

Suicidal Tendencies and Ideation Prediction using Reddit

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Abstract - One of the leading causes of death in young adults is suicide. Amidst the pandemic the number of suicides has risen by a large amount. Many individuals before committing suicide might leave some hint on social media forums. The main goal in this study was to explore the posts on Reddit and examine them to find any factors that may expose hints of depressive attitude or suicidal ideation in the user. Natural Language Processing (NLP) techniques to process the posts and Machine Learning methods to train the data and check the capability of the prediction model were used. Our model was trained using the posts on depression and suicide related subreddits. And finally we check the efficiency of our model using passages of notes written by an actual victim of suicide.

Key Words: Depression, Suicide, Reddit, Social Media, Social Networks, Natural Language Processing, Machine Learning

1. INTRODUCTION

Suicide due to depression and other underlying mental illness has become a common occurrence in the recent years. Everyone is involved in some kind of rat race one way or another which can create immense mental pressure on individuals and eventually lead to depression. Suicide has become an ever-looming threat in the age of social media and the internet. Every year suicide claims almost 800,000 lives globally [1]. Approximately 264 million have been affected by depression worldwide making its occurrence more frequent than ever. In young adults, mainly between the ages 15-29 suicide has become the second leading cause of death. In India itself, more than 90,000 young adults committed suicide in the year 2019[2]. The pandemic that has been affecting us since the past year has only added to this figure. According to Dr. Poonam Khetrepal Singh the Regional Director of WHO, South-East Area Region the pandemic is causing fear, anxiety, depression, and stress among people. Social distancing, isolation, and coping with perpetually evolving and changing information about the virus has both triggered and aggravated existing and pre-existing mental health conditions which need urgent attention[1]. These increasing numbers of deaths by suicide motivated us to find a solution that can help detect early signs of suicidal tendencies or future suicidal ideation among the youth. Social media has become an integral part of our

lives today. Due to which many people share their deepest and most hidden emotions on such networks. Anonymity is a big reason why people feel easier to share their feelings on the internet rather than with their parents or peers. Hence, we decided to use such platforms for our project. Reddit was our preferred platform due to its ease of integration and web scraping process with python.

Reddit is a massive collection of forums where people can share news and content or comment on other people's posts. Reddit is broken up into more than a million communities known as "subreddits," each of which covers a different topic. The name of a subreddit begins with /r/, which is part of the URL that Reddit uses. For example, /r/nba is a subreddit where people talk about the National Basketball Association, while /r/boardgames is a subreddit for people to discuss board games[3]. Other such platforms where this model can be introduced in the future are Twitter, Facebook, 4chan, and many others.

2. LITERATURE REVIEW

The paper written by Micheal M. Tadesse , Hongfei Lin , Bo Xu , and Liang Yang titled 'Detection of Depression-Related Posts in Reddit Social Media Forum' [4] was one of the major inspirations for our project. The paper discusses methods for detection of signs of depression using poems from suicidal and non-suicidal patients. These datasets are used for building the model that will help to predict if the posts from reddit fall into the suicidal category or not. Support Vector Machine Classifier (SVM) was used for the research in this paper as opposed our Naïve Bayes classifier. Similar techniques to pre-process the data were also employed where removing urls, removing punctuations and stemming were some of the steps involved. Term frequency-inverse document frequency (TF-IDF) vectorizer was used for n-gram modelling. The performances of the methodologies applied were noteworthy and reasonably good. But the researches still believed that further exploration is required and that their experiment could further help develop mechanisms in healthcare to estimate depression and other variables which we believe to be absolutely true as their research helped us greatly to develop our project.

Another paper written by Jane H. K. Seah and Kyong Jin Shim titled 'Data Mining Approach to the Detection of Suicide in Social Media: A Case Study of Singapore' [5] was very interesting and one of the focal points in developing this project and paper. The researchers acquired datasets from r/Singapore for their project by using data crawling techniques. PRAW a python package along with a Reddit API wrapper was used to get a hold of these sets. Topic modelling using Latent Dirichlet Allocation(LDA) was performed which helps automatically discover topics for topic modelling. The results for this paper demonstrated that a data mining approach allows for more efficient and automatable techniques for prediction of suicide in using social media sites.

