide Sentiments



- Suicide Sentiments



Feature Engineering

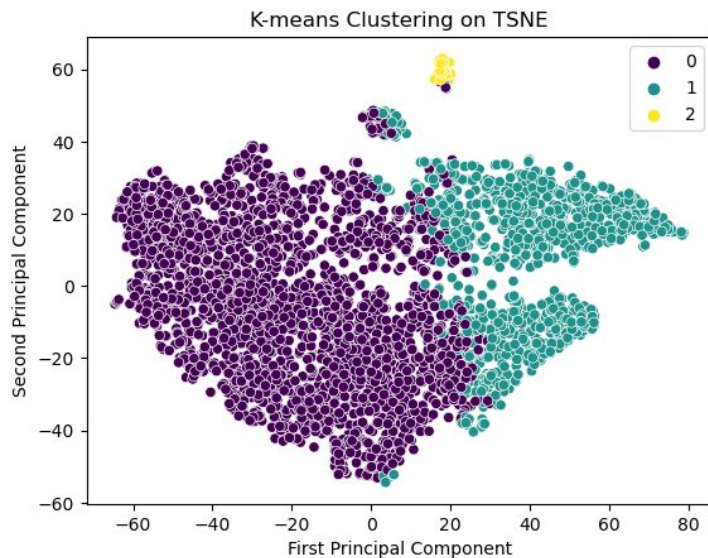
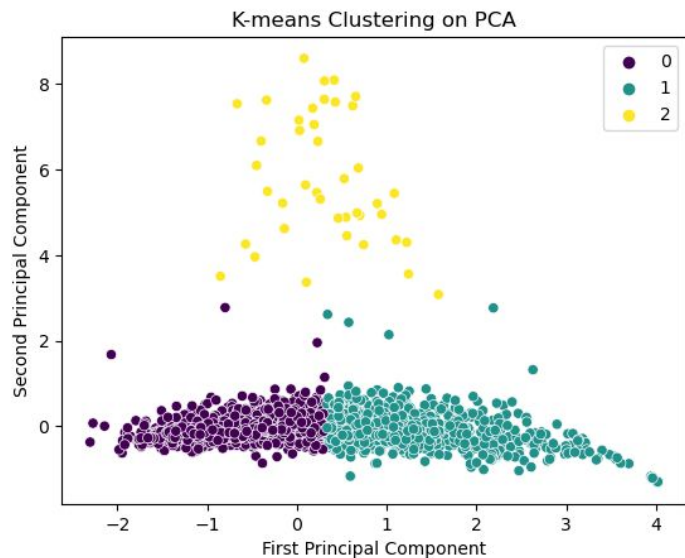
1. Word Embedding
2. TF-IDF Vectorisation

