

CONTENT ANALYSIS OF MESSAGES IN SOCIAL NETWORKS IDENTIFICATION OF SUICIDAL

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ABSTRACT

This project describes content analysis of text with to identify suicidal tendencies and types. This article also describes how to make a sentence classifier that uses a neural network created using various libraries created for machine learning in the Python programming language. Attention is paid to the problem of teenage suicide and «groups of death» in social networks, the search for ways to stop the propaganda of suicide among minors. Analysis of existing information about so-called «groups of death» and its distribution on the Internet.

I. INTRODUCTION

Suicide ideation expressed in social media has an impact on language usage. Many at-risk individuals use social forum platforms to discuss their problems or get access to information on similar tasks. The key objective of our study is to present ongoing work on automatic recognition of suicidal posts. We address the early detection of suicide ideation through deep learning and machine learning-based classification approaches applied to Reddit social media. For such purpose, we employ an LSTM-CNN combined model to evaluate and compare to other classification models. Our experiment shows the combined neural network architecture with word embedding techniques can achieve the best relevance classification results. Additionally, our results support the strength and ability of deep learning architectures to build an effective model for a suicide risk assessment in various text classification tasks.

Every year, almost 800,000 people commit suicide. Suicide remains the second leading cause of death among a young generation with an overall suicide rate of 10.5 per 100,000 people. It is predicted that by

2020, the death rate will increase to one every 20 s [1]. Almost 79% of the suicides occur in low- and middle-income countries where the resources for the identification and management is often scarce and insufficient.

Suicide ideation is viewed as a tendency to end ones' life ranging from depression, through a plan for a suicide attempt, to an intense preoccupation with self-destruction [2]. At-risk individuals can be recognized as suicide ideators (or planners) and suicide attempters (or completers) [3]. The relationship between these two categories is often a subject of discussion in research communities. According to some studies, most of the individuals with suicide ideation do not make suicide attempts. For instance, Klonsky et al. [4] believes that most of the oft-cited risk factors (depression, hopelessness, frustration) connected with suicide are the predictors of suicide ideation, not the progression from the ideation to attempt. However, Pompili et al. [5] reveals that a suicide ideator and suicide attempter can be quite similar to “several variables assumed to be risk factors for suicidal behavior”. In WHO countries, early detection of suicide ideation has been developed and implemented as a national suicide prevention strategy to work towards the global market with the common aim to reduce the suicide rates by 10% by 2020 [1].

Over recent years, social media has become a powerful “window” into the mental health and well-being of its users, mostly young individuals. It offers anonymous participation in different cyber communities to provide a space for a public discussion about socially stigmatized topics. Generally, more than 20% of suicide attempters and 50% of suicide completers leave suicide notes [6]. Thus, any written suicidal sign is viewed as a worrying sign, and an individual should

be questioned on the existence of individual thoughts. According to Choudhury et al. [7], social media text, such as blog posts, forum messages, tweets, and other online notes, is usually recorded in the present and is well preserved. In comparison to an offline text, it can minimize any misleading text interpretations produced by a retrospective analysis.

Social media with its mental health-related forums has become an emerging study area in computational linguistics. It provides a valuable research platform for the development of new technological approaches and improvements which can bring a novelty in suicide detection and further suicide risk prevention [8]. It can serve as a good intervention point. Kumar et al. [9] studied the posting activities of Reddit SuicideWatch users who follow news about celebrity suicides. He introduced a method that can be efficient in preventing high profile suicides. Choudhury et al. [7] studied the shift from a mental health discourse to suicide ideation in Reddit social media. He developed a propensity score matching-based statistical approach to derive the distinct markers of this shift. Recently, Ji et al. [10] has developed a novel data protecting the solution and advanced optimization strategy (AvgDiffLDP) for early detection of suicide ideation.

Apart from traditional text classification approaches, deep learning methods have already made an impressive advance in the field of computer vision and pattern recognition. While traditional machine learning approaches liaise heavily on time-consuming and often incomplete handcrafted features, neural networks based on dense vector representations can produce superior results on various Natural language processing (NLP) tasks [11]. The growing success of word embedding [12,13] and deep neural networks are reflected in outperforming more traditional machine learning systems for suicide risk assessments.

