

SilverCare Senior Activity Centre

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1. Background

General Observations

- Aging Population: By 2030, 1 in 4 Singapore residents will be 65 years or older.
- Mental Health Challenges: Increased loneliness, depression, and anxiety among seniors.
- Suicide Risk: In 2022, senior suicides reached a record high [1], emphasizing the need for early intervention.

[1]: <https://www.straitstimes.com/singapore/476-suicides-reported-in-singapore-in-2022-98-more-than-in-2021>

1. Background

About SilverCare SAC

- Government-affiliated non-profit organisation.
- Near mature estates of high % of elderly residents e.g. Chinatown and Toa Payoh
- Operate senior activity centers for the elderly



List of SACs in SG by Location

East

- CCSS SAC
- Goodlife! SAC
- Kembangan-Chai Chee SAC
- King George's SAC
- Thye Hua Kwan (THK) SAC

North

- Fei Yue SAC
- NTUC Health SAC

South

- Thong Kheng SAC

Central

- Chong Hua Tong SAC
- Kreta Ayer SAC
- Lions Befriender Service Association SAC
- PeCCO Peace Connect SAC

West

- AWWA SAC
- Care Corner SAC
- Sunlove SAC
- TOUCH SAC



2. Problem Statement

- Lack of Early Detection: Current mental health support is largely reactive rather than proactive.
- Underreporting & Stigma: Seniors may not openly express distress, making traditional intervention methods less effective.
- Reporting Lag: Self-reported data based on questionnaires provided by healthcare and social service professionals. Answers based on memory recollection, accuracy an issue , assessment can also be subjective.
- Limited Resources and Skills: Lack of professional counsellors and thus have to rely on volunteers to engage seniors whom may not be well-versed in detecting suicidal tendencies.

Need for new intervention methods

3. Proposed Intervention - AI-Powered Text Analysis for Suicide Detection

- Utilizing AI & NLP models to analyze text-based conversations for suicide risk indicators.
- Integrating with digital platforms (e.g., senior community apps, chatbots, support groups).
- Providing real-time alerts to caregivers and support services for early intervention.

The goal of the model is to:

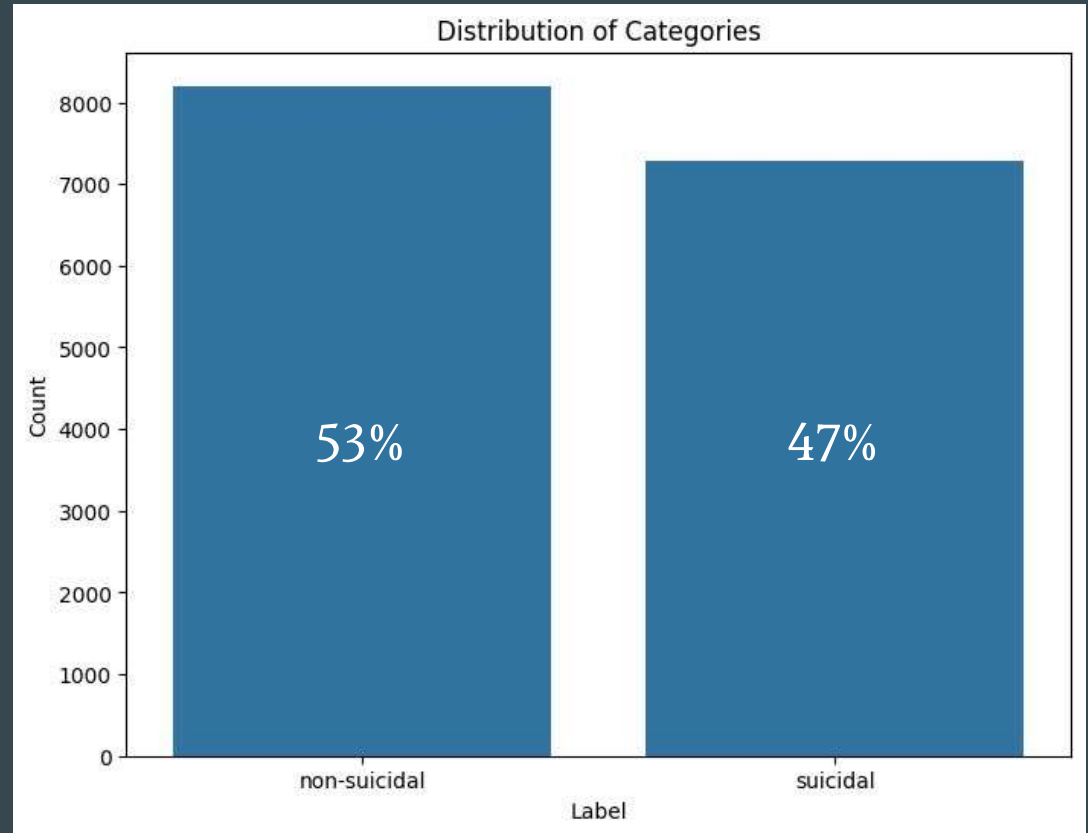
- Detect real potential suicidal cases (true positive).
- Have 0 missed real potential suicide cases (0 false negative).
- Reduce unnecessary pressure on limited resources, as much as possible, to have reduced misidentification of real suicide cases (low false positive).

