

Deep Neural Network based mechanism to compute Depression in social media users

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Abstract - Depression is one of the most prevalent Mental Illnesses. The purpose of this paper is to gauge the extent of depression using Sentiment Analysis. To this intent the authors employ Deep Learning Neural Networks to analyze social media posts and capture the emotions and habits displayed by its user. Using CNN the authors plan to be able to better deal with the obscurity which is often an obstacle in Sentiment Analysis. Regression analysis of these habits and emotions over a period of time will be used to determine the Depression Quotient of the user. Depending upon the severity, the user is provided with a detailed prognosis and general advice.

Key Words: Depression, Sentiment Analysis, Deep Learning, Neural Networks, Regression.

1. INTRODUCTION

According to the World Health Organization (WHO), depression is the fourth largest disease in the world and suicide has been among the top three causes of death worldwide, leading to one death in every forty seconds. Almost every day many cases come up about people attempting to commit suicide due to depression. Almost 30% of internet users look for online healthy discussions mainly related to psychological and social aspects. The objective of this paper is to gauge a person's mental health using their social media activity. Social networks have become a universal means of communication via expression of opinions, sentiments and sharing of different types of information. Most times, individuals are not vocal about their feelings in person. But they express their opinions more openly on social media platforms. Text analysis provides a more conclusive result to understand the inner-workings and intentions of the human mind.

The data for the paper is obtained from the users of social media by a regular input of information in the form of posts. The paper proposes the use of a 3 layered Deep Neural Network[1] architecture to analyze text and determine the emotions and habits displayed by the users. All the posts made during the period of 24 hours will be considered as a single unit or quantum. The analysis and results of all the quanta will then be subjected to regression analysis[2] and the final result will be produced. The result generated will be a score called the depression quotient (DQ), by means of regression plotting. The DQ generated will not only raise awareness about the widespread prevalence of mental health disorders, but also enable the affected individuals to

seek the help they require. Based on the depression quotient, personal automated advice will be given to the people which will help them to deal with their problems. Also a prognosis will be offered whether the depression could lead to suicide.

2. REVIEW

Most of the depression self-diagnostic tools available online are in the form of questionnaires. While these are designed by psychologists and can be highly accurate, it is often the users that cheat the system. As has been reported by psychologists interviewed by the authors, patients tend to subconsciously hide their real intentions and feelings when answering these questionnaires.

While systems have been developed to analyze text for emotions exhibited, the informal nature and imprecise use of grammar has been a hurdle in using traditional NLP[3] and Sentiment Analysis[4] tools like the Stanford CoreNLP[5]. Lack of proper grammar is the root of these troubles.

These systems also only use crisp binary classification. They also fail to connect the emotions with their subjects.

3. PROPOSED SYSTEM

3.1 Principle

In order to overcome the mentioned obstacles, the authors propose a system that discards the need of correct grammar. The proposed system takes into account only effects with relevant subject i.e. only when the user is talking about themselves or a subject with direct effect on them. To deal with the ambiguity of language, instead of strict allotment, every token is to be assigned to emotions to varying degrees based on consult from Psychologists.

3.1 Methodology

In order to accurately simulate a real world social media platform, a micro-blogging website is to be designed and deployed for the purpose of data collection. Users of the website posted about their day to day activities and thoughts. The process of collecting data was carried out for a period of 90 days. This raw data was then processed using Natural Language Processing(NLTK)[6] tools in Python to produce word bags[7] and frequency tables[8]. This step comprises of data collected every day and processed

accordingly for the particular time period. This information then forms the input to our Artificial Neural Network Model[9]. The first hidden layer works at the primary level, giving us the kind of emotion displayed. Unlike traditional methods, instead of distinct classification of words in sentiment categories, they're to be allotted to different categories with varying degrees of participation. This helps deal with the ambiguity of human language.

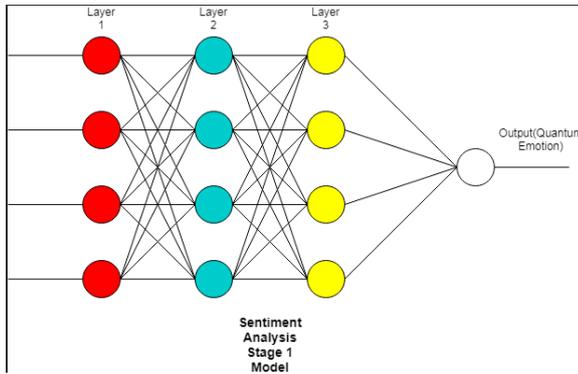


Fig -1: The proposed 3 layer DNN model

The second hidden layer relates these emotions with their subjects and determines their relevance to the originator of the data. The third hidden layer generates the flow of emotions and the relationships between different ideas present. The operation performed in the hidden layers is of convolution [10]. The output of this process is an aggregate, on a numerical scale, of all the emotions displayed in the particular time period.

Algorithm: DNN Sentiment Analysis

- (1) Layer 1 Convolution (word frequency, POS tag, emotion bias)
- (2) Associate word frequency with POS tags
- (3) Perform Convolution with Emotion bias
- (4) Output is Convolution result
- (5) Layer 2 Convolution (Layer 1 output, Clause bias)
- (6) Perform Convolution of Layer 1 output and Clause bias
- (7) Output is Convolution result
- (8) Layer 3 Convolution (Layer 2 output, Factor bias)
- (9) Perform Convolution of Layer 2 output and Factor bias
- (10) Output is Convolution Result
- (11) Output Layer (Layer 3 output)
- (12) Perform aggregation of emotions
- (13) Output is Quantum Emotion

The results of 90 days are then fed to regression and pattern recognition model[11]. Plotting the observed pattern and the

regression line[12], emotional variance of the user is found out, which in turn determines the Depression Quotient of the user. This follows closely the procedure employed by Psychologists during patient evaluation. The use of regression provides with higher accuracy than classification as it is able to focus on the finer distinctions which are intrinsic to psychological evaluation.

4. CONCLUSIONS

The proposed system will be able to work on sentences without a proper grammatical structure. The method when employed will be able to differentiate between general thoughts and wonderings and those concerning the user. The use of regression will enable us to better analyze the generated data.

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