**INTRODUCTION:**

THe number of active online social network (OSN) users has grown considerably, and some studies indicate there will be 2.95 billion users by the end of 2020 [1]. This high number of users, on OSN, is mainly due to the increase of the number of mobile devices, such as smartphones and tablets, connected to the Internet. Currently, OSN have become a rich and universal means of opinion expression, feelings, and they reflect the bad habits or wellness practices of each user. In recent years, the analysis of the messages posted on OSN have been used by many applications [2], [3] in the industry of health care informatics.

The sentiments and emotions, expressed on the messages posted on OSN, provide clues to different aspects of the behavior of users; for instance, sentences containing words with negative meaning may indicate sadness, stress, or dissatisfaction [4]. Conversely, it can be inferred that if a person is in a positive mood state, this person can be more self-confident and emotionally stable [5]. Users have different behaviors on OSN, if the sentiment intensity value of posted sentences remain at low levels, or if it frequently changes from high to low levels and vice versa, these facts can indicate some emotional disturbance, such as depression or stress events [6]. Hancock, Gee, Ciaccio et al. [7] and Liu [8] observed that users write short sentences when they are experiencing a period of depression. Also, these users use the first person pronoun in their sentences and suffer from chronic insomnia. Therefore, their behavior can be reflected in the sentences posted on OSN. The presence of certain words in the sentences can be monitored and analyzed to identify users at a high risk of attempting suicide and an appropriate intervention can take place [9].

Depression is one of the most prevalent mental disorders in all regions and cultures around the world [10]. Unfortunately, depression recognition rate remains low. Most of the studies about health systems [11]–[13] use sensor devices to detect mental disorders. In [14], the proposed trained classifier, which is trained using electroencephalogram signals, is able to detect stress with an average accuracy of 80.45% using 4- fold cross validation. In [15], authors use heart rate variability data to propose a classification model that considers different stress levels, baseline, mild stress and severe stress, reaching accuracy values of 74%, 81%, 82%, respectively.

There is a scarce number of studies that use textual information from OSN data to detect physiological disorders. Xue et al. [16] use different machine learning (ML) classifiers to perform emotion classification focused on psychological disorders from micro-blogs, reaching an average accuracy of 80%. In [17], the proposed model to detect stress based on the information of Twitter activities reached an accuracy of 69%. In [18], authors study the causes of postpartum depression using OSN information. ML algorithms are also used in studies about mood monitoring systems analyzing messages from OSN [19], reaching an accuracy of 57%. Ma and Hovy [20] introduce a network architecture to analyze sentences meaning through character-level representations by using a combination of Long Short-Term Memory (LSTM), a Convolutional Neural Network (CNN) and Conditional Random Field (CRF). Lample et al. [21] combine Recurrent Neural Networks (RNNs) with CRFs to obtain the best results on Named Entity Recognition (NER) datasets. A bi-directional LSTM (BLSTM), an improved version of the LSTM, is also used for labeling tasks.

The deep learning approach has been explored in several areas [22], such as personality analysis [23], age group classification on OSN [24], sentiment analysis [25], among others. However, this approach is not widely explored in psychopathology studies. In this context, our study intends to test the performance of deep learning algorithms in scenarios of depressed, stressed, and non-depressed and non-stressed users’ detection.

A Recommendation System (RS) application can be used as a method to enhance the user’s emotional health, improving the person’s mood in case of negative emotional states [26]. RS based on ontology is being used for health purposes [27], presenting reliable results from diseases treatment plans.

In this context, the main goal of this work is to introduce an RS that uses an approach named Knowledge-Based Recommendation System (KBRS), which aggregates an ontology collection for health scenarios, named Nuadu [28], which is not addressed in other RSs designed to improve emotional health. The proposed KBRS also includes the sentiment analysis approach and an emotional health monitoring system. The monitoring system filters sentences from an OSN that allows to identify potential users with depression or stress conditions. To accomplish this task, an objective method based on an BLSTM-RNN is used to detect potential psychological disorders, along an CNN. Later, a KBRS is activated to send happy, calm, relaxing, or motivational messages to these users. These messages have different intensity levels depending on the sentiment intensity of the sentences posted on an OSN, which is determined by an enhanced sentiment analysis metric, eSM2. This proposed metric is based on a word-dictionary, considering the Portuguese language, and enhanced with additional information such as user’s profile data, user’s geographic location, and the theme of the sentence. Furthermore, in the cases of depression detection, the solution sends warning messages to authorized people who are previously registered in the system. According to the subjective test results, users reported high satisfaction with the KBRS, improving their emotional states. Tests were also performed with a traditional RS without the Nuadu ontology and the eSM2 for comparing it with the proposed KBRS. Furthermore, subjective tests reported that the application running on the user mobile electronic device had low complexity and low-power consumption.