The primary objective of our study is to share the knowledge of suicide ideation in Reddit social media forums from a data analysis perspective using effective deep learning architectures. Our main task is to explore the potential of Long Short-Term Memory (LSTM), Convolutional Neural Network (CNN) and their combined model applied in multiple classification tasks for suicide ideation struggles. We try to test if an implementation of CNN and LSTM

classifiers into one model can improve the language modeling and text classification performance. We will try to demonstrate that LSTM-CNN model can outperform the performance of its individual CNN and LSTM classifiers as well as more traditional machine learning systems for suicide-related topics. Potentially, it can be embedded on any online forum's and blog's data sets.

In our experiment, we first choose the data source, define our proposed model and analyze the baseline characteristics. Then, we compute the frequency of n-grams, such as unigrams and bigrams, in the dataset to detect the presence of suicidal thoughts. We evaluate the experimental approach based on the baseline and our proposed model. Finally, we train our LSTM-CNN model using 10-fold cross-validation to identify our best hyper-parameter selection for suicide ideation detection. For our dataset, we apply the data collected from Reddit social media which allow its users to create longer posts.

Our study has specific three-fold contributions:

N-gram analysis: we evaluate the n-gram analysis to show that the expressions of suicidal tendencies and reduced social engagements are often discussed in suicide-related forums. We identify the transition towards the social ideation associated with different psychological stages such as heightened self-focused attention, a manifestation of hopelessness, frustration, anxiety or loneliness.

Classical features analysis: using CNN, LSTM and LSTM-CNN combined model analysis, we evaluate bag of words, TF-IDF and statistical features performance over word embedding.

Comparative evaluation: we explore the performance of LSTM-CNN combined class of deep neural networks as our proposed model for detection of suicide ideation tasks to improve the state-of-the-art method. In terms of evaluation metrics, we compare its strength and potential with CNN and LSTM deep learning techniques and four traditional machine learning classifiers including SVM, NB, RF and XGBoost) on the real-world dataset.

II. LITERATURE SURVEY

1) Addressing Suicidal Thoughts and Behaviors in Substance Abuse Treatment: Information You Need To Know

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Suicide risk is a problem that every frontline substance abuse counselor must be able to address. This chapter is written for you if you are a frontline counselor in a substance abuse treatment program and/or if you work with individuals who have both a substance abuse and mental health disorder and/or if you provide supervision or consultation to frontline counselors. While the information in this TIP is specific to clients with a substance use disorder diagnosis who exhibit suicidal thoughts and behaviors, the content can be generalized for counselors addressing all people with suicidal ideation or behavior. Research consistently shows a high prevalence of suicidal thoughts and suicide attempts among persons with substance abuse problems who are in treatment (Ilgen, Harris, Moos, & Tiet, 2007) and a significant prevalence of death-by-suicide among those who have at one time been in substance abuse treatment when compared with those who do not have a diagnosis of substance use disorder (Wilcox et al., 2004). As a result, substance abuse treatment providers must be prepared to gather information routinely from, refer, and participate in the treatment of clients at risk for suicidal behavior. Suicidal thoughts and behaviors are also a significant indicator of other co-occurring disorders (such as major depression, bipolar disorder, PTSD, schizophrenia, and some personality disorders) that will need to be explored, diagnosed, and addressed to improve outcomes of substance abuse treatment.

2)Scikit-learn: Machine Learning in Python

AUTHORS: Pedregosa F., Varoquaux G., Gramfort A., Michel V

Scikit-learn is a Python module integrating a wide range of state-of-the-art machine learning algorithms for medium-scale supervised and unsupervised problems. This package focuses on bringing machine learning to non-specialists using a general-purpose high-level language. Emphasis is put on ease of use, performance, documentation, and API consistency. It

has minimal dependencies and is distributed under the simplified BSD license, encouraging its use in both academic and commercial settings. The Python programming language is establishing itself as one of the most popular languages for scientific computing. Thanks to its high-level interactive nature and its maturing ecosystem of scientific libraries, it is an appealing choice for algorithmic development and exploratory data analysis (Dubois, 2007; Milmann and Avaizis, 2011). Yet, as a general-purpose language, it is increasingly used not only in academic settings but also in industry. Scikit-learn harnesses this rich environment to provide state-of-the-art implementations of many well known machine learning algorithms, while maintaining an easy-to-use interface tightly integrated with the Python language. This answers the growing need for statistical data analysis by non-specialists in the software and web industries, as well as in fields outside of computer-science, such as biology or physics. Scikit-learn differs from other machine learning toolboxes in Python for various reasons: i) it is distributed under the BSD license ii) it incorporates compiled code for efficiency, unlike MDP (Zito et al., 2008) and pybrain (Schaul et al., 2010), iii) it depends only on numpy and scipy to facilitate easy distribution, unlike pymvpa (Hanke et al., 2009) that has optional dependencies such as R and shogun, and iv) it focuses on imperative programming, unlike pybrain which uses a data-flow framework. While the package is mostly written in Python, it incorporates the C++ libraries LibSVM (Chang and Lin, 2001) and LibLinear (Fan et al., 2008) that provide reference implementations of SVMs and generalized linear models with compatible licenses. Binary packages are available on a rich set of platforms including Windows and any POSIX platforms.

