

Literature Review on Self-Harm and Suicidal Tendencies using Machine Learning Technology

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Publication Info

Article history:

Received : 23 February 2020

Accepted : 26 May 2020

Keywords:

Mental Health, Self-harm, Suicide/Self-harm, Machine Learning, Data Mining, Suicidal Ideation, Suicidal behaviors, Psychological disorders, W.H.O (World Health Organization).

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Abstract

As per W.H.O, nearly 793,000 individuals passed away in 2016 due to suicidal and self-harm tendencies which is approximately one individual every 40 seconds. It is a global phenomenon and occurs throughout the lifespan. There are suggestions that for every adult who was deceased by suicide there might have been more than 20 others attempting suicide. Although effective treatment is known for self-Harm and suicidal tendencies, it is not accessible to the majority of sufferers in both wealthy and poor nations. In this aspect, many scientific discipline and researchers have been working on machine learning models to determine the stage of self-harm and suicidal tendencies. This paper presents contextual knowledge on self-harm and suicidal tendencies and practice of machine learning and also evaluation of past studies that apply machine learning for determining self-harm and suicidal tendencies with their features.

1. INTRODUCTION

Across the world, Suicide/Self-harm is well-thought-out important topic. As the day passes by, the frequency of Suicide/Self-harm is growing gradually. The extreme statistics of persons committing Suicide/Self-harm are found in the range of 14-25 years. Closely 800,000 people expire due to Suicide/Self-harm which is approximately equal to the frequency of one individual every 40 seconds. Suicide and Self-harm is the second important reason for demise amongst the age group of 15-29 years [11]. Suicide/Self-harm risk valuation is at present a vital sector of clinical care in psychoanalysis and conducted in entities. Numerous diverse designed tools are used to contribute in clinical policymaking, many have not been authenticated in external data, and some of which have poor precision, possibly increasing job of medical teams by classifying incorrect positives. Therefore, some experts have endorsed that such tools should be avoided to be used, and clinical decision be only used for Suicide/Self-harm risk valuation.

The W.H.O states psychological health as the level of well-being in which the person learns about their own skills to get on through the regular tensions of work and life efficiently and should make their valuable contributions to their society. The Psychological wellbeing issues are

considered as trivial and are left out of the sights of an individual but on a greater extent these issues are needed to be openly discussed and proper diagnosis should be given to the individual. Every individual once in life faces the issues of self-harm tendencies or other Psychological ailments due to numerous problems like family issues, raging or harassment, sexual abuse, education but keeps the secrets to themselves. Also understanding the problem and taking further actions for solving the issues are of greater help to an individual.

The paper broadly focuses on the evaluation of self-harm and suicidal tendencies and use of machine learning models along with the evaluation of studies in past that practice machine learning for deciding self-harm and suicidal tendencies with their features, merits, demerits. This paper's objective is to provide data about preliminary concepts in machine learning which are regularly used in psychological health field and applications. Study of psychological wellbeing using various Machine Learning methods which are primarily centered on supervised learning for classifications is analyzed. The paper discusses the various psychological healthcare solutions and machine learning techniques used in forecasting the self-harm and suicidal tendencies.

2. LITERATURE REVIEW

The literature review is done widely based on findings of psychological healthcare solutions and machine learning techniques used to predict self-harm/suicide tendencies and attributes contributing to such issues. Initially, the suicide/self-harm ideation and factors that contribute to such issues are widely studied in initial papers, followed by various Psychological healthcare solutions provided in recent years. The literature review is done chronologically and holistically.

2.1. Adolescent Suicide/Self-harm and suicidal behaviour (Published in the year 2006)

This assessment inspects the expressive detection, danger and securing aspects for adolescence suicide and suicidal tendencies. The prototype for adolescence suicidal tendencies are enunciated, hereby suicidal tendencies follows as the outcome for communication involving a combination of social and cultural factors, progressive, mental, psychiatric, and household ambience aspects. In this paper authors discuss, medical along with social well-being methods for decreasing dolefulness in adolescence along with suggestions of supplementary study are conferred. Self-harm and Suicidal tendencies are the lethal self-imposed damaging actions which have clear or indirect aim to expire. Suicide denotes every Self-harm -associated demeanours along with ideas which consist of finishing or trying Self-harm, suicide contrivance or dispatch. This assessment emphasis on the range of dolefully self-harm thoughts to suicidal conduct, along with non-active ideas of demise along with finished suicide denoting farthest terminations of danger range. Non-suicidal self-damage, occasionally denoted by way of 'parasuicide'. It's observed by way of different than doleful conduct and more generally includes self-piercing by not having self-harm aim. The drawback for this is issues related by parasuicide were not reviewed, even though frequently, non-doleful self-harm and suicidal conduct can happen [1]

Further in this paper, the expressive detection of adolescence suicide and self-harm conduct has been considered.

