

# Machine Learning Applications For The Promotion And Management Of Community Mental Health In The Pandemic Era Covid-19: A Scoping Review

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## ABSTRACT

The Covid-19 pandemic affects not only physical health but also people's mental health. The machine learning approach has been widely used to support the policymaking related to handling Covid-19. However, its application in the handling of public mental health in the pandemic era has not been clearly conceptualized. This review aims to identify and map the innovations in the promotion and treatment of public mental health-based machine learning during pandemics. The systematic scoping review process is based on the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines. The search is carried out in two stages. First, searches were conducted on five online databases: SpringerLink, Science Direct, ProQuest, Scopus, and Nature. In the next stage, the addition of literature with snowball techniques through manual searches from other resources, including Google Scholar. As much As 34 eligible literature has been selected and classified into three categories; the application purpose, the method used, and the performance result. The application of machine learning for the classification and prediction of mental health status results in an average accuracy above 80%. There are many variations of machine learning applications for mental health in pandemic times, both prevention and handling of mental health disorders. The addition of more neuro-psycho-physiological predictors based on objective assessments may support earlier assessment of vulnerable individuals, so that would be an important step forward in the prevention of mental health disorders caused by the pandemic.

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## INTRODUCTION

The impact of the Pandemic of Covid-19 on mental health cannot be excluded. Such a policy quarantine, lockdown, and distance restrictions during the pandemic has influenced mental pressure at a population level (Davison et al., 2021)(Mccartan et al., 2021)(Thenral & Annamalai, 2020). The pressure that the mind is very likely resulted in anxiety, depression, even the idea of suicide (Castillo-sánchez et al., 2020). The Severity of the mental pressure

during the implementation of the quarantine and lockdown has also triggered the emergence of posttraumatic stress disorder (Thenral & Annamalai, 2020).

Trend pean increase in psychological distress during the pandemic demand for mental health services that are more adaptive to the policy restrictions of social distancing. In this context, the use of technology such as machine learning and artificial intelligence (AI) seems to be able to support such efforts (Castillo-sánchez et al., 2020). In fact, the application of machine learning in the handling of the pandemic Covid-19 is already found in

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the form of digital-epidemiological surveillance through the web-based epidemic intelligence tools and online syndromic surveillance, or the application of rapid case identification such as medical image analysis (Budd et al., 2020).

In the research previously, applications of machine learning in the field of mental health include diagnosis, prognosis, and management of community mental health, including in terms of support skills clinical (Su et al., 2020). Nevertheless, the application of machine learning in terms of promotion and treatment of mental health in the era of the pandemic, yet coseptualized clearly.

This paper aims to identify and map the characteristics of various innovation utilization of machine learning that is associated with the promotion and handling of mental health during the pandemic Covid-19. The Review focused on three aspects namely: the purpose of the application, the techniques used, as well as the performance of the approach is machine learning used.

## METHOD

The review process uses The Preference Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA). Article search using some keywords related to machine learning, mental health, and the pandemic of Covid-19. The literature search is carried out in two stages. In the first stage, the search is performed in five databases online, i.e., SpringerLink, Science Direct, ProQuest, Scopus, and Nature. At the next stage, do the addition of the literature through a search technique snowball manually, including Google Scholar.

## RESULTS AND DISCUSSION

### Results

As many as 34 articles the results of studies eligible based on the guidelines of the PRISM into the material of the raw scoping review. The year of publication of the whole article is in the range of 2020 until 2021. Most of the articles are the results of studies in the United States (Choudrie, 2021)(Yao et al., 2021)(Kabir & Madria, 2021)(Wieckiewicz et al., 2021)(Ćosić et al., 2020)(Jha et al., 2021)(Prout et al., 2020)(Samuelson et al.,

