

Sentiment Analysis of Depression Prediction from Social-Media: A Comprehensive Review

Yogesh Sahu¹, Dr. Pinaki Ghosh², Dr. Gourav Shrivastava³, Dr. Kirti Jain⁴
¹Research Scholar, ²Head and Professor, ³Associate Professor, ⁴Associate Professor
SSAC, SAGE University, Bhopal, India

Abstract - Because of the growing awareness of the importance of mental health, the identification of mental illness is becoming a major problem. Because of the multifaceted nature of each mental problem, many psychiatrists found it difficult to diagnose the presence of mental illness in a patient, making it impossible to provide proper therapy to the patient before it was too late. Yet, the integration of social media into people's everyday lives has created an atmosphere in which new information on a patient's mental disease may be obtained. This research was conducted as a Comprehensive Literature Review (CLR), which is described as the process of locating, analyzing, and interpreting existing resources in order to offer answers to a set of research questions. The analysis is performed to answer questions about text-based mental illness detection based on the social media activity of people with mental disorders, and it reveals that it is indeed possible to do early detection of depression on social media due to the presence of specific characteristics in the way these subjects use their social media. This Paper discovered that, because of the scarcity of research employing a text-based method, most studies utilize deep learning models like as RNN on the early diagnosis of depression patients. Yet, the purpose of this research is to discover a strategy that may be more successful.

Keywords: Linguistic analysis; Natural language processing; Depression detection; social media.

How to cite this article: Yogesh Sahu, Dr. Pinaki Ghosh, Dr. Gourav Shrivastava, Dr. Kirti Jain "Sentiment Analysis of Depression Prediction from Social-Media: A Comprehensive Review" Published in International Journal of Scientific Modern Research and Technology (IJSMRT), ISSN: 2582-8150, Volume 12, Issue 2, Number 2, Aug 2023, pp.5-13, URL: <https://www.ijsmrt.com/wp-content/uploads/2026/09/IJSMRT-23080202.pdf>

Copyright © 2023 by author (s) and International Journal of Scientific Modern Research and Technology Journal. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0) (<http://creativecommons.org/licenses/by/4.0/>)



IJSMRT-23080202

I. INTRODUCTION

Depression is a frequent ailment that many individuals suffer from in today's culture. Depression, according to Parekh, is a medical illness that can have a detrimental impact on a person's way of thinking, feeling, and/or doing. According to World Health Organization data, there were around 322 million instances in the year 2015, with approximately 788,000 cases ending in suicide. Nonetheless, as terrible as it may appear, there is still a stigma in society that having a mental disease displays weakness and frequently leads to banishment from the community. According to one study, while individuals recognize depression as a severe illness, they believe

it is less treatable. This may make persons with mental illnesses hesitant to seek professional help, exposing even fewer people to adequate treatment [1, 16]. Approximately 75% - 85% of persons suffering from depression do not receive adequate treatment. Given the current trend of individuals venting their issues on social media, this may not only provide psychiatrists and/or psychologists with more information before making judgements, but it also opens the door to early identification by analyzing data gathered from the subject's social media platform. It is supported by a discovery that students with depressive symptoms use the internet significantly more than those without symptoms. This motivates researchers to develop the most effective way for early depression identification.

This Research seeks to develop and analyze text-based techniques for early identification of depression based on social media posts. [1, 3, 19]

Most individuals nowadays express their views, ideas, and share their experiences through the Internet and social networks. This frequently results in the transmission of huge amounts of data through the Internet. Yet, most of these data are beneficial when examined; for example, most industrial enterprises and political campaigns rely on understanding people's opinions and determining whether they are good, negative, or neutral through communication sites.