- Suicidal thoughts which depict that suicidal thoughts in adolescence is around 15–25%.
- Self-harm attempt: Lifespan assessments of suicidal tries amid adolescents vary between 1.3–3.8% in males, in females its 1.5– 10.1%, hence by the lesser proportion in males than females in the elder adolescent age set
- Repetition of suicidal behaviour: Evaluations of the danger of replication of suicidal conduct varies by 10% on a 6-month continuation to 42% and on 21-month continuation, by the transitional reappearance by 5–15% per year frequency.

- Completed Suicide: Suicidal proportions in the previous Soviet states Russia including Russia, Ireland, Finland and New Zealand are also very high.
- Oldness and teenage level: Suicide proportions steadily surge after infantile to adolescence, possibly since more occurrence of psychopathology in adolescents, specific mixtures of feelings disorder and substance misuse, bigger danger of suicide is carried by psychopathology on elder adolescents
- Gender: The variance in males and females in adolescence suicide is more probable as the greater probability of men might have many danger aspects like co-dire attitude along with liquor exploitation ailments, bigger levels of violence, and choosing more fatal attempt approach, because of this, they become more probable than ladies to attempt a lethal suicidal effort.
- Race and ethnicity: Sometimes ethnic and social background contributes to the self-harm attempts rate of adolescents in various parts of the world.
- Profane vogues: Throughout the previous decade, there is a noteworthy reduction in adolescence Self-harm rates across some nations such as the United States of America because of the greater preventive gun act along with the prescription of pills, this might aid in these circumstances.
- Approaches for Suicide: The top approaches used for Self-harm among adolescence in the USA are guns, poisoning, hanging, respectively, although in rest of Western nations vehicular exhaust and hanging outweigh poisoning and guns [1]

Later the review considered the danger aspects of accomplished and endeavoured Self-harms activities. The subsequent are the issues consisting of it.

- Suicide/Self-harm ideation: Individual who attempted display determined suicidal ideation, mainly by a strategy or bigger aim of committing Self-harm are at greater peril to retry.
- Earlier Suicidal conducts: An earlier attempt is the on its own greatest compelling peril aspect for adolescence suicide in the study-control and prospective studies, increasing the peril for the following one many-folds. The peril of duplication is maximum in the following 3 to 6 months period after an attempt, then are considerably raised since the populace for a minimum of 2 years.
- Fatality of the Self-harm endeavour: The peril for duplication is maximum at following 3 to 6 months after the endeavour, then are considerably raised from the social populace for a minimum of 2 years. Although, the endeavour of less fatality will not essentially specify lesser suicidal aim, particularly

in infants who have intellectual naivety does it problematic to build and implement a suicidal strategy. For a whimsical human being for him or her a deadly instrument like a weapon or pills are accessible, an effort with comparatively lesser determination can affect in a clinically severe or worst can be deadly.

- Resolute and inspiration: Suicidal resolute or the degree at which the suicidal desires to deace, is differentiative and prophetic constant for replication of these tries and accomplished efforts. Inspiration remains the motive by suicide and the family of the person committing the deadly act. 33.33% of the suicides have maximum suicide resolute, for them, the stimulant is to die or to forever break from the mentally painful circumstance.
- Precipitator: The utmost shared precipitators for adolescent doleful conduct are relational struggle or abatement, mainly for adolescence with substance misuse.
- Psychological disorder: Any mental ailments are existing in almost 90% of rejected adolescent suicide sufferers, and stances are many-fold escalated peril for Suicide. Ailments along with-it difficulties which attribute to persons suicidal conduct are Attitude ailments, Substance misuse issues, Behaviour ailment, Asocial conduct, Nervousness ailment, Post-incident strain ailment, Psychosis, Consumption ailments, Mental multi-condition. Some researchers have examined suicidal conduct in the nonappearance of other Mental or substance misuse ailment found that sufferers not having distinct mental knowledge are most probable than social regulations lacking it had previous suicide conduct, lawful or castigating difficulties, and availability of a loaded weapon.
- Physical fitness: There exists research that proposes a relation amongst suicidal conduct and precise enduring diseases.
- Interco related wellbeing peril behaviours: Suicidal behaviour hardly arises when an individual is in seclusion. Its utmost regularly happens with other wellbeing peril conduct, like excessive drinking and eating, misuse of tobacco, bringing firearms, and having unguarded sex.
- Character and psychological issues
- Ancestral issues in adolescence suicidal conduct
- Household circumstances issues
- Organic issues
- Openness to Self-harm, Suicidal nature
- Accessibility of deadly mediums
- Intervention
- Clinical management [1]

