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AUTOMATIC EYE DISEASE PREDICTION

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ABSTRACT:

Millions of people around the world are affected by one or more mental disorders that interfere in their thinking and behavior. A timely detection of these issues is challenging but crucial, since it could open the possibility to offer help to people before the illness gets worse. One alternative to accomplish this is to monitor how people express themselves, that is for example what and how they write, or even a step further, what emotions they express in their social media communications. In this study, we analyze two computational representations that aim to model the presence and changes of the emotions expressed by social media users. In our evaluation we use two recent public data sets for two important mental disorders: Depression and Anorexia. The obtained results suggest that the presence and variability of emotions, captured by the proposed representations, allow to highlight important information about social media users suffering from depression or anorexia. Furthermore, the fusion of both representations can boost the performance, equaling the best reported approach for depression and barely behind the top performer for anorexia by only 1%. Moreover, these representations open the possibility to add some interpretability to the results.

1.INTRODUCTION

A mental disorder causes different interferences in the thinking and behavior of the affected person [1]. These interferences could vary from mild to severe, and could result in an inability to live routines in daily life and ordinary demands [2]. Common mental disorders such as depression and anorexia affect millions of people around the world. They may be related to a single

incident causing excessive stress on the person or by a series of different stressful events. It is also well known that mental disorders tend to increase in countries experiencing generalized violence or recurrent natural disasters. For example, in 2018 a study of mental disorders in Mexico revealed that 17% of its population has at least one mental disorder and one in four will suffer a mental disorder at least once in their life [3]. In another vein, in the modern world, we take for granted that social life could be experienced either in the physical world or in a virtual world created by social media platforms like Face book, Twitter, Redd it, or similar platforms. This reality presents some challenges, but also great opportunities which, if properly addressed, could contribute to the understanding of what and how we communicate. In this regard, the goal of this study is to analyze, via the automatic identification of emotional patterns, social media documents 1 with the purpose of detecting the presence of signs of depression or anorexia in the population of that area [4]– [6]. Previous works have addressed the analysis of emotions of social media users by paying attention to their contrast and tone. They have mainly applied this analysis to predict users' age and gender as well as a range of sensitive personal attributes including sexual orientation, religion, political orientation [7], [8], income [9], and personality traits [10], [11]. According to these studies, the analysis of emotions in social media allows capturing important information related to users. This information presents an opportunity for us to extend the use of emotions in the detection of depression and anorexia in social media. Former studies focused on the detection of depression and anorexia have mainly considered linguistic and sentiment analysis [12]– [14]. Note that the use of sentiments, i.e. polarity, was the preamble for the later use of emotions for the same task [15]. This line of thought exposed the potential of using emotions as features, such as" anger"," surprise" or" joy", instead of linguistic features or general sentiments like positive and negative. In this direction, in our previous work [16], we introduced a novel representation that was built using information extracted from emotions lexicons combined with word embeddings as a way to represent the information contained in users' documents. Then, using a clustering algorithm, we created sub-groups of emotions, that conveniently we named as sub emotions. These discovered sub-

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emotions provided a more flexible and fine-grained representation of users and a better performance for the detection of depression. In a few words, the idea behind this representation was to capture the presence of sub-emotions in users' posts. The intuition of our approach is that users suffering from depression would show a distribution of emotions different from healthy users. Motivated by the encouraging results of the representation based on sub-emotions, in this study we give a more complete treatment of the method. In particular, we propose a new representation that not only captures the presence of sub-emotions, but also models their changes over time. The intuition is to model emotional fluctuations that users with mental disorders could continuously present. This temporal information is later integrated to enrich the original approach. That is, we build a fusion of both representations, that at the end attains very competitive results, practically equal to those of the state of- the-art approaches. Finally, we envision how these two representations can be applied beyond detecting depression to also detect other important mental disorder such as anorexia. Using this new representation, we contrast emotional patterns between the two disorders, possibly finding what could be described as their emotional" silhouette".