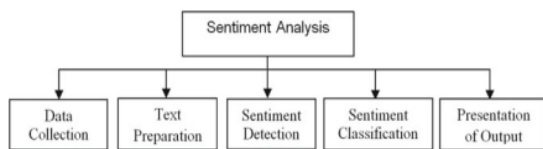


Figure 1: Sentiment analysis process steps [2]

II. LITERATURE REVIEW

Jitimon Angskun et al [1], During the Covid pandemic, the quantity of sadness cases has decisively expanded. A few sadness victims unveil their genuine inclination through online entertainment. Accordingly, large information investigation on interpersonal organizations for continuous discouragement identification is proposed. This exploration work identified the downturn by dissecting both segment qualities and assessments of Twitter clients during a two-month time span in the wake of having addressed the Patient Wellbeing Survey 9 utilized as a result measure.

Md. Rafidul Hasan Khan et. al [2], These days, Feeling Investigation is one of the high level matters of regular language handling. Opinion investigation decides a specific shaft of a section.

Hasan Mahmud et. al [3], With the fast development of web-based entertainment, clients are engaging in virtual communism, creating an immense volume of text based and picture contents. Taking into account the items, for example, announcements/tweets and shared posts/retweets, enjoying different posts is

mirroring the internet-based conduct of the clients. Foreseeing character of a client from these computerized impressions has turned into a computationally difficult issue. In a profile-based approach, using the client produced text-based items could be valuable to mirror the character in virtual entertainment.

Md. Kamrul Hasan et. al [4], online entertainment has turned into a tremendous storehouse of text-based information and pictures as every one of the clients are making posts, sharing perspectives or news, catching the minutes by means of photographs and so forth. Sharing or posting situations with/could be considered as a typical element among the famous interpersonal interaction destinations like Facebook, Twitter, Google+ and so forth. Client produced literary information, for example, situations with tweets could be considered as the fundamental language to discuss in online entertainment with others.

Ahmed Al Marouf et. al [5], web-based entertainment has turned into an immense vault of text-based information and pictures as every one of the clients are making posts, sharing perspectives or news, catching the minutes by means of photographs and so forth. Sharing or posting situations with/could be considered as a typical component among the well-known interpersonal interaction locales like Facebook, Twitter, Google+ and so forth.

Rabeya et. al [6], somewhat recently, feeling investigation is a thriving trial subject of exploration as a result of a great deal of obstinate information open on Websites and person to person communication locales. It is the reference to the task of Normal Language Handling to conclude whether text or content contains any emotional data like positive, pessimistic or not.

III. SENTIMENT ANALYSIS

The interaction which includes assortment, cleaning, change, and demonstrating of information to catch significant data for different cycles for independent direction is called as Information examination. The fundamental use is to gather data from the crude information. It comprises of steps like Information necessity gathering, Information assortment,

Information cleaning, Information investigation, Information translation, and Information representation. The requirement for information investigation ought to be found out, at first. Then, at that point, the information for the examination ought to be gathered from various information sources. The extremely next significant step is information cleaning. The information ought to be sans blunder, for that every one of the undesirable subtleties like copy records, blank areas, and errors will be eliminated from the gathered information. In the Examination step, the basic examination will be finished on the cleaned and handled information. Subsequent to examining the information, the information/results will be deciphered either as straightforward words or outlines or tables, and so forth. The last step is information perception, where the outcomes will be envisioned as outlines, charts, and so forth, as the last result. Figure 2 shows the important information investigation steps.

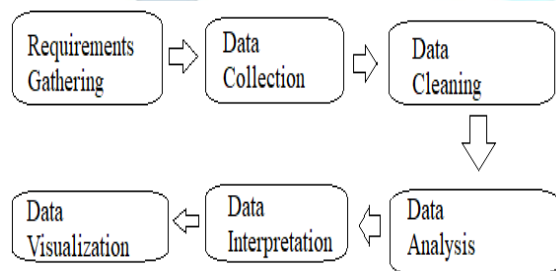


Figure 2: Data analysis steps

The arrangement of the block of message is whether positive, negative, or unbiased, is called Opinion Examination. The principal point will be to examine individuals' advantage such that it can assist the organizations with growing. It portrays on extremity (positive, pessimistic impartial) yet additionally on feelings (blissful, miserable, furious, and so forth.). It utilizes different Normal Language Handling calculations. The relevant mining of words demonstrates the social feeling of a brand. It likewise assists with deciding the business whether the item in which they are fabricating will make an interest on the lookout or not. Figure 3 shows the important opinion examination steps.