4a. Sentiment Analysis Technique - Source of Data

- A collection of posts from Reddit collected using PRAW.
- Consists of 15,477 records with 3 attributes, i.e. title, posts and label.
- Class distribution is quite balanced.

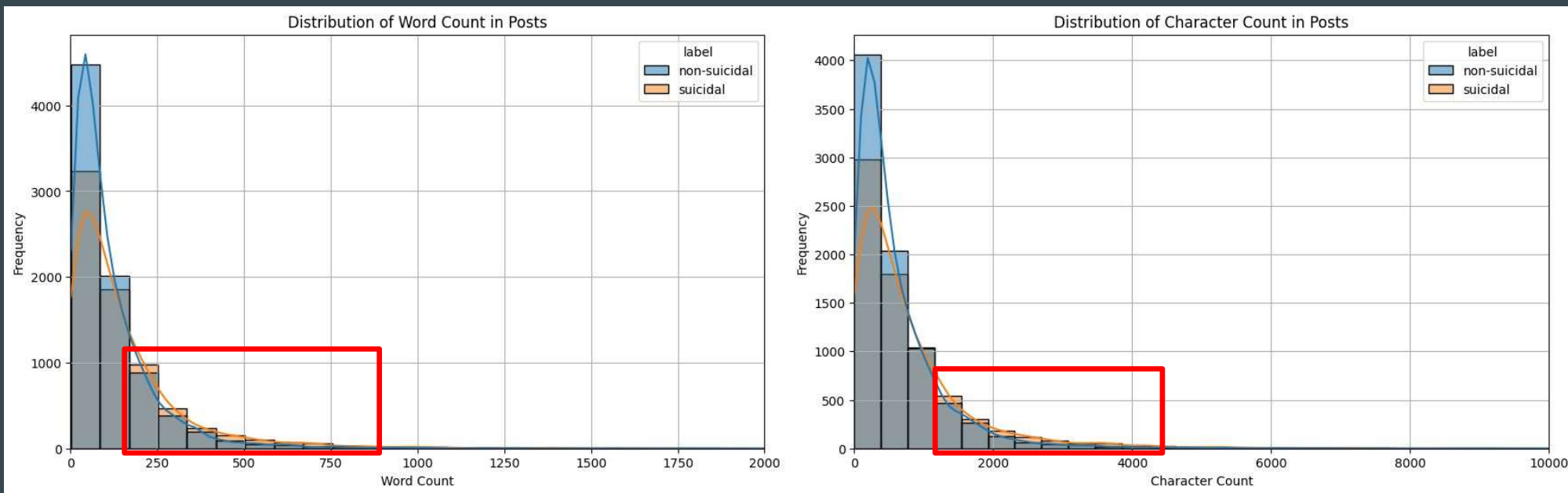
Dataset credits to:

