MONITORING SUSPICIOUS ACTIVITY ON ONLINE FORUMS USING VADER AND TEXT ANALYSIS

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Abstract—*As the era of Internet has progressed is has changed the lives of many people in both, a good way and a bad way. As online technology is progressing, many illegal activities have also increased exponentially. The Internet is an unexplored pathway for illegal activities such as hacking, trafficking, betting, frauds and similar activities. The cyber-crime units are actively looking for tools to detect these forums for illegal feedbacks and comments. This proposed system will monitor for suspicious posts from the website on which it is implemented on and use techniques of data mining to extract meaningful data. In this, we focus on Data Mining and Sentimental Analysis to enhance the techniques and to extract the features of the text to represent them. To perform sentimental analysis of the text, we will be making use of VADER.*

***Keywords*—Data Mining, Text Analysis Suffix Stripping, Affix Stripping, Porter's Algorithm, VADER**

1. INTRODUCTION

Accelerating crimes on digital mediums alert the law implementation bodies to continuously monitor online activities. To achieve the above, we need to build a system which detects suspicious postings on online forums. A lot of surveys and facts have proved that it is difficult to manage information which constantly keeps changing on internet thus data mining is the optimal choice to analyse and gather data. Using various data mining techniques, raw data is extracted from a large text corpus and this raw /unstructured data is transformed into structured data in pre-processing. This report highlights the data mining techniques which are prototyped and implemented using python which is functional in natural language using Natural Language Toolkit (NLTK) library. To perform effective sentimental analysis we will be using a tool called VADER. VADER (Valence Aware Dictionary and sentiment Reasoner) is a lexicon and rule-based sentiment analysis tool that is *specifically attuned to sentiments expressed in social media.*

2. PREVIOUS WORK

[3] elaborates about Stop-word Selection, Stemming algorithm, Brute-force algorithm, Learning Based algorithm and Matching algorithm. Matching algorithms use two constraints Stemmer Strength and Index Compression. Using these two constraints, stem words in

database are compared and their value is calculated. Learning based algorithms include machine learning theories like SVM and conditional random field. This system also focuses on plan execution time, automated classification to identify more significant suspicious discussions. The drawbacks in this system is that it takes up a lot of time to actually process huge corpus of text due to its use of Brute Force algorithm which is not viable in real world applications. [5] takes a more practical approach at sentimental analysis but still fails to effectively optimize the process of analysis as it depends on its custom-made dataset because not all words may be present in it. In [7], although all the correct steps are stated, it does not provide an effective application which uses the stated approaches making it only a theoretical application. [9] is a practical approach as it also categorizes the texts it has analyzed into certain niches of suspicious behaviors like hacking, piracy and more. What this approach fails to achieve is that, it takes up a lot of time to train the machine learning models used here which is not needed as there are tools available to do the same work in less time.

3. PROPOSED SYSTEM

The proposed system has following steps. The initial step is to take message sent by user as input from discord server/api. From next step pre-processing of message starts. First message will be tokenized into sentences followed by words. The next step is identification of stop words. After the identification of stop words, they will be removed from message. The next step is stemming. The next step is sentiment analysis using VADER. Finally, based on the results generated from previous step, either results will be printed or user will be kicked out of channel.

3.1 Identifying and Removing the Stop Word

Stop word are commonly used words ("a", "an", "the") which should be removed to reduce processing times and free up database space.

3.2 Sentiment Analysis

After removal of stop words and further processing the text using various algorithms, sentimental analysis is performed to find out the correct context or the correct sentiment in which the said text was used. This step is extremely crucial and needs to be effectively handled. To do this, the tool VADER has been implemented. Valence Aware Dictionary and sentiment Reasoner or VADER is a lexicon and rule-based sentiment analysis tool that is *specifically attuned to sentiments expressed in social media*. VADER doesn't output the sentiment as a string like negative, neutral or positive but rather it gives you a dictionary with a negative, neutral, positive and compound score. The positive, neutral and negative scores represent the proportion of the text that falls inside these categories whilst the compound score represents the sum of all the lexicon ratings where +1 represents most positive and -1 represents most negative. If this score is between -0.05 and 0.05 then the sentiment is neutral. If it is lower than -0.05 then the sentiment is negative and if the compound score is bigger than 0.05 it's positive.

Assume a text: "*programming is fun*"

The result after this text is processed using VADER tool comes out as: *Output-> {'neg': 0.0, 'neu': 0.377, 'pos': 0.623, 'compound': 0.5106}*

The VADER sentiment analysis library allows us to easily create sentiment analysis applications that operate at almost real-time speed which is a big advantage over previous systems.