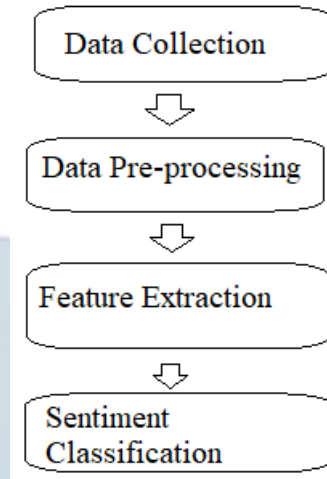


Figure 3: Sentiment analysis steps

Two procedures that includes in Feeling examination are:

- Rule-based opinion examination

It utilizes rules and an assortment of words marked by extremity to recognize the text assessment. Opinion esteem normally should be joined with additional powers to comprehend sentences containing mockery, nullifications, or ward conditions.

- AI based opinion examination

It Includes preparing an AI model to comprehend the extremity in view of the word request utilizing a feeling marked preparing set.

Informal community investigation implies the method involved with recognizing and understanding the connections and information stream between individuals, gatherings, associations, PCs and other associated data elements. The organization hubs are the gatherings and individuals, though the connections show connections between the separate hubs. It performs examination like visual and numerical investigation of human connections. Scientists estimates the action of organization for a hub that includes the idea of degrees — the complete number of associations a hub has straightforwardly.

A centralized network is distinguished by one or a few core nodes. If the network soon breaks into disconnected sub-networks, central nodes are

damaged or deleted. It has the potential to become a single point of failure. If a well-connected hub is removed or deactivated, a centralized system might fail. Hubs are nodes that are highly central.

4. DEEP LEARNING TECHNIQUES

Deep learning is a technology that teaches various systems to execute various tasks that people do naturally: learn by example. In deep learning, it performs picture, text, or voice categorization problems. It reaches a degree of precision that occasionally exceeds human ability. In the training phase, a set of labelled data and neural network topologies with several layers are employed. Because the majority of deep learning approaches employ neural network designs, deep learning models are frequently referred to as deep neural networks. The first table compares several Deep Learning Methods.

Table 1: Different Deep Learning Techniques

Authors	Classifier	Accuracy (%)	Dataset
Bohang Chen et al. [7]	LSTM	74.18	Twitter
	CNN	75.97	
	CNN—LSTM	74.70	
Li Chen Cheng et al. [18]	LSTM	80.83	Twitter
	BiLSTM	87.17	
	GRU	64.92	
Fazeel Abid et al. [21]	word2vec—	82.73	Multi source
	BiLSTM—	81.17	
	CNN	84.09	
	word2vec—	84.9	
	BiGRU—	83.75	
	CNN	83.97	
	GloVe—	80.11	
	BiLSTM—	79.57	
	CNN	87.92	
	GloVe—	86.79	
	BiGRU—		
	CNN		
	FastText—		
	SW—		
	BiLSTM—		
	CNN		
	FastText—		
	SW—		

	BiGRU— CNN Random— SW— BiLSTM— CNN Random— SW— BiGRU— CNN DECN— BiLSTM— CNN DECN— BiGRU— CNN		
Kantinee Katchapakin et al. [29]	LSTM	85.0	Facebook
Kali Cornn et al. [38]	char—CNN (no emb) char—CNN (w/o embed)	92.5 77.7	Reddit
Shakeel Ahmed et al. [37]	1—layer LSTM Twitter 1— layer CNN LSTM + CNN	85.07 83.09 92.06	Twitter
Reneta L. Rosa et al. [41]	CNN- BiLSTM-RNN CNN-LSTM- RNN	89.0 87.0	KBRS
Li yang et al. [42]	CNN CNN + Attention BiGRU BiGRU+Attent ion	90.9 91.4 92.6 93.1	

5. DEPRESSION DETECTION

Misery is one of the emotional well-being issues looked by individuals around the world. Concentrates on shows that not exactly 50% of the individuals who have this close to home issue accessed psychological wellness administrations. This could be because of absence of mindfulness about the sickness. Sadness

frequently starts in adulthood. Sadness is perceived as happens in youngsters and teenagers, despite the fact that it at times gives more unmistakable crabbiness than low temperament.