Mafi, Md Mafiul Hasan Matin; Alam, Md. Sabbir (2023), "Suicidal Ideation Detection Reddit Dataset", Mendeley Data, V1, doi: 10.17632/z8s6w86tr3.1



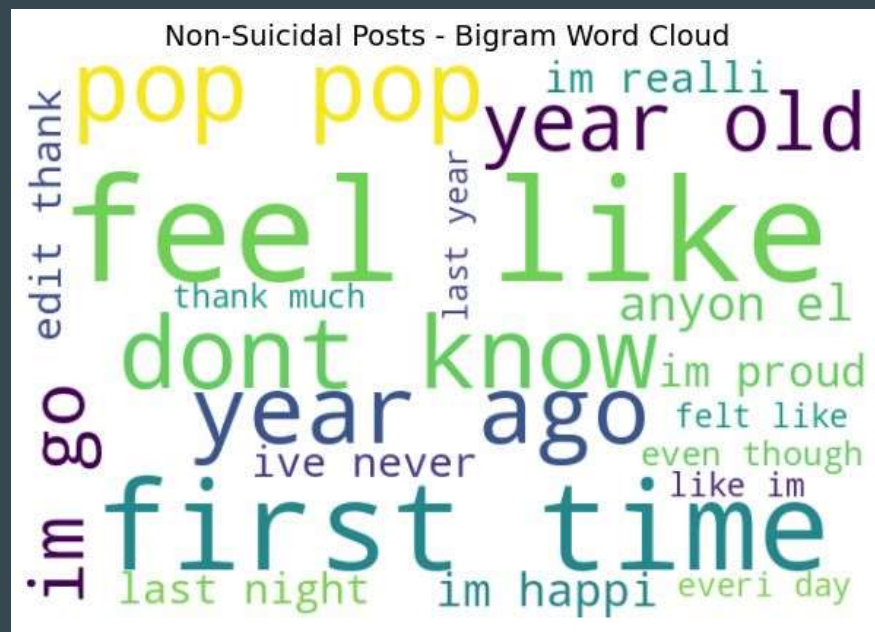
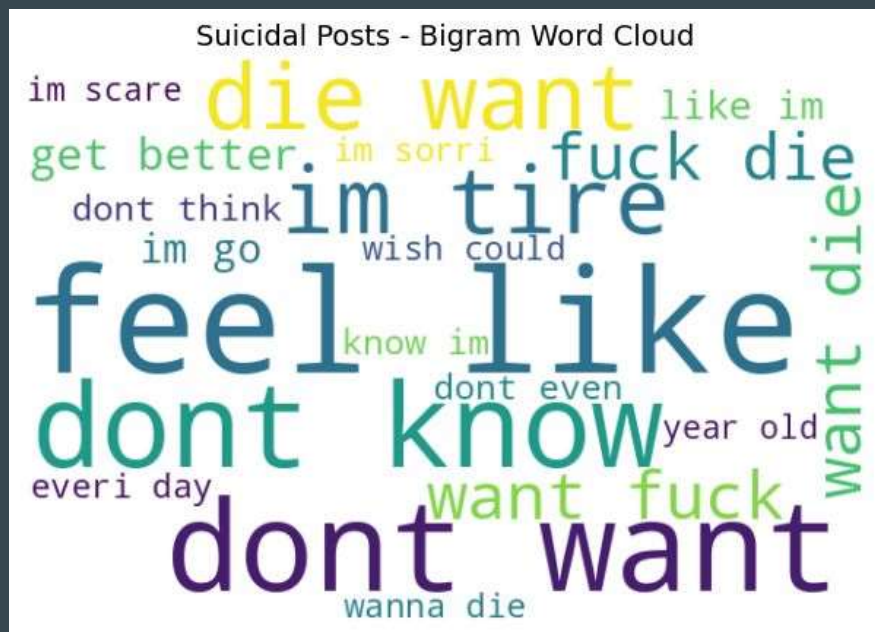
4b. Sentiment Analysis Technique - EDA (Word & Character Count)

- Suicidal messages tend to be longer, both in terms of word count and character count.
- Users may write lengthier messages when expressing distress.