The proposed static and dynamic representations, named as BOSE and _-BOSE respectively, are inspired in two hypotheses. The first one is that words assigned to coarse emotions in lexicons cannot capture subtle emotional differences, which in fact are what provide the most important insights into the mental health condition of users. For example, the lexicon associated with the anger emotion includes words such as furious, angry and upset that represent different degrees of anger, however, they are tagged with the same emotion. Thus, our proposal is to represent each user by a histogram of sub emotions, which are discovered by clustering the embeddings of words inside coarse emotions. The second hypothesis is that people with depression and anorexia tend to expose greater emotional variability than a healthy person. In this case, the idea is to represent each user by a set of statistical values that describe the frequency changes of the sub-emotions over time. Based on these hypotheses, the contributions of this work for detecting people that have depression or anorexia are the following:

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1) We further explore the BOSE representation and propose a new representation based on sub-emotions that allow capturing the emotional variability of social media users over time.

2) We propose an approach to combine both static and dynamic representations using early and late fusion strategies to improve the detection of depression.

3) We extend the use of these representations based on fine grained emotions for the task of anorexia detection and contrast the discovered emotional patterns with those obtained from the task of depression detection.

The remainder of the paper is organized as follows: Section 2 presents a brief overview on the detection of mental health disorders using social media data. Section 3 describes in detail the creation of sub-emotions and how to convert text to these new sequences. Section 4 presents our emotion-based representations. Section 5 describes in detail our experiments, results, and their analysis. Finally, Section 6 presents our main conclusions.

2. EXISTING SYSTEM

Depression is a mental health disorder characterized by persistent loss of interest in activities, which can cause significant difficulties in everyday life [1], [17]. Studies focusing on the automatic detection of this disorder have used crowdsourcing as their main strategy to collect data from users who expressly have reported being diagnosed with clinical depression [18], [19]. Among these studies, the most popular approach considers words and word n-grams as features and employs traditional classification algorithms [13], [20], [21]. The main idea is to capture the most frequent words used by individuals suffering from depression and compare them against the most frequent words used by healthy users. This approach suffers because there is usually a high overlap in the vocabulary of users with and without depression.

Another group of works used a LIWC-based representation [22], aiming to represent users' posts by a set of psychologically meaningful categories like social relationships, thinking styles, or individual differences [18], [23]. These works have allowed a better characterization of the mental disorder conditions, nevertheless, they have only obtained moderately better results than using only the words. Recent works have considered

ensemble approaches, which combine word and LIWC based representations with deep neural models such as LSTM and CNN networks [24], [25]. For example, in [25], [26], the combination of these models with features like the frequencies of words, user-level linguistic metadata, and neural word embeddings offered the best-reported result in the risk- 2018 shared task on depression detection [27].

These works show that in social media texts exist useful information to determine if a person suffers from depression, but the results are sometimes hard to interpret. This is an important limitation since these types of tools are naturally aimed to support health professionals and not to take the final decisions. In [28] [29], the authors conduct studies to tackle this problem. They characterize users affected by mental disorders and provide methods for visualizing the data in order to provide useful insights to psychologists.

Disadvantages

1) The system doesn't implement Converting text to sub-emotions sequences techniques.

2) The system doesn't implement emotion-based detection of mental disorders.

3. PROPOSED SYSTEM

The proposed static and dynamic representations, named as Bose and _-Bose respectively, are inspired in two hypotheses. The first one is that words assigned to coarse emotions in lexicons cannot capture subtle emotional differences, which in fact are what provide the most important insights into the mental health condition of users. For example, the lexicon associated with the anger emotion includes words such as furious, angry and upset that represent different degrees of anger, however, they are tagged with the same emotion. Thus, our proposal is to represent each user by a histogram of sub emotions, which are discovered by clustering the embeddings of words inside coarse emotions. The second hypothesis is that people with depression and anorexia tend to expose greater emotional variability than a healthy person. In this case, the idea is to represent each user by a set of statistical values that describe the frequency changes of the sub-emotions over time.

