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A Review Paper on Prediction of Depression Using User-Generated Content

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Abstract: ***Depression is a major issue which is increasing every day. So, to detect depression level it is best to study social media posts. Through social networking, users can communicate their feelings and share it online with their closest friends and family members.. Users are able to share the photos, ideas, texts; videos and information depend on their mood, feeling, vibes and emotion as well. Many people have difficulty for reflecting their feelings and mood to the doctors. Through social media tools such as Facebook, Twitter, Instagram, etc., they can display those moods. Depression can cause people to attempt suicide. So the study was done by analyzing various papers related to mood and negativity of users through Instagram, Twitter, Weibo, Facebook, etc. This survey is an outline of work done by the researchers in the area of twitter and Facebook posts about prediction of depression with machine learning methods.***

Keywords: Depression, social media, sentiment analysis, prediction, machine learning

1. INTRODUCTION:

Social platforms like Facebook, Instagram, Twitter etc. primarily used by youth are becoming increasingly popular. Social networks make it possible to voice their interests and feelings and communicate their everyday activities. Twitter is a platform of blogging where users may tweet about everyday events, politics, news, and other topics. Facebook is one popular communication channel where people can post or share images, audios, videos, comments, likes, and dislikes associated to their daily routines and special days. There are certain limitations to put posts on social platforms like word limits. Nowadays emoji are used frequently instead of text to show emotions. Twitter uses emoticons less than Facebook does. Emojis are becoming common practice for all posts and messages for easy communication.

Depression in youth affects human lives. Mental Health is a rising concern in today's youth. Earlier, depressed patients were diagnosed based on questionnaires and opinion of his/her relatives. Currently Posts, Tweets on social channels are used as screening tool to predict depression. So detailed investigation of the behavioural attributes of individuals needed for prediction. Now a days younger generation is using social

communication channel frequently. It becomes most important sharing channel rather than relatives and friends. It is difficult to express perspectives on Twitter and SMS due to lack of phrases. So emojis are replaced for text data for facial perspectives and opinions. This provides possibility to split social sites for clients' feelings and emotions to analyze their intellectual states and viewpoints. The reactions of posts or tweets of users may be positive, bad, or neutral. To identify depression in textual context, the bad reaction resulted in approximately sadness. Many researchers performed experiments on comments posted by users of Facebook and similar data from twitter.

Sentiment analysis is a method to categorise emotions in word-based content records. It is frequently used for classification method. For decades, the trouble of sentiment evaluation has been significantly researched. The records collected from different sources like microblogs, and reviews used in sentiment classification techniques. The most of approaches for organizing quality instructions heavily rely on textual content assessment.

2. RELATED WORK:

(Qiu Guang, 2010) A rule-based approach is proposed for extracting opinion topic words. Negative sentiment is associated with advertising keywords. Design a prototype system for submitting product information for ad selection. [47]

(Maks Isa, 2012) Emotional indicators permit people to give their opinions in social communication channels. People post include both plain text and emotional signals. Emotional indicators allow examining which emotions are voiced in the text. Maks developed lexicon model to describe verbs, removed all punctuation marks and left all letters while reading the sound quality of a textual material from post. By removing noisy data emotional signals provide a clean emotional content, which is useful for increasing the categorization accuracy of textual content [30].

(Vishal A. Kharde, 2016) Analysis of existing opinion mining methods conducted by researchers was comprehensive and comparative with machine learning methods (Naive Bayes, Support Vector Machine, and Max Entropy) lexicon-based approaches and assessment measures. Also discussed about the general issues and sentiment analysis applications.[55]

(Renu Gautam, 2017) The research found the various levels of depression and assessed them by textual content present in posts. Electroencephalogram (EEG) signals were summarized in MATLAB for a publicly accessible database. The classifier tool can be beneficial in categorizing patients with depression using good and bad words. [49]

(Andrew G. Reece, 2017) Authors created a computational model to guess the sadness in the initial stage of users by their Twitter postings and views through supervised learning algorithms. These users were suffering from severe anxiety or combat disorder. For this study, they collected past information from 204 samples where 105 were depressed and 99 were healthy. [7]

(Chiara Zucco, 2017) focused on text content analysis and emotional Computing approaches to implement a basic design for an integrated multimodal system. Researchers discussed SA and AC (Affective Computing) analysis systems in depth. Besides that, major challenges to such a system's development and execution features were studied. [11]

(S. Advanced, 2017) The collection and processing of unstructured data like posts, comments, tweets, and photographs published on social platforms like Facebook, Instagram, MySpace, and Twitter is recognized as data mining on social contents. Artificial Intelligence (AI) and psychology developments in social media statements monitoring permit unique insights to be derived from large datasets available on social platforms. [50]