2.1.1. Prototype of suicide conduct:

Considering the present work as a foundation base, the preliminary-transferable prototype of adolescence detecting self-harm conduct has been the prying benefit which can be conjecturally classified forerunner of suicidal conduct and apply this prototype to make interferences to depress the Self-harm capability, was introduced. Following is the model.

Lastly, future exploration on the heredities and neural-biology of initial-commencement self-harm demeanour and associated with the study of behavioural symptoms like abrupt violence and their communication with anxious lifespan occurrences like abuse, are required. Neural illustration offers the chance to inspect, an associate of inferior difficulty solving ability, sentimental sensitivity, and hasty that illustrate numerous youthful Suicide patients. This research might assist to simplify the composite observable characteristics which are utmost gainful to do research intrinsically and deliver additional direction for treatment [1]

2.2. Sleep disorders and suicidal ideation in patients with depressive disorder (Published in 2007)

An inherent link amongst suicidal thoughts and sleep ailments present amongst sufferers involving anxiousness ailment have been detected amongst the newest research papers. This assessment was operated to get to inspect the association amongst doleful thoughts and sleep ailments like restlessness and unnecessary sleepiness, in sufferers having leading dreary ailment. Seventy sufferers with analysis of leading dreary ailment were questioned and evaluated by the Sleep Routine Survey and the Beck Rule for Suicidal Ideation (SSI). Statistics examines were done by Students t-test, descriptive analysis, logistic regression model and Chi-square test, with the importance of 5%. This research states about despondent sufferers have bigger SSI grade levels (6.12 ± 2.67), mainly for lively suicidal thoughts

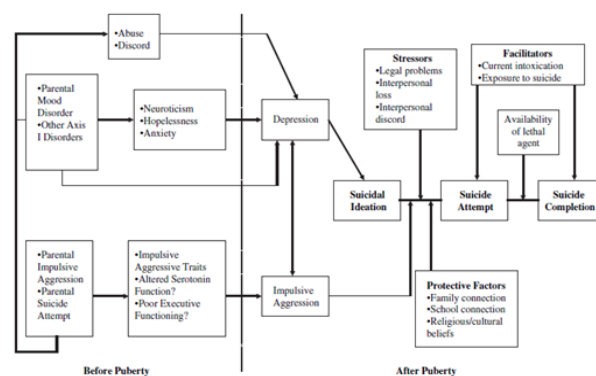


Figure 1: Preliminary-transferable model of adolescence suicidal conduct (2007, Sarah Laxhmi Chellappa et al.[2]).

(1.61 ± 0.39) and precise strategies for Self-harm peripheral (1.51 ± 0.40). Depressed sufferers with sleeplessness have pointedly bigger SSI grade level (7.39 ± 2.84), with respect to sufferers with unnecessary drowsiness (3.68 ± 1.73). Also, it has been detected that wakeful sufferers have pointedly larger grade levels in the subsequent aspects: lively Self-harm thoughts, precise tactics of committing Self-harm and earlier attempts. The outcomes of multivariate evaluation displayed if only wakeful sufferers had a noteworthy link with suicidal thoughts. Thus, sleep troubles, mainly wakefulness, must be assessed in the evaluation of suicidal peril in sufferers with doleful ailment [2]

This study starts by the brief introduction of how sleep disorders are associated with psychiatric illnesses often the insufficient or non- rejuvenating sleep, and trouble in getting sleep, regular nightly and initial morning arousal, these add to the sleep ailments. Suicidal sufferers routinely complain about difficulties with his or her siesta, hence this directs to the forthcoming research. The plan along with the context of the research is explanatory, perceptible and cross-factional by the sample consisting of 70 patients. This research has been operated by the Onofre Lopes University Hospital Psychiatry Unit, which is a social tertiary general hospital in Natal, RioGrande doNorte, Brazil. Information gathering has been completed amid time span between April and July 2005. The contributors for the research had been aged mostly amid between 18 and 65 years old and sufferers having an analysis of main suicidal perils. These analyses had been supported by medical survey utilizing the Diagnostic and Statistical Manual of Mental Ailments standards for main suicidal peril by five psychiatrics accountable for medical assessment of patients [2]