Numerous constant states of mind and tension issues in grown-ups start as elevated degrees of uneasiness in youngsters. Misery in midlife or more seasoned grown-ups can co-happen with other serious clinical sicknesses like diabetes, malignant growth, coronary illness, and Parkinson's illness. These circumstances are much of the time more regrettable when despondency is available. Meds taken for these actual sicknesses might cause incidental effects that add to sadness. A specialist experienced in treating these confounded sicknesses can assist with working out the best therapy methodology. Risk factors incorporates:

- Individual or family background of misery.
- Significant life altering events, injury, or stress.
- Certain actual ailments and prescriptions.

Discouragement is analyzed normally made by medical services laborers with the assistance of different surveys and self-announcing. These techniques not just rely upon the ongoing state of mind of the patient yet in addition the experience of individuals who are hesitant to look for help. Individuals express their sentiments and considerations with loved ones through different web-based entertainment.

As per American Mental Affiliation " Sorrow influences an expected one out of 15 grown-ups (6.7%) at whatever year. Also, one out of six individuals (16.6%) will encounter despondency eventually in their life. Wretchedness can happen whenever, yet by and large, first shows up during the late adolescents to mid-20s. Ladies are almost certain than men to encounter melancholy. A few examinations show that 33% of ladies will encounter a significant burdensome episode in the course of their life".

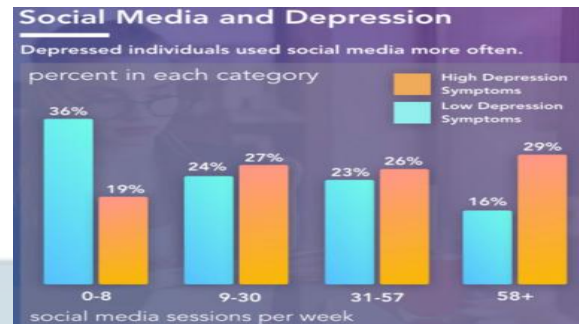


Figure 4: social media and depression. Source**: Clearview Health

Figure 4 shows the bar chart which illustrates the percentage of depression among people in different age groups.

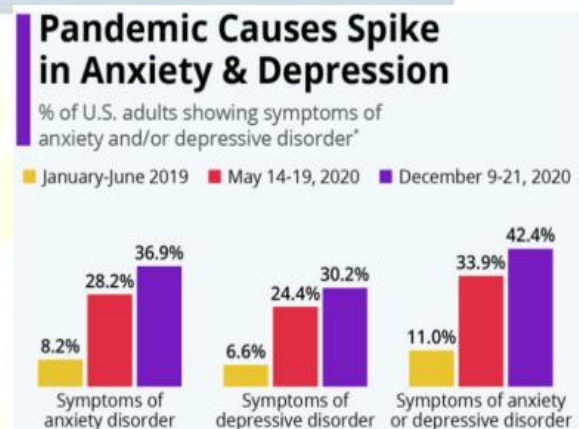


Figure 5: Pandemic spike in causes depression & anxiety. Source**: CDC, NCHS, U.S Census Bureau

Figure 5 shows the spike of uneasiness and gloom during the pandemic, as indicated by CDC, NCHS, U.S Evaluation Agency. In India, 30% of the 103 million individuals over the age of 60 display side effects of discouragement, as per a new system review. It assessed that 8.3% of the country's older populace have likely significant discouragement. This assigns, one in each 12 old individuals in the nation have had despairing. The predominance figure is multiple times higher than oneself announced analyzed despondency of 0.8% in the older populace, pointing at the encumbrance of undiscovered cases, the report verbally communicated. Among individuals who are of 45-59 years old, 26% show burdensome side effects.