(Barbieri , 2017) By analyzing the words in text-based tweets, authors could predict which emojis will be invoked. They trained models Bidirectional Long Short-Term Networks based on RNN. [19]

(H. Ritchie, 2018) Depression is the leading cause of suicide worldwide, affecting people of all eternities, genders and occupations. In 2017 between three and fourth tenths of the world's population suffered from depression. [20]

(Paridhi Pravin Nigam, 2018). Sentiment investigation of Twitter data is valuable for firms who want to monitor public sentiment about their brands. This article provided studies of different articles where Twitter data was used by method sentiment text analysis. Taken overview of distant supervised and supervised types. Also discussed new techniques used for mining. [46]

(Namrata Sonawane, May 2018) According to author to predict depression levels; need to study complete understanding of user behaviours through social platform. Machine learning methods such as Naive Bayes used to guess the user's depression level based on psychological data published on social media and a questionnaire-based survey. [40]

(Md. Rafqul Islam, December 2018) Study aimed to analyze depression using Facebook data obtained from social sites. Author specified that the use of machine learning to detect depression is an effective and scalable method. The research study result shown that Decision Tree method improve ML methods in detecting depression. [32]

(Jini Jojo Stephen, 2019) The research offered an operative method for discover depression levels in Twitter tweets. Sentiment ratings can be coupled with other emotions for more accurate technique of calculating depression levels. This procedure highlighted many features with sorrow and sadness that were previously neglected. [24]

(Neha U, May 2019) developed a multilevel predictive model to sense posts that convey signs of depression. The more negative words used means the more negative emotion the tweet carries. Classifiers like Linear Support Vector and Naive Bayes were used by Machine Learning to determine presence of signal of depression. [42]

(Anatoliy Surikov, 2020) The research focused on three techniques of conveying emotions in text i.e. emotional punctuation, emojis and emoticons. Authors used new method for analyzing text tonality. Five models developed by authors using different data sets and CNN algorithm and RNN algorithm. [5]

(Mohsin Kamal, 2020) A novel machine learning approach was suggested for classifying patients' mental illness depended on their postings (along with their appropriate comments) on the well-known platform, Reddit. According to author XGBoost" was a successful classifier in diagnosing and categorizing mental illness. [35]

(Sangeeta Lal, 2020) Six main emoji were utilized for the study. Sentiment analysis done based on compound sentences from Twitter with both positive words and negative thoughts. A sentiment score was computed for each tweet using the SentEmoji technique. The proposed approach gave an accuracy of 87%. [52]

(Chuchu Liu, 2021) Emoji-embedding model built on Bi-LSTM (specifically, CEmo-LSTM) for evaluating online Chinese texts. The CEmo-LSTM algorithm was used on a huge dataset gathered from Weibo to investigate sentiment analysis of users who used online sources in the period of COVID-19. According to study, the pandemic affected individual feelings rather significantly (e.g., horror, sadness). [13]

(Emmanouela E. Manganari, 2021) The goal of the study was to give a critical analysis of what was currently known about the usage of emoji in computer-mediated communication (CMC). A critique study of 46 research papers which published among 1998 and 2020 was given. The Summary Table provided each paper's methodology and sample size. [16]

(David William, 2021) Social media accounts of depressed persons showed certain characteristics that could be detected early due to the presence of certain characteristics. It used deep learning model RNN to diagnosis of depression cases. [14]

(Naw Raj Bhatt, 2021) Authors compared all the learning approaches available for analysis of sentiments on Twitter using Multinomial-Naive Bayes Classifier, Gaussian-Naive Bayes and Bernoulli-Naive Bayes Classifier. [41]

(Martin Weiß , 2022) Multiple regression model was used to detect mental health by considering sorrow and anxiety scores. [31]

(K. Victor Rajan, 2022) The author proposed Artificial Neural Networks as a tool for determining sentiment polarity of social media content. For the task of classifying social media text, the researchers used machine learning algorithms without actually having to understand the content on social media. [26]

Data of social platform can be classified into three main categories like emotional process, temporal process, and linguistic style for the detection and analysis of depressive data. The classification methods applied like Decision Tree, k-Nearest Neighbor, Support Vector Machine. [38]

Researchers used NCapture to collect data from Facebook. Data set analyzed using LIWC software [32].