Additionally, the process utilized to survey patients consisted of Sleep tendency Survey along with Beck Scale of Self-harm Ideation that has been approved by the Ethics Committee of the Federal University of Rio Grande do Norte. Sleep evaluation was organized utilizing the Sleep Habits Survey and the Global Categorization of Sleep Ailments identifying standards for sleep ailments because of attitude ailments and ICSD diagnostic standards for sleep ailments were utilized [2]

Information evaluation had been conducted on the basis of subsequent statistical evaluation: 1. Descriptive analysis of the civil-polls constant and for the grade levels gained from the SSI; 2. Student t-test of the autonomous specimen to evaluate the SSI global and element grade levels amid patients having wakeful or unnecessary drowsiness; 3. Chisquare test for examining the relation of SSI grade levels by diverse age sets along with the SHQ items concerning wakeful and unnecessary drowsiness; 4. Bivariate study to understand the relation among suicidal thoughts and co-variables of concern, utilizing proportions

along with their trust breaks as approximations of relation. Co-variables displaying P-values under 0.20 had been nominated and verified utilizing the manifold logistic model, and it was part of the final prototype variables having P-values under 0.05. Logistic regression models had been utilized to examine the multivariate associations for co-variables having suicidal thoughts. This study has been accustomed to the conceivably confounding aspect of medicine consumption. Outcomes had been thought-out statistically noteworthy at $P \leq 0.05$. Examines had been done utilizing the EPIINFO software [2]

The key discovery from this research had been suicidal thought and sleep ailments, predominantly wakefulness, present patients having main suicidal ailment may be related. The present research, wakefulness patients got larger SSI worldwide grade levels to contrast to patients having unnecessary rest. Also, subsequent modification of the confounding variable of medicine consumption, only wakefulness had been considerably related by suicidal ideation. The key medical inference for the suicidal ideation or sleep ailments association was sleep evaluation should add to the assessment for suicide danger in patients having main nervousness ailment. Concerning the research boundaries, the modest amount for the research specimen limits sure and universal inductions regarding the suicidal ideation and sleep disorders link in suicidal patients. Furthermore, the cross-factional plan for this research doesn't allow the formation of a motive and result association [2]

In summary, sleep ailments, like wakefulness, have been related by medically important suicidal ideation and especially by lively suicidal ideation and having precise schemes for Suicidal tendencies in patients with nervousness ailment. Hence, sleep disorders must be treated as the medical evaluation for depressed patients with respect to suicide danger [2]

2.3. Characteristics of suicidal ideation that predict the transition to future Suicide/Self-harm attempts in adolescents (Published in 2014)

This study is pursued with the aim to inspect features of suicidal ideation (SI) which forecasts the forthcoming suicidal attempt (SA), outside the boundaries of psychiatric analysis along with past SA records. Partaking individuals consisted of 506 youngster's of which 307 were female youths who finished the Columbia Suicide Screen (CSS) along with nominated components from the Analytical survey Plan for Kids within the context of 2-stage secondary school evaluation along with individuals who are tracked for 4-6 years in future for levying for a SA subsequent baseline. Near baseline, partaking individuals who had SI in their CSS answered four questions concerning about

money, regularity, solemnity, and time span of their SI. The part of the sample consisting of 122 youths that had SI near baseline too finished the comprehensive interview concerning their latest SI [3]

Outcomes: Ideation about being suicidal frequently (OR = 3.5, 95% CI = 1.7-7.2), seriously (OR = 3.1, 95% CI = 1.4-6.7), and for the large time period (OR = 2.3, 95% CI = 1.1-5.2) are linked by upcoming SA, changing for sex, the existence of frame of mind, nervousness, and substance use analysis, and baseline SA records. Though, only SI regularity was pointedly related by bigger probabilities of the forthcoming SA (OR = 3.6, 95% CI = 1.4-9.1) even after changing for coinage, seriously, and large time period. Amid individuals with these ideas interrogated further concerning his or her latest SI, conceiving 1 hour or more against. less than 1 hour had been linked with forthcoming SA with OR = 3.6, 95% CI = 1.0-12.7[3], changing for sex, nervousness indications, past SA records, along with rest of baseline SI features, with it had been linked with building an upcoming SA previously. Conclusion: Evaluations of SI in youths must have extra care to query about the regularity of his or her SI and span of his or her latest SI [3]