Advantages

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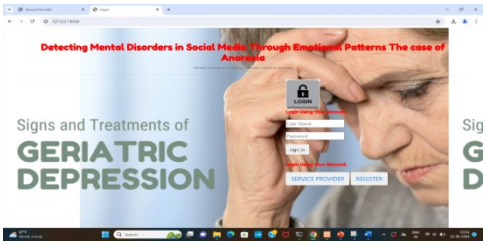
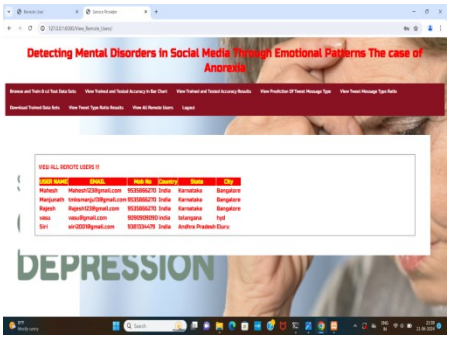
1) The system further explores the Bose representation and proposes a new representation based on sub-emotions that allow capturing the emotional variability of social media users over time.

2) The system proposes an approach to combine both static and dynamic representations using early and late fusion strategies to improve the detection of depression.

3) The system extends the use of these representations based on fine grained emotions for the task of anorexia detection and contrast the discovered emotional patterns with those obtained from the task of depression detection.





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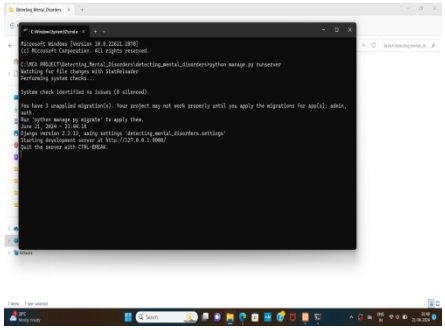

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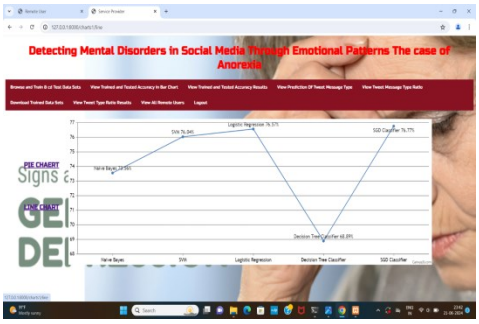