2021)(Choi et al., 2020) followed by India (Kaur et al., 2021)(Choudrie, 2021)(Science et al., 2021)(Mondal et al., 2021)(A. Kumar, 2021), China (Choudrie, 2021)(Wang et al., 2020)(Prout et al., 2020)(Elhai et al., 2021)(Ren et al., 2021), English (Choudrie, 2021)(Zhang et al., 2021)(Prout et al., 2020), Italian (Choudrie, 2021)(Zhang et al., 2021)(Flesia et al., 2020),Canada(Choudrie, 2021)(Hu & Sokolova, n.d.)(Prout et al., 2020),Africa(Choudrie, 2021)(Shafi, 2021)(Herbert et al., 2021),Global(The et al., 2021)(Id et al., 2021)(Machuca et al., 2021),Germany(Choudrie, 2021)(Herbert et al., 2021),Singapore(Pandey, 2021)(Yao et al., 2021),the European(Yao et al., 2021)(Wieckiewicz et al., 2021),Spanish(Zhang et al., 2021)(Ryu et al., 2021), Bangladesh(Salehin et al., 2021)(Victor et al., 2020), Saudi(Choudrie, 2021)(Wang et al., 2020), France(Choudrie, 2021)(Zhang et al., 2021), Israel(Dolev, 2021)(Ćosić et al., 2020), Iran(Nooripour et al., 2021), Australia(Choudrie, 2021), Brazil(Choudrie, 2021), New Zealand(Choudrie, 2021), Mexico(Salvador & Cardenas, 2020), Netherlands(Prout et al., 2020), Hungary(Prout et al., 2020), and South Asia(Shafi, 2021).

Given the pandemic of Covid-19 just happened in the last two years, it's only natural that almost all studies using the method of cross-sectional (Choudrie, 2021)(Kaur et al., 2021)(Nooripour et al., 2021)(Pandey, 2021)(Science et al., 2021)(Yao et al., 2021)(Kabir & Madria, 2021)(The et al., 2021)(Zhang et al., 2021)(Wieckiewicz et al., 2021)(Wang et al., 2020)(Salehin et al., 2021)(Jha et al., 2021)(Al-wesabi et al., 2022)(A. Kumar, 2021)(Asthi et al., 2020)(Ren et al., 2021)(Hu & Sokolova, n.d.)(Choi et al., 2020)(Machuca et al., 2021)(Herbert et al., 2021)(Victor et al., 2020)(Salvador & Cardenas, 2020)(Ryu et al., 2021)(Elhai et al., 2021)(Ahmed et al., 2021)(Flesia et al., 2020)(Id et al., 2021)(Shafi, 2021)(Mondal et al., 2021)(Prout et al., 2020) and (Samuelson et al., 2021). While the three ribs of other studies use the method of cohort(Dolev, 2021), longitudinal(Low et al., 2020), and the proposed model (Ćosić et al., 2020). Image 1 shows the distribution of study seen from the country of origin of the respondents.



**Figure 1.** Spider Diagram the distribution of studies based on the country of the respondent

The source of the learning data used is quite diverse. Article(Kaur et al., 2021)(Choudrie, 2021)(The et al., 2021)(Science et al., 2021)(Yao et al., 2021)(Kabir & Madria, 2021)(Zhang et al., 2021)(Id et al., 2021)(Mondal et al., 2021)(Victor et al., 2020) and (Machuca et al., 2021) using data derived from the posting tweets during the pandemic. Article (Nooripour et al., 2021)(Pandey, 2021)(Wieckiewicz et al., 2021)(Shafi, 2021)(Wang et al., 2020)(Asthi et al., 2020)(Herbert et al., 2021)(Prout et al., 2020)(Salehin et al., 2021)(Jha et al., 2021)(A. Kumar, 2021)(Samuelson et al., 2021)(Elhai et al., 2021)(Flesia et al., 2020) and (Ren et al., 2021) using the data obtained from the survei online, either through the app such as Google Form or survei web-based. Article (Salvador & Cardenas, 2020)(Hu & Sokolova, n.d.)(Al-wesabi et al., 2022) and (Low et al., 2020) using secondary data from a dataset related to covid-19. While the article (Ryu et al., 2021) use of the data by utilizing the smartphone respondents.