2.4. Comparison of machine learning algorithms to predict psychological wellness indices for ubiquitous Healthcare System Design (Published in 2014)

Meant for ever-present medical facility distribution, mental health indices have got refined. The mental health guide assimilates the study outcomes which determine stress, despair, rage, and exhaustion. The present prototype has been built on a numerous regression procedure, also it physically builds a reason and consequence prototype for the psychological well-being. But the prototype-built rests on the study feedback. The association among these feedbacks and mental health indices is non-linear owing to data disparity. If any data irregularity occurs, the dependability of the prototype reduces along with that ultimately expenditure on conservation of prototype modification rises and if new data entries and variables are measured, the whole prototype would be built over. This paper inspects the practicability for machine learning procedures for forecasting the mental health indices built on the recreated feedbacks. The authors use four machine learning procedures consisting of support vector regression, multi-layer perceptron, k nearest neighbour regression and generalized regression neural network are linked and the test outcomes are presented [4]

The research mainly focuses on mental health, initially, linear regression was used to train the prototype but it didn't take into consideration the non-linear factors hence a classification prototype was suggested because it helps in

classifying non-linear factors in mental health and endures data imbalance problem well. Hence several machine learning algorithms are applied and the one's which gives the best performance on the unseen dataset is considered. There is no one significant way to tell which algorithm works well for the prototype, each and every algorithm has its advantages and disadvantages. The authors use four machine learning procedures consisting of support vector regression, multi-layer perceptron, k nearest neighbour regression and generalized regression neural network [4]

The five diverse mental health indices which might be applied to denote mental health stage. By forecasting this guide, authors endeavour to improved learning their statistical features, to grow the realism of the mental health indices such that they can be installed in healthcare structures. Authors equated four diverse machine learning procedures with respect to the mean square error measure so as to classify the skill to predict the mental health indices. The authors have done tests utilizing different factors associated with every procedure. KNN and SVR regression surpassed the rest of procedures, although MLP fared comparatively inferior by its implementation. The outcomes display whether the structures having data disparity and variation like mental health service should analyze the deterministic procedure, it handles by nonlinearity in a good way. The author states future work as the authors are intrigued on functioning in classifying the association amongst every guide along with the intake variables are accounted here as well. Hence by considering this, the authors assume to be capable forecasting the indices more accurately [4]

2.5. Prediction of Mental Health Problems Among Children Using Machine Learning Techniques (Published in 2016)

According to the paper 'Prediction of Mental Health Problems among Children', twenty-five attributes were identified and five mental health problems were discussed which are as follows:

- Attention problem
- Anxiety problem
- Attention Deficit Hyperactivity Disorder
- Academic problems
- Pervasive Developmental Disorder (PDD)[1]

The aim was to study such mental health issues and create an analytical model which predicts mental health problems among children using machine learning technology. The paper broadly discusses the parameters that contribute to the children's mental health and further developed a prediction model that can use algorithms such as Multilayer Perceptron, Multiclass Classifier and LAD Tree [5]

2.6. Prediction of Suicide/Self-harm Causes in India using Machine Learning (Published in year 2017)

The authors carried out an investigation in the direction of forecast the reasons for suicide in India by applying the machine learning processes along with data mining practices. This would help the administrations to take effective decisions in that domain backed by the evidence of sufficient supporting data and to not repeat the same mistake. The administration can make the lives better by having a better supportive environment for all. The authors claim to have scrutinized the pattern of Despondent cases and projected the reasons for upcoming perversities by using machine learning procedures, the Artificial Neural Network and Support Vector Machine [6]

This study comprises a dataset of suicide in all the provinces of India amidst the time period of 2001 and 2012 and is issued by the National crime record bureau, India. The Dataset contains characteristics like sex, province, Age set, Overall Suicide, Educational Level, Marital Status, Professional Occupation and Type/Cause. This study is not forecasting the reasons individually for each age set and to categorize corresponding reasons as per the gender distinctly. The data pre-processing stage consists of data cleaning, data integration and data transformation phases. The next stage had numerical data study of reasons of Suicide by MATLAB and SPSS through smearing the procedures for machine learning model over the accessible dataset. Predicting Prototype using ANN and Prediction Model using SVM were developed on this data analysis. The accuracy of Predicting Model using the ANN model is 77.5%. and 17% of the incorrect predictions. The accuracy for Forecasting Model using SVM is 81.5%. Hence here SVM performs better than ANN [6]