More older ladies (9%) have pervasiveness of plausible significant downfall than men (7%). Also, the figure is higher among country occupants (9%) than their metropolitan partners (6%). The report withal expresses that 10% of the older populace who live alone experience the ill effects of despondence. The review shows 3% of all the older have some type of noetic disability. Less individuals over the age of 60 who have at least 10 years of tutoring (5%) have despondence than those with not exactly essential enlightenment (9%).

Over a 10th of the older populace have plausible significant sadness in Madhya Pradesh (17%), Uttar Pradesh (14%), Delhi (11%), Bihar (10%), and Goa (10%). Among the more established grown-ups over the age of 45 years, more than 60% were hospitalized at a confidential office in a year preceding the study. The mean personal use in confidential wellbeing office among the old is Rs. 31,933 contrasted with Rs. 71,232 among those matured 45-59.

6. PROBLEM IDENTIFICATION

Discouragement is an exceptionally extreme and untraceable disease that is spreading wildly, particularly among this age. It was logically found that 264 million individuals of any age experience the ill effects of discouragement (World Wellbeing Association, 2017). Roughly 76% to 85% of discouraged individuals in low and center pay nations are not getting medicines; [2] hindrances to treatment incorporate mistaken evaluation, absence of prepared medical care suppliers, social disgrace, and absence of assets. [3] Paces of psychological well-being laborers fluctuate from under 2 for each 100,000 populaces in low-pay nations to more than 70 for every 100,000 in big time salary nations. Indeed, even after such countless progressions, there is still no full-verification strategy to concentrate on various psychological maladjustments; it is presently founded exceptionally on patients self-gave reports or by individuals in their area.

Discouragement is positioned as the single biggest supporter of worldwide handicap (7.5% of all years lived with inability in 2015). Best case scenario, sadness can prompt self-destruction; more than 800,000 individuals bite the dust because of self-

destruction consistently. Self-destruction is the subsequent driving reason for death in 15-29-year-olds. In India, the Public Emotional well-being Review 2015-16 uncovers that almost 15% of Indian grown-ups need dynamic mediation for at least one psychological wellness issues and one out of 20 Indians experiences gloom. Assessment presents that in 2012, India had north of 258,000 suicides, with the age gathering of 15-49 years being generally impacted.

Online entertainment clients have passed the 3.8 billion imprints. Accordingly, online entertainment's viewpoint is being investigated to figure out potential appearances of wretchedness in people. Individuals utilize virtual entertainment to put themselves out there, including their contemplations, suppositions, mind-sets, and day to day way of life; this data can be utilized to be familiar with their mental condition and even make a potential strategy for recognizing mental problems in the previous progressive phases. This should be possible by observing the subtleties that happen in their day-to-day posts, including their looks, foundation, inclination of variety, subtitle, hashtags utilized, emoticon counts, and some more. This data can be assessed together and consolidated to shape a numerical model that can be applied to distinguish and try and check their state of mind. The fundamental commitments of the work are as per the following:

- Make an organized strategy that can recognize wretchedness from information gathered through online entertainment foundation of clients
- Proposing a few expected results or examples which can be closed from discouraged individuals.
- Finding all that fit prescient model which can dissect individuals' dataset and can anticipate regardless of whether they are discouraged

Following are the issue recognizable proof based on existing work:

- An inconsequential melancholy recognition creates because of low accuracy and review.
- The precision of misery identification is low because of low exactness and F1-Score.
- The downturn recognition time is high because of the great mistake rate.