The purpose of the application of machine learning is also different. The article the results of studies (Kaur et al., 2021)(Choudrie, 2021)(The et al., 2021)(Science et al., 2021)(Yao et al., 2021)(Kabir & Madria, 2021)(Zhang et al., 2021)(Id et al., 2021)(Low et al., 2020)(Machuca et al., 2021) specifically aimed at using the approach of machine learning or deep learning to analyze public sentiment (positive, negative, or neutral) in the face of a pandemic. Studi (Nooripour et al., 2021)(Wieckiewicz et al., 2021)(Dolev, 2021)(Hu & Sokolova, n.d.)(Asthi et al.,

2020)(Herbert et al., 2021)(Prout et al., 2020)(Jha et al., 2021)(Samuelson et al., 2021)(Elhai et al., 2021)(Flesia et al., 2020)(Choi et al., 2020)(Ren et al., 2021) aims to analyze the factors that relate to or affect the level of mental health during the pandemic. Studi (Pandey, 2021)(Shafi, 2021)(Mondal et al., 2021)(Salvador & Cardenas, 2020)(Al-wesabi et al., 2022)(Ryu et al., 2021) intended to perform the grouping of types or levels of mental distress caused by the pandemic. Studi (A. Kumar, 2021)(Victor et al., 2020) devoted specifically to predict the mental pressure of the society as the effects of the pandemic. While studies (Wang et al., 2020)(Salehin et al., 2021) aims to estimate the pressure changes mental or behavioral psychiatric due to the pandemic. There is one article (Ćosić et al., 2020) that special propose a method based on machine learning for the prediction of the beginning of the health care workers who may have a higher risk of experiencing mental health disorders in later in the day due to the pandemic Covid-19.

The difference of these goals leads to the Techniques of machine learning that are used is also different. To perform the analysis of sentiment related to the response of the psychiatric community against the pandemic, used the algorithm of Recurrent Neural Network (RNN) and Support Vector Machine (SVM), Advanced deep learning technique of Transfer Learning and Robustly Optimized BERT Pretraining Approach (RoBERTa), TClustVID, the NRC emotion lexicon, The long short-term memory (LSTM), Deep Neural Network, the Model of the extra - trees classifier (ETC), and Logistic Regression. Techniques to perform classification and clustering algorithms using Support Vector Machine, Logistic Regression, Decision Tree, Logistic Regression, Naïve Bayes, KNN, Perceptron, and Stochastic Gradient Descent. Techniques to detect the relationship of the influence of variables using Adaptive neuro-fuzzy inference system (ANFIS), Random Forest, Decision Tree, Logistic Regression, Naïve Bayes, Bayesian Network, Gradient Boosting Regression (GBR), Support Vector Regression (SVR), eXtreme Gradient Boosting, Elastic Net Regularized Regression, GLMnet (lasso, ridge, and elastic net regression),

XGBTree, SVMRadial, Akaike Information Criterion (AIC), Multivariate Logistic Regression and Artificial Neural Network (ANN). While the two studies aims to predict changes in the behavior of psychiatric due to the pandemic, using the technique of XGBoost, Logistic Regression, and Decision Tree.

Method and the approach used also vary. As many as fifteen studies (Kaur et al., 2021)(Pandey, 2021)(The et al., 2021)(Zhang et al., 2021)(Yao et al., 2021)(Id et al., 2021)(Shafi, 2021)(Mondal et al., 2021)(Hu & Sokolova, n.d.)(Herbert et al., 2021)(A. Kumar, 2021)(Victor et al., 2020)(Samuelson et al., 2021)(Elhai et al., 2021)(Flesia et al., 2020) which compares several algorithms to see the algorithm with the best performance. There are six studies (Choudrie, 2021)(Nooripour et al., 2021)(Kabir & Madria, 2021)(Zhang et al., 2021)(Al-wesabi et al., 2022)(Ren et al., 2021) the proposed techniques or algorithms of machine learning specifically built or developed from existing algorithms to test its performance. Eight studies (Dolev, 2021)(Wang et al., 2020)(Asthi et al., 2020)(Prout et al., 2020)(Salehin et al., 2021)(Jha et al., 2021)(Low et al., 2020)(Ryu et al., 2021) using the method of combination by combining several algorithms of machine learning or by the method of conventional statistics. Only four studies are choosing one particular algorithm as the classifier then test the results of its performance.