2.7. Adolescents Psychological Well-Being Estimation Based on a Data Mining Algorithm (Published in 2018)

According to the IEEE Paper, four classes of the well-being of school children were identified and two extreme classes of well-being and not well-being are observed. It checks and monitors on the individual, social and conjectural aspects linked with the concepts of mental health of youths. Various techniques were practised to classify the level of danger of anxiety disorder of infants. The different steps which are followed are as follows:

- Create a software
- Decrease the number of questions in the quiz, correct and applicability
- There were 155 questions 135 multiple choice questions
- Identification data{v1}: {age, class, sex}
- Objective characteristics: {distance of school from

urban infrastructure, stage of schooling, number of school children} [7]

The algorithm used was GMDH (group method of data handling). It predicts on combining the knowledge of network structure and partial description of neurons. The algorithm proceeds in the way that from among all the variables, the neurons select the active variables and then the algorithm is applied for data mining, forecasting and classification tasks [7]

Data built on this mental study are applied by the Tomsk region edification division to build administrative verdicts intended at observing the dangers for falling psychological wellbeing along with Psychological health of countryside students. It has four classes of well-beingness and the accuracy rate is higher in the extreme classes first and fourth rather than second and third. The first, second, third and fourth class of well-beingness has an accuracy rate of 91%,72%,72% and 90% [7]

2.8. Use of a Machine Learning Algorithm to Predict individuals with Suicide/Self-harm Ideation in the General Populace (Published in 2018)

In this research, authors have intended to develop a prototype forecasting person with Suicidal ideation within an overall populace by means of a machine learning process. The dataset comprises of statistics from the Korea National Health and Nutrition Examination Survey, conducted between 2007 and 2012. It has statistics of more than 35,000 persons having age above 19 years from the KNHANES, authors nominated 11,628 people through random down-sampling. This comprised 5,814 Despondent individuals and the equal amount of non- suicidal ideators. The authors arbitrarily allocated topics to the test and training sets respectively. Random forest model was trained for the training set with 15 features nominated with recursive feature removal by mixed authentication. Later, a tailored prototype was applied to forecast Despondent individuals in the test set and midst the overall of 35,116 topics. Entire studies were performed in R [8]

The queries and scales can distress the performance of the machine learning model, suicidal ideation in the KNHANES comprised slight, fleeting forms which further affects the analysis and consequences. Also, there is low relation of suicidal ideators among the total individuals. Here authors have only used the random forest model [8]

The forecast prototype attained a respectable performance within the test set, the forecast individuals amid the entire models with an exactness of 0.821, acuity of 0.836, and particularity of 0.807. The research demonstrates the opportunity of a machine learning method which allows filtering from Despondent danger for the overall populace [8]

2.9. Early Detection of Depression in Women using Machine Learning Methods

Year (Published in 2019)

The authors claim that Depression in India is more usual in women in every age groups by giving reference to WHO report of 2008 which states that chances of depression in women can be as high as 50% higher than that of men. India has a greater amount of Suicide/Self-harm instances in 2012 as per WHO, at a frequency of 40 seconds one person commits activity related to Suicide/Self-harm. In the year 2015, every 1 in 5 Indian citizens are going through from Depression as per the survey done by WHO. Also, authors refer to study in India by National Care of Medical Health, which state that chances of individuals going through depression are about 6.5 %.

Major studies are as follows [9]

- 2012- Park
By taking one Week's tweets previous and up to date research. It had 69 users with 23 depressed and considered 5,706 tweets. It uses Linguistic Inquiry Word Count (LIWC) for feature extraction.
- 2013- De Choudhary
It considered tweets one year posted one year before the survey or when the user reported depression. It considered total of 476 users of which 171 were depressed and considered total of 2,157,992 tweets. It used dynamic parameters for feature extraction. It has used SVM classifier.
- 2013- T Sugawa
It considered 50 users and how timely they used words in their tweets. It considered total of 14,157 words. It uses the approach of Bag of Words for feature extraction.
- 2015-CLPsych Shared Tasks
It considered 1,148 users out of which 327 were depressed. It considered 3438 tweets in total of all users.
- 2017- Reece et al
It considered 204 users out of which 105 depressed. In total 279,951 tweets of 204 users posted publicly.