Support Vector Machine (SVM) is a supervised learning models with associated learning algorithms that analyze data used for classification and regression analysis. Support Vectors are essentially the coordinate of person perception. Researcher implement input in the form of vector, for illustration with a unigram function extractor, each single word treated as a feature found in a tweet. If the function was present, the value was 1, however if the feature was absent, then the value was 0. Instead of using numbers, feature presence used so that to scale the input information, which speeds up overall processing [2].

Naive Bayes classifiers in machine learning are a group of basic probabilistic classifiers depend on applying Bayes' theorem with solid (naive) independence presumptions between the features. With help of Naïve Bayes classifiers level of depression identified and number of stressed and non-stressed users found [40].

From the literature review it is noticed that various emotion sensing strategies used for detecting depression. Using machine learning, researchers identified classifiers (SVM, KNN, and Ensemble) for the retrieved dataset and finally, predicted depression for mental illness. The social sites like Facebook, YouTube, Twitter, Instagram support emojis. Earlier research had been done on predicting depression level by social sites for posts only in textual format not on emojis.

V. COMPARATIVE STUDY:

Recent years study on Depression prediction using SVM, Naïve Bayes, Linear Regression has been done. Researchers are experimenting with various machine learning algorithms. The number of research in the domain also appeals for comparative understating of the work done in the past few years. Table 1 gives comparative tabulation of work done in classification and identification of depression prediction.

PAPER	METHOD	DATASET	FEATURES / MEASURES	RESULTS
Alec Go	Naive Bayes, Maximum Entropy, and SVM	Twitter	Unigrams and Bigrams	Accuracy 80%
Ebunoluwa Okediran	Support Vector Machine, Naive Bayes, Logistic Regression, k-Nearest Neighbor, Decision tree	Twitter Myvocabulary.com	Magnitude	Accuracy 66%
Chuchu Liu	SVM LSTM	Weibo from December 1, 2019 to March 20	Sentence with emoji and without emoji Compared accuracy	Accuracy 95%
Anatoliy Surikov	Connected Neural Network	Facebook API	Ensemble methods	Accuracy 85%
Heerscchop B	WSD algorithm	Movie Reviews	Precision, Recall, and F1 Score	Baseline approach accuracy of 0.585 and Macro-level F1 of 0.569.
Anurag Illendula	Support Vector Machine, Naive Bayes, Logistic Regression, k-Nearest Neighbor and decision tree	Twitter API Depressive Sentiment Vocabulary (DSV)	First order embeddings Second Order Embedding	SVM 63.6 % RF 60.7%
Mohsin K.	Machine Learning Method XGBoost	Reddit	Accuracy, Precision, Recall, F-measure	1.7%, 1.3%, 4.7% and 10% Improvement OCD, Autism, PTSD and Schizophrenia respectively

Munmun De Choudhury	SVM	Twitter	Accuracy and precision	Accuracy of 70% and precision of 0.74.
K. Victor Rajan	Feature extractor and CNN	Twitter	Accuracy,Recall and precision	Improved accuracy
Ng. Hwee	Perceptron learning algorithm	Newswire articles	Correlation coefficient	Fast for text categorization
Moin Nadeem	Multinomial approach to the Naïve Bayes' algorithm	Twitter	Accuracy and precision call	81% accuracy Precision score of .86.
Francesco Barbieri	RNN	Twitter	Accuracy and precision	computational models are able to better capture the underlying Semantics of emoji.
Thorsten Joachims	SVM	Reuters-21578 dataset compiled by David Lewis	Recall and precision	SVMs consistently achieve good performance on text categorization
Ko Youngjoong	Naïve Bayes and X^2 Statistics	Web documents	Recall, precision, and F1 measure	This method can be used in areas where low-cost text categorization is needed.
Zhao Yan-Yan	Maximum entropy (ME)-based classifier and a support vector machine	5617 sentences from Chinese Opinion Analysis Evaluation (COAE)	Recall, precision, and F1 measure	Graph-based method can yield good results, and perform better (F-score) than either of the unsupervised or supervised method

Table 1: Comparative Study

3. CONCLUSION AND FUTURE WORK:

This study concludes that social media post is an effective way to predict depression. The study examines a number of recent articles and demonstrates a recent trend in predictions, sentiment analysis, and related areas of research. Mostly Machine learning algorithms (Support Vector Machines, Naive Bayes, Maximum Entropy, and Classification) are used for classifying sentiments. Earlier research had been done on predicting depression level by social sites for posts only in textual format, not on emoji. So Need to analyze posts with emoji. Future work will focus to work on emojis to classify positive and negative posts; as younger generations write comments by use of emoji to express themselves. Further, more research is needed to improve methods and techniques of machine learning to predict emotions and sentiments.

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