The results of the use of machine learning and deep learning on all studies showed good performance. The study proposes a model/algorithm deep learning such special RoBERTa (Choudrie, 2021) managed to improve the performance of classification-based AI that already exists. So also with the technique of Adaptive neuro-fuzzy inference system (ANFIS), which combines the Neural Network with Fuzzy Inference System (FIS)(Nooripour et al., 2021), managed to capture the relationship is non-linear between the variable of the collected data, while analysis and statistical methods to traditional (multiple linear regression) are not yet able to do so. It is also indicated by (The et al., 2021) with techniques TClustVID, proven to provide the performance that is better than algorithm DT, GB, KNN, LR, MLP, NB, RF, SVM, and XGB.

Model Multilabel Sentiment Classifier model-based deep neural network language proposed by (Zhang et al., 2021) managed to uncover the fluctuations in the development of the expression of the emotions of the global community in responding to covid-19, including understanding the differences in response in six different languages. Prediction Model Named IFSSML-DAS, which consists of sub-processes: data pre-processing, FSS, classification, and parameter tuning, delivering the performance accuracy of the prediction of depression, anxiety, and stress in over 97 %. Merging the techniques of The Synthetic Minority Oversampling Technique (SMOTE), Akaike Information Criterion (AIC), and Multivariate Logistic Regression (Ren et al., 2021), managed to explore the factors that significantly affect anxiety and depression with an accuracy above 80%.

Different results indicated by the studies (Pandey, 2021)(Yao et al., 2021)(Id et al., 2021)(Shafi, 2021)(Mondal et al., 2021)(Hu & Sokolova, n.d.)(Herbert et al., 2021)(A. Kumar, 2021)(Victor et al., 2020)(Samuelson et al., 2021)(Elhai et al., 2021)(Flesia et al., 2020) using the technique of comparing several algorithms for the purpose of classification and prediction. Random Forest outperformed the algorithm of Support Vector Machine, Logistic regression, Naïve Bayes, and Decision tree in classifying students based on the level of pressure caused by the use of online classes during the pandemic. (Pandey, 2021). Of all the classifiers are tested, The long Short-Term Memory (LSTM) - based Hard classification results with the finest precision in analyzing public sentiment (positive and negative) in the major cities of the world in response to the pandemic. While Extra Trees Classifier (ETC) model to produce the performance of a classification of the most well compared to model Random Forest (RF), XGBoost, Support Vector Classifier (SVC), Decision Tree (DT), and The long short-term memory (LSTM), in analyzing the sentiment of tweets about Covid-19. (Id et al., 2021) Model Logistic Regression is considered to have criteria for detection of stress that most good (sensitivity 95% and ROC-AUC of 0.73) compared to the Random Forest, Decision Tree, Support Vector Machine, Naïve Bayes, KNN, Perceptron, and Stochastic

Gradient Decent in assessing the stress or the presence or absence of a person during the period of lockdown (Shafi, 2021). Gradient Boosting and Random Forest has the performance prediction of the most well compared to other algorithms (the accuracy of each 68,19% and 68,08%), to find the potential factors that affect the mental health of someone during the pandemic Covid-19(Hu & Sokolova, n.d.). Multinomial Naive Bayes produces a classification accuracy of up to 92,15%, better than the Decision Tree, Support Vector Machine, K-NNand Logistic Regression in detecting the onset of anxiety disorders and disorders of mood during the pandemic(A. Kumar, 2021). Logistic Regression, Support Vector Machine, Decision Tree, Naïve Bayes, K-NN, and Random Forest has almost the same performance with average accuracy is very good (90% for the test data and 91% for the training data) in estimating depression (two categories) through data posting tweets(Victor et al., 2020).