The scale used in studies is Centre for Epidemiological Studies Depression which has 3 levels: low level, moderate level and high level. The scores for low level, moderate level and high level are 0-15,16-22 and 23-60 [9]

2.10. Machine Learning Framework for Detection of Psychological Disorders at OSN (Published in year 2019)

Here authors propose a system of Psychological ailments detection that can deliver online communal behaviour extraction. Authors accomplish the study of the features, and we also apply machine learning classifier in huge-

scale information sets and examines characteristics of Psychological ailments. After classification results display that user is in stress or not, will be detected by PDD system is used to mention hospitals on a map and at the equal time supervisor will direct mail of protection list to the user for user's wellbeing. Here authors propose a system that discovers that individual's ailment state is thoroughly linked to friends in social network websites, and authors work on a Facebook information set from practical environment communal platforms to systematically study the association of individuals ailment stages and communal interactions. Authors follow to achieve their complete process by:

- Collection of Information
- Preprocessing and Cleaning of Information.
- Extracting Characteristics

In the preprocessing algorithm, the steps are:

- Stop word Removal
- Tokenization
- Stemming [10]

Classification algorithm used by authors is Naive-Bayes Machine learning algorithm.

For the system the inputs taken by the authors are personal characteristics, online social network features along with communal attention factors.

Precision, Recall, TPR, FPR and accuracy percentage rate for SVM is 50%,65%, 50%, 33%,75% and for Naïve Bayes Classifier it has 50%,62%,50%,38% and 67% respectively. Hence Naïve-Bayes performs better than SVM [10]

2.11. Prediction of Mental Disorder for employees in IT Industry (Published in 2019)

In this system, they diagnose Psychological illness in worker by comparing worker's psychological fitness with the DSM-IV-TR. They have used genetic procedure, classification and machine learning procedures to build a semi-automated system. The forthcoming goal is to copiously mechanize the system. The valuation is done by the classifier and the final call will be of forecaster for treatment of the patient. Individuals suffering from psychological ailments face nervousness ailment which lastly progresses into depression. They have measured the input for their model and then machine learning psycho-linguistic posts. Numerous techniques are applied to the model to recognize Psychological health-related features. Their key emphasis was on pioneer, reasoning alteration and indications of psychological behaviour like anorexia, anxiety and depression. They have applied LIWC (Linguistic Inquiry and Word Count) to extract features and further machine learning is applied. According to research, stress leads to misery, stroke, heart attack, cardiac arrest. They used the EEG signal(electroencephalogram)

for analysis where stress is added to the MIST (Montreal Imaging Stress Task). Machine learning with EEG gives feature extraction, selection, classification (Logistic Regression and naïve Bayes [11]

They have scuttled data from 247 operational groups of 80,000 users in online communities for data. They have focused on precursor, cognitive distortion and symptoms of psychological behaviour like anorexia, anxiety and depression. The authors have compared various machine learning models such as Logistic Regression, Decision Tree, Random Forest, Bagging, Boosting, Neural Network. Boosting had the most accuracy of 81.75% and precision of 76.1% [11]

The authors suggest the managers take psychological fitness of workers seriously. They suggest tracking the Psychological wellbeing of the employees and having a flexible environment for all employees. It suggests providing liveness to managers by providing flexible working hours and working from home. They should get timely response direction for nurturing workers' fitness. This type of model might be used to notice psychological fitness development amid workers and also could lead to policy changes. Workers could have a conversation with contemporaries and their managers about their problem easily. Hence higher administration might support them to get precise assistance with beneficiaries like work from home, lithe timings, extra leaves, etc. Workers must see fitness benefits provided by their association contribute to any wellness programs. The correct response should be provided to the worker when they quit their job. This possibly will support them to progress their well-beingness. [11]

2.12. Predictive Research for Mental Health Disease (Published in 2019)

The rise of devices connected to the web along with the increase in the internet of things has given rise to an exponential amount of data formed daily is enormous. This information is kept within a semi-organized means, also is given to get relevant associations and vogues in data. Data mining methods can be precisely applied on this data to discover invisible outlines amongst diverse characteristics of data. Here author designates the model to apply data mining technique specifically random forests classification to decide person's psychological state based on characteristics such as age, lifestyle, gender, schooling, profession, diabetes, salary, aim, siesta, flexibility, hypertension. This data can be found on numerous websites accessible on the internet [12]