7. EXPECTED OUTCOMES

Assessment/Opinion examination Mining grasps the sentiments, replications, and decisions accumulated or recovered from messages or different information utilized in information examination or mining, web mining, and online entertainment examination since feelings are utilized to evaluate human way of behaving. They can be delegated either great, negative, or unbiased. It recognizes suppositions, conveys them, and arranges them division-strikingly. The information accumulated during the most common way of valuing their sentiments, sifting attributes, consigning feelings, and definitively processing opinion extremity. It is profoundly valuable for corporate item audits, financial exchange highs and lows, individuals' understanding propensities, and sentiments on political questions.

There are a few strategies for consigning sentiments. There are two sorts of learning in the AI approach: managed learning and unaided learning. Regulated learning is the most common way of making a model utilizing beforehand scholarly information and anticipating the objective class for that information, though unaided gaining is the method involved with gaining from unlabeled information to recognize the provided input information. To consolidate information about different element depiction levels through procedures and exercises, profound comprehension is a basic field in AI.

REFERENCES

- [1] Jitimon Angskun, Suda Tipprasert and Thara Angskun, "Big data analytics on social networks for real-time depression detection", *Journal of Big Data*, 2022.
- [2] Md. Rafidul Hasan Khan; Umme Sunzida Afroz; Abu Kaisar Mohammad Masum; Sheikh Abujar; Syed Akhter Hossain, "Sentiment Analysis from Bengali Depression Dataset using Machine Learning", 11th International Conference on Computing, Communication and Networking Technologies (ICCCNT), 2020.
- [3] Tanna D, Dudhane M, Sardar A. Deshpande K, Deshmukh N., "Sentiment analysis on social media for emotion classification", In: International Conference on intelligent computing and control systems, 2020.
- [4] Md Kamrul Hasan, Hasan Mahmud, Ahmed Al Marouf, "Comparative Analysis of Feature Selection Algorithms for Computational Personality Prediction From Social Media", *IEEE Transactions on Computational Social Systems*, 2020.
- [5] Yang X, McEwen R, Ong LR, Zihayat M., "A big data analytics framework for detecting user-level depression from social networks", *Int J Inf Manag.* 2020.
- [6] Lyua YW, Chow JC-C, Hwang J-J, "Exploring public attitudes of child abuse in mainland China: a sentiment analysis of China's social media", *Weibo. Child Youth Serv Rev.* 2020.
- [7] Chen B, Cheng L, Chen R, Huang Q, Phoebe Chen Y-P. Deep neural networks for multiclass sentiment classification. In: *IEEE 20th International Conference on high performance computing and communications, IEEE 16th International Conference on Smart City, IEEE 4th International Conference on Data Science and Systems 2018*; pp. 854–59.
- [8] Sethi M, Pande S, Trar P, Soni P. Sentiment identification in COVID-19 specific tweets. In: *International Conference on electronics and sustainable communication systems (ICESC 2020)*, pp. 509–16, <https://doi.org/10.1109/ICESC48915.2020.9155674>.
- [9] Kundale JU, Kulkarni NJ. Language independent multi-class sentiment analysis. In: *5th International Conference on computing communication control and automation (ICCUBEA)*, 2019; pp. 1–7, <https://doi.org/10.1109/ICCUBEA47591.2019.9128383>.
- [10] Ruz GA, Henriquez PA, Mascareno A. Sentiment analysis of Twitter data during critical events through Bayesian networks classifiers. *Future Gener Comput Syst.* 2020;106:92–104.
- [11] Yang X, McEwen R, Ong LR, Zihayat M. A big data analytics framework for detecting user-level depression from social networks. *Int J Inf Manag.* 2020;54:102141.