Table 1 shows the characteristics of the studies viewed from the aspect of the type and source of data used, the purpose of the application of machine learning, the techniques used, and the results found.

**Table 1.** Characteristics of the study viewed from the aspect of data sources, methods used, and the resulting performance

<b>The identity of the Study</b>	<b>Sources of Data</b>	<b>the Purpose of</b>	<b>the Method/Technique</b>	<b>Results</b>
Kaur, et,al (2021)	500 posting tweets in India by 2020	Analyzed the sentiment through the classification of sentiment is positive, negative, and neutral	Heterogeneous Support Vector Machine (H-SVM) compared to Recurrent Neural Network (RNN) and Support Vector Machine (SVM)	RNN and SVM successfully perform the classification of the sentiment well in three groups: positive, negative, and neutral
Choudrie, et.al (2021)	2 million tweets (February-June 2020)	to Understand the emotions that are expressed globally during the early months of the pandemic Covid-19	Deep learning and Natural language Processing (NLP) by the method of Advanced deep learning technique of Transfer Learning and Robustly Optimized BERT Pretraining Approach (RoBERTa)	the Accuracy of the classification of tweets generated 80.33% with an average score of MCC 0.78.
Nooripour, et.al (2021)	755 Iranian society through the online survey between March 15 – May 20, 2020	Propose model-based machine learning to detect the relationship between resilience and hope with the pressure of Covid-19 with the spiritual well-being.	The technique of Adaptive neuro-fuzzy inference system (ANFIS), which combines the neural network with the Fuzzy Inference System (FIS).	ML models proposed can capture the relationship is non-linear between the variables of the data collected, which is not able to carried out by the method of statistic traditional (multiple linear regression).
Pandey, et.al (2021)	647 students through survei online in Singapore	Classifying students based on the level of mental pressure caused by the use of online classes during the pandemic Covid-19	K-Means for clustering and Random Forest, K-nearest Neighbour (k=5), Support Vector Machine, Logistic Regression, and Naive Bayes for classification.	The accuracy of the best produced by the Random Forests (500 trees), followed by K-Nearest Neighbors (k = 5), Support Vector Machine, Logistic regression, Naive Bayes, and Decision tree.
A, et.al (2021)	16 million tweets related to Covid-19 before 20 March 2020	to Design the model of classification and extraction of topic-based clustering	the Method of K-Mk for clustering, then the classification by using the TClustVID and compare it with the	Model machine learning - based cluster intelligent proposed (TClustVID) works well in the

		smart to analyze the sentiment (positive, negative, and neutral) tweets in the era of pandemic Covid-19	classifier of the other.	analyze sentiment and classify the topic, compared with other methods.
Gupta, et.al (2021)	About 884.111 Posting tweet in a number of locations in India from March 25 2020-9 June 2020.	Analyze the forms of emotions contained in tweets related to Covid 19.	NRC Emotion Lexicon and interactive web.	The technique used successfully uncover the proportion of the emotions of each group, including the emotions of the dominant who appears in public in a pandemic situation.
Yao, et.al (2021)	As much as 1.578.627 tweets in a number of cities of the world that is posted from March 2 – May 21, 2021.	Analyze public sentiment (positive and negative) in the major cities of the world in response to the pandemic covid-19	Naïve Bayes and Logistic Regression as a classifier with Bag-ofWords as a text representation. The method of refinement of the Model using CNN-based Hard with TensorFlow as a backend, as well as The long short-term memory (LSTM) - based Hardware.	Of all pengkalsifikasi tested, LSTM generates the performance of the classification with the best precision.
Kabir & Madria (2021)	More than 500 million tweets since March 5, 2020 in the United States.	Designing the model classifier to analyze the response of the emotions of the people against the pandemic covid-19.	Using a Deep Neural Network which consists of 6 layers. Model classifier equipped with the tools incognito Languages that are made, that is RoBERTa.	The proposed Model has the performance of the classification results that exceed other systems.
Wieckiewicz, et.al (2021)	As much as 1642 the respondents through survei online in Europe and North America	to Identify predictors, risk factors, and factors associated with mental disorders as the indirect impact of the Covid-19	Decision Tree	Managed to show the level of anxiety, depression, headaches, and behavior of oral, as well as uncover the risk factors yag associated with mental disorders due to Covid-19.
Dolev, et.al (2021)	As much as 91 senior doctors who care for patients Covid and	Knowing the predictors of physiological affect the	Algorithm K-Mk for clustering. Anova two-way to see the effect	The use of machine learning is able to distinguish between groups of