The model would forecast if the patient is having a psychological ailment. Decision tree provides an efficient way to forecast whether a person Psychological state

by taking quotation from previous instances. With data mining authors are able to classify and forecast whether an individual is sane or insane. Knowledge Discovery from Databases (KDD) is the process used in data mining by authors. The authors use weka and rattle tools for data mining. In machine learning, we use the Random Forest classifier for machine learning. The accuracy rate of the Random Forest Tree algorithm is 83.33% and 92.85% for Weka and rattle tool respectively. Hence RATTLE tool has given better accuracy than WEKA [12]

3. CONCLUSION

In this research, we have studied background knowledge on Self-Harm and Suicidal Tendencies and practice of machine learning models along with an evaluation of studies in past that practice machine learning for deciding Self-Harm and Suicidal Tendencies with their features. Various Machine Learning techniques were applied such as KNN, Random Forest, GBM, SVM, Naïve Bayes in these disciplines. As per our evaluation, various Machine Learning methods were deployed to forecast self-harm and suicidal tendencies. Each model has its individual advantages along with its disadvantages. The functioning of the models depends on various characteristics of the dataset along with the aim of the study. A lot of individual preprocessing of Machine Learning models like modification of models so as to fit into optimality, data preprocessing is done. It's hard to estimate whether a specific model is finest for each area during every time. Inspection of facts by researchers with various classifiers with the intention of selecting the best classifier which yields the highest precision. The precision of these algorithms needs to be enhanced in order to practice with extensive data.

4. REFERENCES

- [1] Jeffrey A. Bridge, Tina R. Goldstein, and David A. Brent, "Adolescent Suicide/Self-harm and suicidal behaviour," *Journal of Child Psychology and Psychiatry* 47:3/4 (2006), pp 372–394.
- [2] Sarah Laxhmi Chellappa, John Fontenele Araújo, "Sleep disorders and suicidal ideation in patients with depressive disorder," *Science Direct Psychiatry Research* 153 (2007) 131–136.
- [3] Regina Miranda, Ana Ortin, Michelle Scott, and David Shaffer, "Characteristics of suicidal ideation that predict the transition to future Suicide/Self-harm attempts in adolescents," *J Child Psychol Psychiatry*. 2014 November ; 55(11): 1288–1296. doi:10.1111/jcpp.12245.
- [4] Junheung Park, Kyoung-Yun Kim and Ohbyung Kwon, "Comparison of machine learning algorithms to predict psychological wellness indices for ubiquitous Healthcare System Design," 2014 International Conference of

- Innovative design and manufacturing, 978-1-4799-6270-9/14/\$31.00 ©2014 IEEE.
- [5] Ms. Sumathi M.R; Dr.B. Poorna, "Prediction of Mental Health Problems Among children Using Machine Learning Techniques," IJACSA, 2016.
- [6] Imran Amin, Sobia Syed, "Prediction of Suicide/Self-harm Causes in India using Machine Learning," Journal of Independent Studies and Research – Computing Volume 15 Issue 2 July-December 2017.
- [7] S.V.Tyulyupo; A.A.Andrakhanov; B.A. Dahieva; A.V.Tyryshkin, "Adolescents Psychological well-being Estimation Based on a Data Mining Algorithm," IEEE CSIT 2018, 11-14 September, 2018.
- [8] Seunghyong Ryu, Hyeongrae Lee, Dong-Kyun Lee, and Kyeongwoo Park, "Use of a Machine Learning Algorithm to Predict Individuals with Suicide/Self-harm Ideation in the General Population," Psychiatry Investigation 2018, Print ISSN 1738-3684 / On-line ISSN 1976-3026.
- [9] Vidya Y. and G. T. Raju, "Early Detection of Depression in Women using Machine Learning," International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-9 Issue-2S, December 2019.
- [10] Punam B. Nalinde, Anita Shinde, "Machine Learning Framework for Detection of Psychological Disorders at OSN," International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-8 Issue-11, September 2019.
- [11] Sandhya P and Mahek Kantesaria, "Prediction of Mental Disorder for employees in IT Industry," International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-8 Issue-6S, April 2019.
- [12] Shaifali Chauhan and Ankur Garg, "Predictive Research For Mental Health Disease," International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-8, Issue- 9S2, July 2019.

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