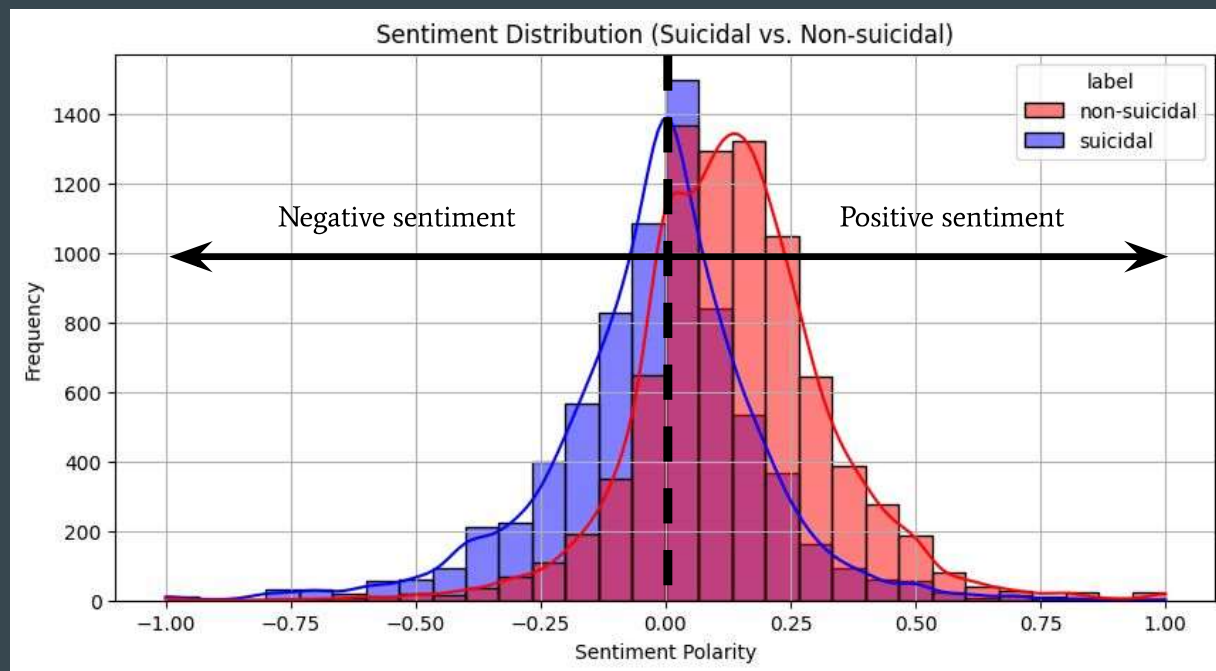
4b. Sentiment Analysis Technique - EDA (Most Common Words)

- Suicidal messages contain phrases expressing despair (“want die”, “im tire”) and helplessness (“dont want”, “im scare”).
- Non-suicidal messages contain more diverse topics, with references to personal achievements, gratitude, general life events, etc.



4b. Sentiment Analysis Technique - EDA (Sentiment Polarity)

- Non-suicidal messages have a higher sentiment score than suicidal messages.
- Suicidal messages have a mix of neutral and slightly negative tones.



4c. Sentiment Analysis Technique - Data Transformation

Data Pre-processing

Lower case, remove special characters, remove stopwords, stemming & lemmatisation, tokenisation

Feature Engineering

Metadata

- Word count
- Character count
- Readability scores

Sentiment

- Polarity
- Subjectivity

TF-IDF Vectorisation

- 5000 features

Word2Vec

- Vector size = 300

GloVe

- 100 dimensions

5406 features in total

4c. Sentiment Analysis Technique - Model Building

- The dataset is trained with three different classification models: -

Logistic Regression

- Simple, interpretable and effective for binary classification.