3.3 Processing based on Condition:

Based on result obtained from previous step if the sentiment of message will be positive or neutral then it will be printed on cmd.

If the result is negative then sentence will be stored in database, and user will be soft warned. If user makes mistake, he will need to contact Admin of server. If user makes same mistake 3 times he will be strictly warned. If he continues, then after another 3 sentimentally negative messages he will be kicked out of the channel.

3.4 Monitoring Suspicious Discussion:

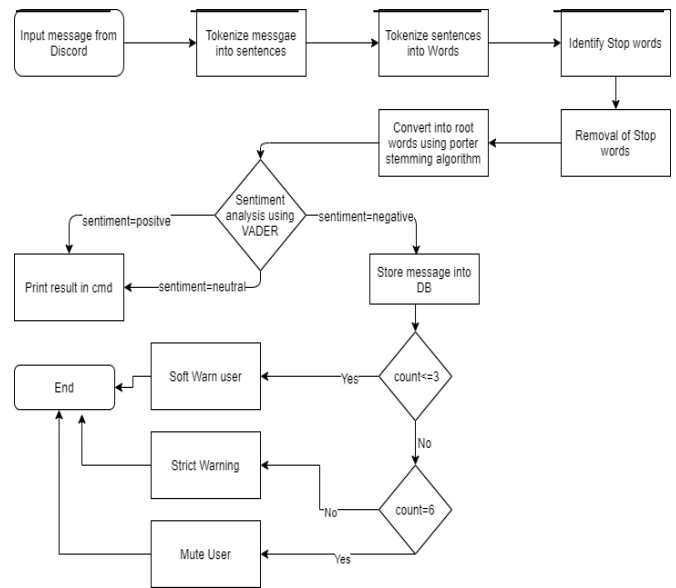Here, the chat is monitored to keep it free from suspicious activities and texts

Fig 1: Basic System Architecture

4. ALGORITHMS USED

4. 1 Stop Word Selection:

Stop words are the words are mostly the pronouns and articles. Pronouns like "I, he, she" and articles like "a, an, the". Following algorithms are used to detect stop words which are suspicious in system.

4.2 Porter's Stemming Algorithm:

Stemming is the process of removing the derived words from the stem words, base or root form – generally a written in any of the word form. The process of stemming is also called conflation. These are the programs which commonly referred to as stemming algorithms or stemmers.

Stemming algorithms mostly differs in terms of accuracy and performance. A stemmer for ENGLISH word, for example, it recognizes the STRING "rewarding" is derived from the root "reward", and "expressing" is derived from the root "express". A stemming algorithm identifies the root word example "enforcing", "enforced" to the root word, "enforce".

Term	Word	Removed
Enginnering	Enginneer	-ing
Engineered	Engineer	-ed

Table 1: Stemming

5. TOOLS AND METHODOLOGY

The most important tool to be used here is Discord which is highly optimized to be configured anyhow the administrator of a forum/channel wants. Discord is an open source forum/chat-room. It has functionalities to create various bots which can be specifically programmed to suit the administrator. We imported a dataset which contained a lot of bad words so, the system can effectively analyze the chats. The bot we have programmed uses the VADER tool with algorithms stated above which performs analysis on the texts sent by users. If user uses profanity more than 2 times, the system automatically kicks the user from the channel. This system not only kicks suspicious users, it also creates a database of users who have broken the rules multiple times which warns the administrator of such users.

6. RESULTS AND OBSERVATIONS

In order to evaluate our results directly against the broader body of literature, we assess both a) the correlation of computed raw sentiment intensity rating to gold standard ground truth, i.e., the mean sentiment rating from 20 prescreened and appropriately trained human raters, as well as b) the multiclass (positive, negative, neutral) classification metrics of precision, recall, and F1 score. The F1 score is the harmonic mean of precision and recall, and represents the overall accuracy.

Tools	Overall Precision	Overall Recall	Overall F1 score
Ind. Humans	0.95	0.76	0.84
VADER	0.99	0.94	0.96

Table 2: Results

We can see that VADER (F1 = 0.96) actually outperforms even individual human raters (F1 = 0.84) at correctly classifying the sentiment of tweets.

7. CONCLUSION

Text Analysis and Data Mining are very effective techniques for discovering suspicious activities being carried out. This system helps in keeping online forums family friendly, safe and healthier to use since it keeps away cyber bullying and other illegal activities. The context-based nature of the text analysis will help in better understanding of the user's real emotions.

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