3) National suicide prevention strategies: progress, examples and indicators

AUTHORS : World Health Organization

National suicide prevention strategies are essential for elevating suicide prevention on the political agenda. A national strategy and associated action plan are necessary to push forward the implementation of suicide prevention. Without these, efforts are likely to

abate and suicide prevention will remain neglected. This document aims to serve as a resource and inspire governments and policy-makers to establish their own national suicide prevention strategy. Examples from each WHO Region show the variety of approaches undertaken and the indicators that have been chosen. The elements for developing, implementing and evaluating a national suicide prevention strategy are described and actions to overcome common barriers are presented.

III. EXISTING SYSTEM:

In the existing system examine the relationship between social networks and suicide ideation using a data set obtained from a dominant social networking service (SNS), named mixi. In this approach addresses limitations very less. First, an entire social network of users is available, where a link between two users represents explicit bidirectional friendship endorsed by both users. Some users have quite a large number of friends, as in general social networks. Second, for the same reason, we can accurately calculate the number of triangles for each user. An additional feature of the present data set is that the sample is relatively diverse because anybody can register for free.

DISADVANTAGES OF EXISTING SYSTEM:

- A function of mixi relevant to this study is user-defined community.
- It is high reliance on a proper presentation of your data. This means that logistic regression is not a useful tool unless you have already identified all the important independent variables.
- **Algorithm:** Multivariate Logistic Regression.

IV. PROPOSED SYSTEM:

The study Experience of content analysis of suicidal statements on the Internet of persons with different levels of suicidal activity» collects data from the pages of people who have actually committed suicide or are potential suicides. By analyzing the collected information, program called TextAnalyst explores the

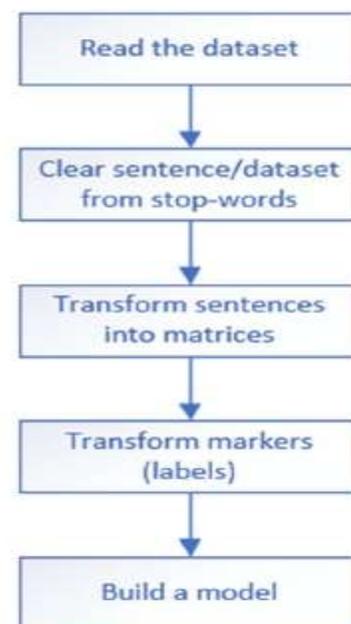
causes of suicidal behavior and their feelings. The aim of the current study is to classify sentences into suicidal and non-suicidal using a neural network. In our system, according to random text, it is necessary to determine whether it is suicidal or not, i.e. to solve the problem of its binary classification. Classification is the distribution of data by parameters.

ADVANTAGES OF PROPOSED SYSTEM:

- The collected dataset consists of two columns sentence and label, where sentence is a column with sentences, and label is a column with the values suicidal/non-suicidal.
- NLTK library to solve the problem words that do not carry any semantic load and symbols.
- Tokenizer library was transform sentences into arrays.

Algorithm: CNN

SYSTEM ARCHITECTURE:



V. IMPLEMENTATION

User:

The User can register the first. While registering he required a valid user email and mobile for further

communications. Once the user register then admin can activate the customer. Once admin activated the customer then user can login into our system. In this project the cnn model already loaded then user can test a tweet message. First user will send an tweet message. Our model will predict the results. Weather that message related to suicidal or non suicidal. As well we can get its scores. Later the wordtovector graph will be generated. For each user search results are stored in the database.

Admin:

Admin can login with his credentials. Once he login he can activate the users. The activated user only login in our applications. In the media folder data.csv file contain label and tweet. By using this we can build the neural network model. The admin can check which user tested which kind of tweet messages. Those all tweet messages will be displayed in the browser.