3. IMPLEMENTATION

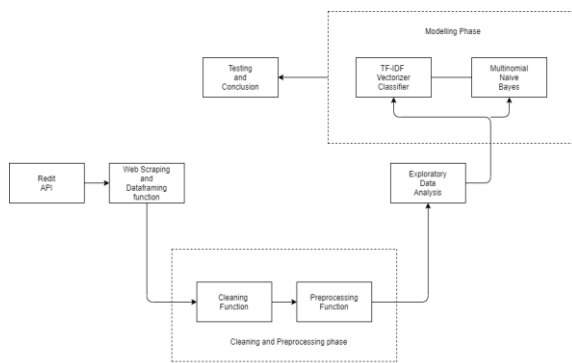


Fig-1: System Architecture

3.1 DATA COLLECTION

We begin our process by first web scraping the pages of Reddit. This is made possible via Reddit’s API. The two subreddits that we decided to choose were r/depression and r/SuicideWatch. These two specific subreddits came into our consideration because of the low spam and troll rate. Also as mentioned in this article [6] r/SuicideWatch seems to have more urgency and immediacy to them. Phrases used there include: “Almost shot myself right now” and “I want to get coronavirus and die”. Identifying the difference between the language used by a person with depressive thoughts and a person at risk of suicide will be useful for frontline professionals like counsellors, educators and psychiatrists[4]. Web scraping the two pages with a GET request provided us with approximately a thousand posts per subreddit. The obtained posts were data framed and stored into csv files.

```

In [12]: SCALING THE FUNCTION ON OUR DEPRESSION SUBREDDIT
depress_scraped = [] #DEFINING AN EMPTY LIST THAT WILL CONTAIN OUR SCRAPED DATA
reddit_scraper("https://www.reddit.com/r/depression.json", 50, depress_scraped)

SCRAPING https://www.reddit.com/r/depression.json
-----
<<<SCRAPING COMPLETED>>>
Downloading Batch 1 of 50...
Downloading Batch 5 of 50...
Downloading Batch 10 of 50...
Downloading Batch 15 of 50...
Downloading Batch 20 of 50...
Downloading Batch 25 of 50...
Downloading Batch 30 of 50...
Downloading Batch 35 of 50...
Downloading Batch 40 of 50...
Downloading Batch 45 of 50...
Downloading Batch 50 of 50...
<<<SCRAPING COMPLETED>>>
Number of posts downloaded: 1231
Number of unique posts: 934
  
```

Fig-2: Data Web Downloading

3.2 DATA CLEANING AND PREPROCESSING

Cleaning the data is very important so that bad data does not interfere with the training and modelling of our production model. This also helps to pull out the crucial data that is required for the process. Before beginning with the cleaning we concatenated the two sets and added a special column to indicate the post is from which subreddit. The first step in cleaning was to reduce the amount of unnecessary columns from our dataframed sets. Both the sets had about one hundred columns of which only five we considered were important. This included the title of the post, name of the author, content of the post, the number comments, the url, and the special column that we previously added.

Each individual has a unique way of writing or expressing their thoughts in the posts. In order to prepare the sets for our classifier pre-processing of these posts was required. This includes removing punctuations, converting the text to lower case and lemmatization. Lemmatization is basically the process of reducing inflected forms of words down to a common base word so that they can be analysed as a single item. The final pre-processed and cleaned data is added into a separate column in our csv files.

```

In [34]: #MERGING ON TITLE_CLEAN
pd.set_option("display_max_colwidth", 100)
combined_data[["title", "title_clean"]].head(5)

Out[34]:
   id  title  title_clean
0  0  Our most broken and least understood rules in "Helpless may not make private contact first resort made new waltz"  Our most broken and least understood rules in "Helpless may not make private contact first resort made new waltz"
1  1  Regular Check-in Post  Regular Check-in Post
2  2  I hate it so much when you say I and express your feelings to your parents. Last they tell u  I hate it so much when you say I and express your feelings to your parents. Last they tell u
3  3  I went to the hospital because I was having really bad panic attacks, and they continued  I went to the hospital because I was having really bad panic attacks, and they continued
4  4  Cake day for me  Cake day for me

In [35]: #MERGING ON AUTHOR_CLEAN
pd.set_option("display_max_colwidth", 100)
combined_data[["author", "author_clean"]].tail(10)

Out[34]:
   id  author  author_clean
1087  author5875  author5875
1088  sptwvhu02wv123  sptwvhu02wv123
1089  Huanxin06  Huanxin06
1090  kxalatlavne  kxalatlavne
1091  cnybaby1577  cnybaby1577
1092  Bighand43  Bighand43
1093  E3001  E3001
1094  Gashimbo  Gashimbo
1095  vucb  vucb
1096  panickin  panickin
  
