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 Asia 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

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.

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.

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
specific words. We check to see the top words that are being used in titles, posts and usernames with the help of wordclouds and barplots. Some other factors for EDA included the occurrence of significant authors and the average length of posts.

3.4 DATA MODELLING

To decide on classifier we used a pipeline to score different models like K-Nearest Neighbours and Multinomial Naïve Bayes. Next we will calculate the baseline score for our models to “out-perform”. A baseline score is the context of our project will be the percentage of use getting it right if we predict that all ur reddit posts are from the r/SuicideWatch subreddit.

Before moving forward to creating a production model, we will run a Count Vectorizer + Naive Bayes model on different columns and score them. This will help us pick which one that we will use to build more models on. CountVectorizer is used to convert a collection of text documents to a vector of term/token counts. It also enables the pre-processing of text data prior to generating the vector representation. This functionality makes it a highly flexible feature representation module for text[7]. Naive Bayes classifiers are a collection of classification algorithms based on Bayes’ Theorem. It is not a single algorithm but a family of algorithms where all of them share a common principle, i.e. every pair of features being classified is independent of each other[8].

In the context of our project, these are what the parameters in our confusion matrix represent:

**True Positives (TP)** - We predict that an entry is from the r/SuicideWatch subreddit and we get it right. As we are seeking to identify suicide cases, our priority is to get as many of these.

**True Negatives (TN)** - We predict that an entry is from the r/depression subreddit and we get it right. This also means that we did well.

**False Positives (FP)** - We predict that an entry is from the r/SuicideWatch subreddit and we get it wrong. Needless to say, this is undesirable.

**False Negatives (FN)** - We predict that an entry is from the r/depression subreddit and BUT the entry is actually from r/SuicideWatch. This is the worst outcome. That means we might be missing out on helping someone who might be thinking about ending their life.

Inspired by our earlier function, we will create a similar function that will run multiple permutations of models with Count, Hashing and TFID Vectorizers. The resulting metrics will be held neatly in a dataframe.

The **Hashing Vectorizer + Multinomial Naïve Bayes** model out-performed other models on multiple metrics. Especially our AUC score(0.77) and the recall score(which measures our model's ability to predict True Positives well). Another notable performer is the TFID Vectorizer + Multinomial Naïve Bayes combination. Apart from the joint-second-highest AUC score of 0.73, its consistent performance on both the test and training sets showed that the model generalises well.

3.5 TESTING

The final phase was to test if our model trained from posts submitted on Reddit is accurate or not. We obtained a some excerpts from a book written by Jesse Bering called ‘Suicidal: Why We Kill Ourselves’. These passages were written by an actual victim of suicide that died from falling ten floors from
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 asked 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.

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.

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.

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REFERENCES