Unsupervised Learning

1. PCA Dimensionality Reduction
2. T-SNE Dimensionality Reduction
3. Clustering

Unsupervised Learning

- Word Embedding Vectors K-Means Clustering of PCA and t-SNE



Model Training

Models Used

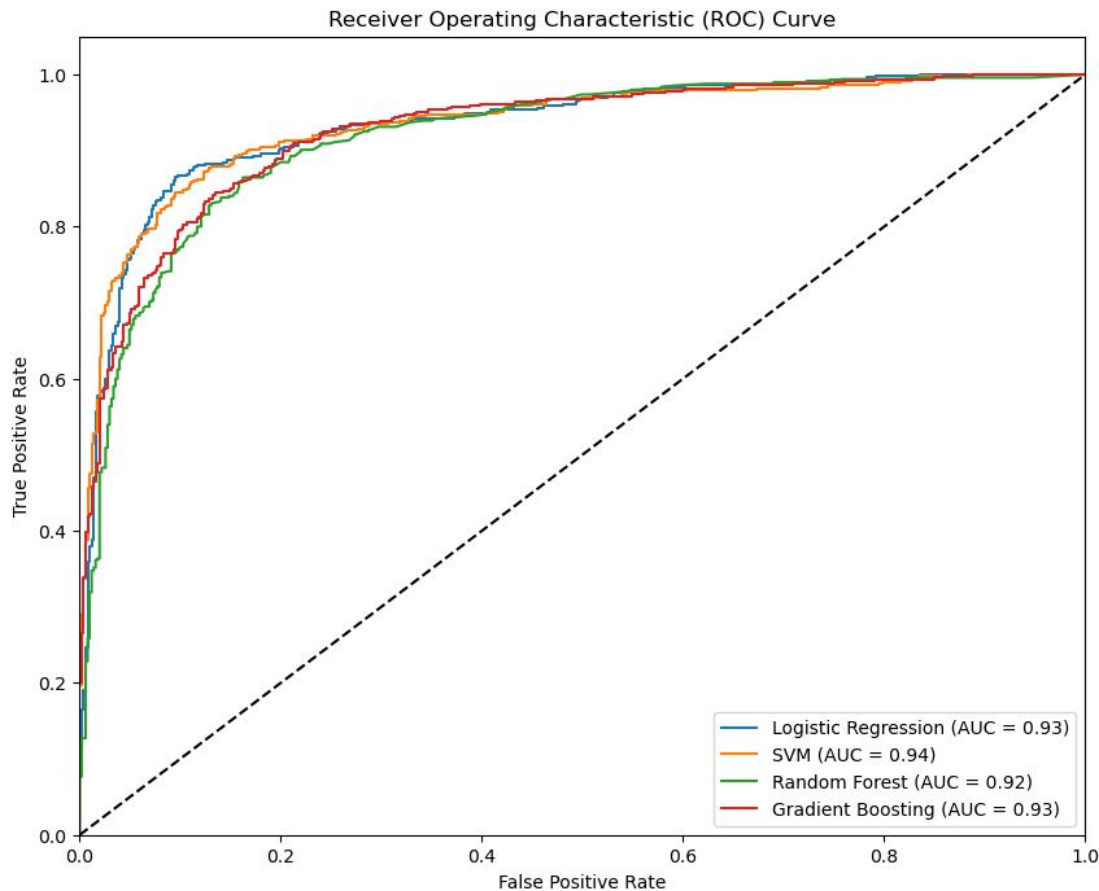
1. Logistic Regression
 2. Random Forest
 3. Gradient Boosting
 4. SVM
- GridSearch Hyperparameters Tuning

Evaluation - Metrics

- Accuracy
 - Logistic Regression: 0.870
 - Random Forest: 0.840
 - Gradient Boosting: 0.848
 - **SVM: 0.877**

Evaluation

- ROC Curve
 - SVM has highest AUC



Evaluation - Prediction

Prediction of new tweets :

Tweet	Predicted Class
"I can't take this anymore"	suicide
"Lawrence Wong is our new prime minister!"	non-suicide
"AI will destroy us all"	non-suicide
"Too tired of all this."	suicide

Limitations and Areas for Improvement

- Data limitations (sample size, demographic representation, potential biases)
 - Data used is a 5000 sample from 200000+
- Need for continuous model improvement and adaptation
 - New generation of children have new slangs
- Expanding to other social media platforms or languages

Business Recommendations

- Targeted intervention strategies based on identified sentiment patterns
- **Development of real-time monitoring tools for social media platforms**
- Collaboration with mental health organizations for support and outreach

Business Recommendations

Development of real-time monitoring tools for social media platforms

1. Continuously process tweets via API
 - (Subject to privacy requirements)
2. Apply the preprocessing pipeline
3. Predict sentiment
4. Trigger Alerts to moderators & professionals



Conclusion

Key Findings:

- The model achieved an **accuracy of 89.9%** in predicting sentiment based on tweets.
- **Linguistic patterns** and features can offer insights into the **language of distress**.
- This can lead to developing real-time monitoring tools and targeted intervention strategies.



Conclusion

- **Mental Health professionals** can identify potential mental health indicators
- **Social media platforms** can proactively identify at-risk individuals and intervene early