```

Fig-3: Data Pre-processing

3.3 EXPLORATORY DATA ANALYSIS

After cleaning and pre-processing we have three possible columns to build our classifier on: "author_clean", "selftext_clean", "title_clean", which are the cleaned version of author name, content of the post, and title respectively. The first key point to check out in our EDA is in the occurrence of

the floor of an apartment block. The suicide note that was found on the victim's body is also present in these excerpts. It was a very short message to whoever found her that said "If I'm brain damaged, I don't want to be kept alive. I don't want to be a vegetable". The prediction model when applied classified this into the suicide category. But the excerpts also included some letters that the victim wrote to fellow classmate in hopeful tone. They were confident and encouraging: *'please remember that you are a living, breathing, intricate, strong, independent person with the ability to love and to laugh and to cry'*. Our model classified these letters to not be in the suicide category. The model gave 70.6 percent accuracy when looking at regular entries (i.e. is not including the suicide note and the letters). This level of accuracy means that the model might have the potential to be generalized for usage in institutions like schools, where students might be ask to fill in survey forms or meet the school counselor. Textual data gathered from sessions like these might yield some revealing results about a student's suicidal tendencies.

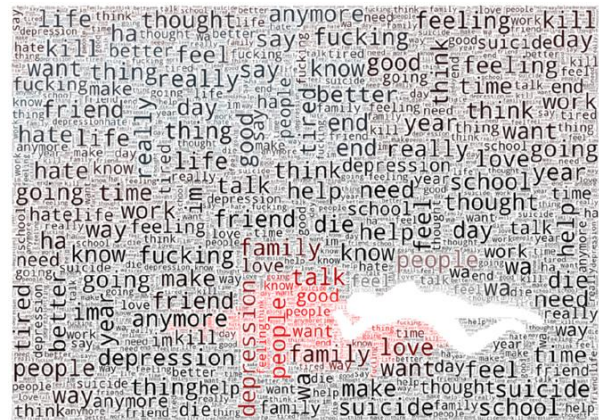


Fig-7: Words used to identify r/SuicideWatch posts

5. CONCLUSIONS

Due to the popularization of social the amount of text has increased exponentially and is still growing. And suicide prevention remains an important task in our modern society. Hence it has become necessary to keep looking for new ways to analyse text that can help detect and prevent suicide. In this project we explored one such method and by scanning various subreddits for hints towards suicidal ideation and tendencies. This can help to provide better help and services to those suffering from such thoughts through early detection. As we saw from the previous results using this model we can somewhat detect suicidal ideation in text based formats. We still have a long way to go as this model can still be improved drastically. Also by using this system we can check specific subreddits for certain keywords and phrases to detect suicide related conversations. This can help us save lives that might fall victim to suicide.

6. ACKNOWLEDGEMENT

This project wouldn't have been possible without the help of our guide, Prof. Rovina D'Britto. The support and suggestions provided helped greatly in moving this task ahead. The guidance provided by our department head Prof. Yogita Mane also immensely helped to move this research forward and achieve our results.

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```
In [30]: #CREATING A DATABASE TO PLOT PREDICTIONS BY CATEGORY
vic_plot_df = pd.DataFrame(vic_details.groupby("vic_detail")["predicted_suicide"].value_counts())
vic_plot_df.columns = ["counts"]
vic_plot_df = vic_plot_df.reset_index()
vic_plot_df = vic_plot_df.iloc[[2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 0, 1],:]
vic_plot_df

Out[30]:
```

	vic_detail	predicted_suicide	counts
2	Stage 1: Falling short of expectations	1	6
3	Stage 1: Falling short of expectations	0	2
4	Stage 2: Attributions to self	1	6
5	Stage 2: Attributions to self	0	1
6	Stage 3: High Self-Awareness	1	4
7	Stage 3: High Self-Awareness	0	3
8	Stage 4: Negative Affect	1	4
9	Stage 4: Negative Affect	0	3
10	Stage 5: Cognitive Deconstruction	1	8
11	Stage 5: Cognitive Deconstruction	0	3
12	Stage 6: Disambiguation	1	8
13	Stage 6: Disambiguation	0	3
14	Suicide note found in her pocket	1	1
15	no timesamp	0	1
16	poem	0	3
17	poem	1	3
0	Final Group Text to her friends	0	1
1	Letter meant for Grace	0	2

Fig-6: Testing on Foreign Set

4. RESULTS

From the modelling and testing phase we can conclude that our classifier has an above average rating in terms of being correct and providing accurate results. This means in the future such a system can be implemented to check if a user on social media has been experiencing suicidal ideation that might lead to possible suicide attempts. Such a system can also be implemented on other social media forums like Twitter, Facebook and even on Tumblr and Instagram albeit only on text based posts. Even though our model was able to achieve close to 70 percent rate of success, with more research and studies this rate can be increased even further and provide more accurate and dependable results. The biggest hurdle was that a lot of pre-processing and data cleaning was required even on the sets on which the models were tested on to provide accurate results. With extra training of the model from more datasets we believe that this process will become easier and even more streamlined if not completely unnecessary.

data-india-young-adults-suicide-2019-india-1717887-2020-09-02

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