- [12] Tao X, Dharmalingam R, Zhang J, Zhou X, Li L, Gururajan R. Twitter analysis for depression on social networks based on sentiment and stress. In: 6th International Conference on behavioral, economic and socio-cultural computing, 2019; pp. 1-4, <https://doi.org/10.1109/BESC48373.2019.8963550>.
- [13] Tanna D, Dudhane M, Sardar A. Deshpande K, Deshmukh N. Sentiment analysis on social media for emotion classification. In: International Conference on intelligent computing and control systems (ICICCS 2020), pp. 911-15, <https://doi.org/10.1109/ICICCS48265.2020.9121057>.
- [14] Arora P, Arora P. Mining Twitter data for depression detection. In: IEEE International Conference on signal processing and communication (ICSC), 2019; pp. 186-89, <https://doi.org/10.1109/ICSC45622.2019.8938353>.
- [15] Chen Y, Zhou B, Zhang W, Gong W, Sun G. Sentiment analysis based on deep learning and its application in screening for perinatal depression. In: IEEE Third International Conference on data science in cyberspace. 2018; pp. 451-6. <https://doi.org/10.1109/DSC.2018.00073>.
- [16] Uddin AH, Bapery D, Arif ASM. Depression analysis from social media data in Bangla language using long short term memory (LSTM) recurrent neural network technique. In: International Conference on computer, communication, chemical, materials and electronic engineering (IC4ME2), 11-12 July, 2019; pp. 1-4, <https://doi.org/10.1109/IC4ME247184.2019.9036528>.
- [17] Cheng L-C, Tsai S-L. Deep learning for automated sentiment analysis of social media. In: IEEE/ACM International Conference on advances in social networks analysis and mining. 2019; pp. 1001-4. <https://doi.org/10.1145/3341161.3344821>.
- [18] Al Asad N, Pranto MAM, Afreen S, Islam MM. Depression detection by analyzing social media posts of user. In: IEEE International Conference on signal processing, information, communication & systems (SPICSCON). Dhaka, Bangladesh, 2019; pp. 13-17, <https://doi.org/10.1109/SPICSCON48833.2019.9065101>.
- [19] Lyua YW, Chow JC-C, Hwang J-J. Exploring public attitudes of child abuse in mainland China: a sentiment analysis of China's social media Weibo. Child Youth Serv Rev. 2020;116:102520.
- [20] Abid F, Li C, Alam M. Multi-source social media data sentiment analysis using bidirectional recurrent convolutional neural networks. Comput Commun. 2020;157:102-15.
- [21] Hammou BA, Lahcen AA, Mouline S. Towards a real-time processing framework based on improved distributed recurrent neural network variants with fastText for social big data analytics. Inf Process Manag. 2020;57:102122.
- [22] Tadessi MM, Lin H, Xu B, Yang L. Detection of depression related posts in reddit social media forum. IEEE Access. 2019;7:44883-93. <https://doi.org/10.1109/ACCESS.2019.2909180>.
- [23] Trotzek M, Koitka S, Friedrich CM. Utilizing neural networks and linguistic metadata for early detection of depression indications in text sequences. IEEE Trans Knowl Data Eng. 2018;32:588-601.
- [24] Tariq S, Akhtar N, Afzal H, Khalid S, Mufti MR, Hussain S, Habib A, Ahmad G. A novel co-training based approach for the classification of mental illnesses using Social media posts. IEEE Access. 2019;7:166165-72. <https://doi.org/10.1109/ACCESS.2019.2953087>.
- [25] Rao G, Zhang Y, Zhang L, Cong Q, Feng Z. MGL-CNN: a hierarchical posts representations model for identifying depressed individuals in online forums. IEEE Access. 2020;8:32395-403. <https://doi.org/10.1109/ACCESS.2020.297373>.
- [26] Syarif I, Ningtias N, Badriyah T. Study on mental disorder detection via social media mining. In: IEEE. 2019; pp. 1-6. <https://doi.org/10.1109/CCCS.2019.8888096>.
- [27] Hussain J, Satti FA, Afzal M, Khan WA, Bilal SM, Muhammad ZA, Hafz FA, Hur T, Bang J, Kim J-

I, Park GH, Seung H, Lee S. Exploring the dominant features of social media for depression detection. *J Inf Sci*. 2019;46:1–21.