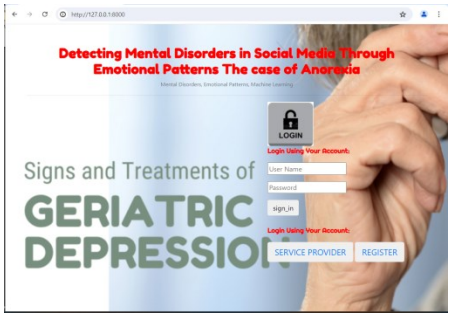

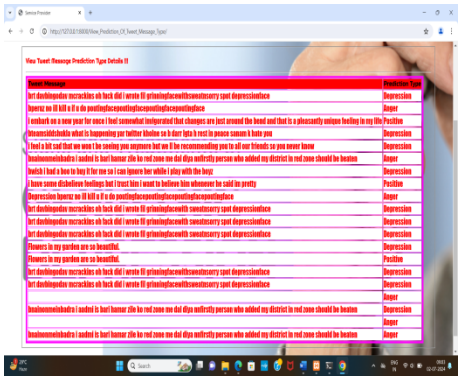

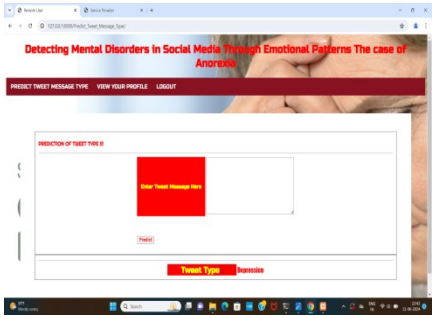

LOG OUT

5. CONCLUSION

In this work, we showed that representations based on fine grained emotions can capture more specific topics and issues that are expressed in social media documents by users that unfortunately experience depression or anorexia. That is, the automatically extracted sub-emotions present useful information that helps the detection of these two mental disorders. On the one hand, the BOSE representation obtained better results than the proposed baselines, including some deep learning approaches, and also improved the results of only using broad emotions as features. On the other hand, the inclusion of a dynamic analysis over the sub emotions, called _-BOSE, improved the detection of users that presents signs of anorexia and depression, showing the usefulness of considering the changes of sub-emotions over time. It is worth mentioning the simplicity and

interpretability of both representations, then creating a more straightforward analysis of the results. Finally, the capability to model the emotional behavior of users using their social media data presents an opportunity for future wellness facilitating technologies. This kind of technology can serve as warning systems that provide wide-area analysis and information related to a mental disorder respecting user privacy. This information could include the presence of mental disorders in certain areas, and the authorities could decide to create professional assistance or emotional support, that the users will decide whether to take or not. We believe that it is important to mention when we analyze social media content, we may have concerns regarding individual privacy or certain ethical considerations. These concerns appear due to the usage of information that could be sensitive, given the personal behavior and emotional health of the users. The experiments and usage of this data are for research and analysis only, and the misuse or mishandling of the information is prohibited.

6. FUTURE SCOPE

Detecting mental disorders like anorexia through emotional patterns in social media is an emerging area of research with significant potential. Here are some future scopes and considerations for this topic:

1. Advanced Natural Language Processing (NLP) Techniques: Develop more sophisticated NLP algorithms that can accurately analyze text for emotional cues, linguistic patterns, and sentiment that are indicative of mental health issues like anorexia. This could involve sentiment analysis, topic modeling, and deep learning approaches to understand subtle nuances in language.

2. Integration of Multimodal Data: Combine text analysis with analysis of other modalities such as images, videos, and voice recordings shared on social media platforms. Images of meals or body shapes, for example, could provide additional context to understand behaviors associated with anorexia.

3. Ethical and Privacy Considerations: Address concerns regarding user privacy and the ethical implications of monitoring social media for mental health purposes. Develop robust frameworks for consent, data anonymization, and secure data handling to protect users' rights and confidentiality.

4. Collaboration with Mental Health Professionals: Establish collaborations

between researchers, social media platforms, and mental health professionals to validate findings and ensure that identified individuals receive appropriate support and intervention.

5. Longitudinal Studies and Prediction Models: Conduct longitudinal studies to track emotional patterns over time and develop predictive models that can identify individuals at risk of developing anorexia based on their social media activity.

6. User-Centered Design: Involve individuals with lived experience of anorexia in the design and evaluation of detection tools to ensure that they are effective, respectful, and sensitive to the nuances of the disorder.

7. Education and Awareness: Raise awareness among social media users, healthcare providers, and the general public about the potential benefits and limitations of using social media data for detecting mental health disorders like anorexia**.**

8. Scaling and Generalization: Develop methods that can scale to analyze large volumes of social media data while maintaining accuracy and reliability across diverse demographics and cultural contexts.

9. Continuous Improvement: Implement feedback loops and mechanisms for continuous improvement of detection algorithms based on new research findings, technological advancements, and user feedback.

10. Regulatory Considerations: Stay informed about and adhere to regulatory frameworks related to data privacy, mental health data handling, and algorithmic transparency in different jurisdictions.

In conclusion, while the detection of anorexia through emotional patterns in social media holds promise, it also requires careful consideration of technical, ethical, and practical challenges to ensure effective and responsible implementation.

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