Building Model:

We are pretending that we are developing a system that can predict the label of textual tweet as either suicidal or non-Suicidal. This means that after the model is developed, we will need to make predictions on new textual tweet. This will require all of the same data preparation to be performed on those new tweet as is performed on the training data for the model. We will ensure that this constraint is built into the evaluation of our models by splitting the training and test datasets prior to any data preparation. This means that any knowledge in the data in the test set that could help us better prepare the data (e.g. the words used) are unavailable in the preparation of data used for training the model.

- Split tokens on white space.
- Remove all punctuation from words.
- Remove all words that are not purely comprised of alphabetical characters.
- Remove all words that are known stop words.
- Remove all words that have a length ≤ 1 character.

Prediction Results:

We use a Convolutional Neural Network (CNN) as they have proven to be successful at document classification problems. A conservative CNN configuration is used with 32 filters (parallel fields for processing words) and a kernel size of 8 with a

rectified linear ('relu') activation function. This is followed by a pooling layer that reduces the output of the convolutional layer by half. Next, the 2D output from the CNN part of the model is flattened to one long 2D vector to represent the 'features' extracted by the CNN. The back-end of the model is a standard Multilayer Perceptron layers to interpret the CNN features. The output layer uses a sigmoid activation function to output a value between 0 and 1 for the negative and positive sentiment in the review. We use a binary cross entropy loss function because the problem we are learning is a binary classification problem. The model is trained for 10 epochs, or 10 passes through the training data.

VI. SCREEN SHOTS

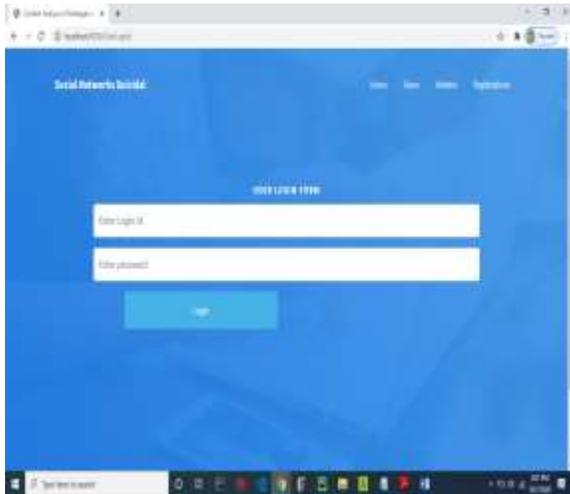
Home page:



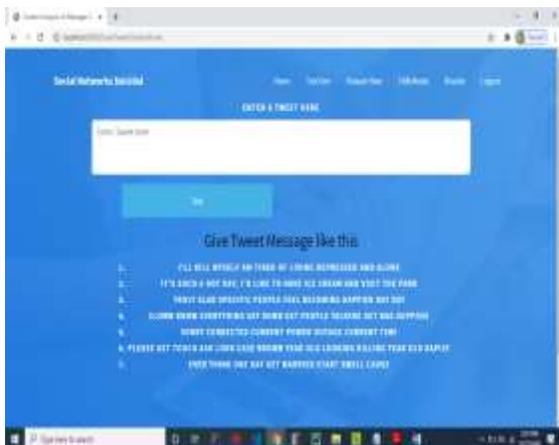
User register form



User Login Form:



Test the message:



Result:



VII. CONCLUSION

Among all models for content analysis of the text, this one differs in that it classifies suicidal sentences, which is extremely useful for reducing the death rate from suicide, which exceeds the death rate from military actions, murders and road accidents. It should be noted that «death groups» were seen not only in «Vkontakte», but also in other social networks and messengers, such as Telegram, Instagram, etc. This neural network can be used to check the text in social networks to block posts containing suicidal overtones, what will prevent the spread and promotion of suicide among young people who cannot imagine life without social networks. Also, this program can be used for parental control, if the parent does not want to violate the privacy of personal messages of the child, but is worried about him: it is enough to collect data and provide them to the program. Also, this neural network can be used to block communities that contain a suspiciously large number of posts with suicidal content.

Further Enhancement

Limitation of our experiment can be found in its data deficiency and annotation bias. Data deficiency is one of the most critical issues of current research [86], where mainly supervised learning techniques are applied. They usually require a manual annotation. However, there are not enough annotated data to support further research. Another issue is the annotation bias caused by manual labeling with some predefined annotation rules. In some cases, the annotation may lead to bias of labels resulting in misleading evidence to confirm the suicide action of the authors.

We believe that our study can contribute to future machine learning research for building an easily accessible and highly effective suicide detection and reporting system implemented in social media networks as an efficient intervention point between at-risk individuals and mental health service.

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