[28] Katchapakirin K, Wongpatikaseree K, Yomaboot P, Kaewpitakkun Y. Facebook social media for depression detection in the Thai community. In: 15th International Joint Conference on computer science and software engineering (JCSSE), 2018; pp. 1–6, <https://doi.org/10.1109/JCSSE.2018.8457362>.

[29] Yazdavar AH, Mahdavinejad MS, Bajaj G, Romine W, Sheth A, Monadjemi AH, Thirunarayan K, Meddar JM, Myers A, Pathak J, Hitzler P. Multimodal mental health analysis in social media. 2020. <https://doi.org/10.1371/journal.pone.0226248>.

[30] Islam MR, Kabir MA, Ahmed A, Kamal ARM, Wang H, Ulhaq A. Depression detection from social network data using machine learning techniques. *Health Inf Sci Syst*. 2018;6:1–12.

[31] Shen G, Jia J, Nie L, Feng F, Zhang C, Hu T, Chua T-S, Zhu W. Depression detection via harvesting social media: a multimodal dictionary learning solution. In: Twenty-Sixth International Joint Conference on artificial intelligence (IJCAI-17) 2017; pp. 3838–844.

[32] Kumar A, Sharma A, Arora A. Anxious depression prediction in real-time social data. In: International Conference on advanced engineering, science, management and technology—2019 (ICAESMT19).

[33] Nalinde PB, Shinde A. Machine learning framework for detection of psychological disorders at OSN. *Int J Innov Technol Explor Eng (IJITEE)*. 2019;8(11), (ISSN: 2278-3075).

[34] Tajuddin M, Kabeer M, Misbahuddin M. Analysis of social media for psychological stress detection using ontologies. In: Fourth International Conference on inventive systems and control (ICISC 2020) IEEE Xplore Part Number: CFP20J06-ART; ISBN: 978-1-7281-2813-9.

[35] Baheti RR, Kinariwala S. Detection and analysis of stress using machine learning techniques. *Int J Eng*

Adv Technol (IJEAT). 2019; 9(1), (ISSN: 2249–8958).

[36] Ahmad S, Asghar MZ, Alotaibi FM, Awan I. Detection and classification of social media-based extremist affiliations using sentiment analysis techniques. *Human Centric Comput Inf Sci*. 2019;24:1–23.

[37] Cornn K. Identifying depression on social media. 2019. [https:// web.stanford.edu/](https://web.stanford.edu/).

[38] Jabreel M, Moreno A. A deep learning-based approach for multi-label emotion classification in tweets. *MDPI Appl Sci*. 2019;9(6):1123. 33. Bouzazi M, Ohtsuki T. A pattern-based approach for multi-class sentiment analysis in Twitter. *IEEE Access*. 2017;5:20617–39.

<https://doi.org/10.1109/ACCESS.2017.2740982>.

[39] Rosa RL, Schwartz GM, Ruggiero WV, Rodriguez DZ. A knowledge-based recommendation system that includes sentiment analysis and deep learning. *IEEE Trans Ind Inf*. 2019;15(4):2124–35. <https://doi.org/10.1109/TII.2018.2867174>.

[40] Yang L, Li Y, Wang J, Sherrarat RS. Sentiment analysis for E-commerce product reviews in chinese based on sentiment lexicon and deep learning. *IEEE Access*. 2020;8:23522–30. <https://doi.org/10.1109/ACCESS.2020.2969854>.

[41] Sadr H, Pedram MM, Teshnehlab M. Multi-view deep network: a deep model based on learning features from heterogeneous neural networks for sentiment analysis. *IEEE Access*. 2020;8:86984–97. <https://doi.org/10.1109/ACCESS.2020.2992063>.

[42] Chen F, Ji R, Jinsong S, Cao D, Gao Y. Predicting microblog sentiments via weakly supervised multi-modal deep learning. *IEEE Trans Multimed*. 2018;20(4):997–1007. <https://doi.org/10.1109/TMM.2017.2757769>.