Support Vector Machines (SVM)

- Handles high-dimensional text data well.

Multinomial Naive Bayes (NB)

- Works well with text data, especially with TF-IDF.

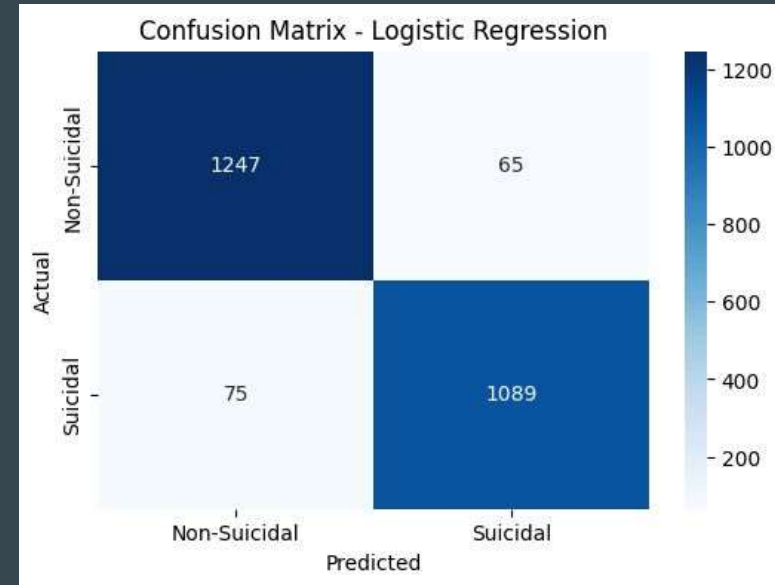
- Apply SMOTE (Synthetic Minority Over-sampling Technique) to balance the class distribution.
- Assign higher weights to the suicidal class.
- Threshold tuning for best metric.

4d. Sentiment Analysis Technique - Model Evaluation

Which evaluation metric is prioritised?

F1-Score : balances precision and recall, as false negatives (missing suicidal posts) and false positives (incorrectly labelling non-suicidal posts) both matter.

	Average Precision	Average Recall	Average F1-Score
Logistic Regression	0.943	0.940	0.942
SVM	0.936	0.937	0.936
Multinomial NB	0.918	0.932	0.925



Logistic Regression Model is selected!

4e. Sentiment Analysis Technique - Model Deployment



Suicidal Ideation Detection

Enter a text message below to check if it indicates suicidal ideation.

Enter text here:



Analyze

5. Application - How SilverCare staff could use this tool

1. Early Detection & Real-Time Support

- Screens messages from seniors (helpline, chat, SMS) to identify distress signals.
- Flags high-risk messages for immediate intervention by social workers.
- Assists in regular sentiment check-ins for ongoing well-being monitoring - social workers/volunteers need not have to set-up a formal interview session to assess senior's mental well-being.

2. Enhancing Helpline & Crisis Response

- Categorizes messages into low, moderate, or high-risk for guided intervention.
- Provides real-time support recommendations for volunteers.
- Helps social workers respond promptly and effectively to at-risk seniors.

3. Personalized Intervention Planning

- Tracks sentiment trends over time to detect escalating distress.
- Enables tailored intervention strategies, such as assigning volunteers or recommending therapy.
- Identify appropriate social support for seniors with higher-risks.
- Supports data-driven decision-making in mental health outreach.

6. Future Development

1. Advanced Feature Engineering
 - Contextual word embeddings (e.g. BERT, RoBERTa, or GPT-based embeddings) to capture deeper semantic meaning.
 - Use NRC Emotion Lexicon or LIWC to detect anger, sadness, fear, stress from text.
2. Model Selection & Optimisation
 - Use ensemble ML and deep learning models to increase recall and F1-score.
3. Multilingual Support
 - Supports other languages, e.g. Mandarin