	non-Covid.in Israel, divided into 2 groups for the blind.	mental health of doctors when treating patients Covid-19 in the future.	and t-Test to see the difference univariate two groups.	Covid-19 and Non Covid-19 with a sensitivity and specificity of the good.
Zhang, et.al (2021)	Over 105 million tweets between March 1 and May 15, 2020 as well as a message on Weibo that was compiled between January 20 and May 15, 2020 which includes 6 languages international.	Mengidentifikasi emotions through the category expression of conversations about Covid-19 on social media.	Make Multilabel Sentiment Classifier model-based deep neural network language for each Language were analyzed.	The model approach used successfully uncover the fluctuations in the development of the expression of the emotions of the global community in responding to covid-19, including understanding the differences in response in six different languages. Model of the ETC produces the performance of the classification most better than the models of <i>machine learning</i> of the other. A Model of deep learning LSTM shows the performance of the classification that is most weak. For feature extraction, the technique of merging TF-IDF and the BoW, giving the best performance.
Rustam, et.al (2021)	As much as 7528 tweets taken through the ports of IEEE on May 31, 2020.	Compare the performance model of machine learning in mnganalysis the sentiment of tweets about Covid-19 approach using supervised machine learning.	Feature extraction using: Term Frequency-Inverse Document Frequency (TF-IDF), Bag-of-Words (BoW) and GloVe. Machine learning uses: Rrandom Forest (RF), XGBoost Classifier, Support Vector Classifier (SVC), Extra Trees Classifier (ETC), and Decision Tree (DT). Deep learning using the Long-Short Term Memory (LSTM)	
Shafi & Rahman (2021)	As many as 260 people were respondents in the survei online, each 159 male and 101 female.	Assess the mental pressure of a person during the period of lockdown due to pandemic Covid-19.	Model machine learning pengkalisifikasi: Random Forest, Decision Tree, Support Vector Machine, Logistic Regression, Naïve Bayes, KNN, Perceptron, and Stochastic Gradient Decent.	Model Logistic Regression is considered to have criteria for detection of stress that most good (sensitivity 95% and ROC-AUC of 0.73) among the other models tested.
Cosic, et.al (2020)	-	Propose a method based on machine learning for the prediction of the beginning of the health care workers who may have a higher risk of experiencing mental	Method consists of five phases: 1) objective stress assessment; 2) subjective stress assessment; 3) selection of multimodal stimulation; 4) multimodal data acquisition and feature computation; and 5) data	The proposed methodology to predict early from mental health workers, have the objectivity which is better with the presence of additional features such as neuro-physiological, talk feature, and



		health disorders in later in the day due to high pressure during the pandemic Covid-19	analysis for prediction of mental health disorder.	biomarkers.
Wang, et.al (2020)	As much as 1172 undergraduate students in 260 cities in China that did not pass in the first half of online learning.	To investigate changes in the severity and prevalence of anxiety of students and evaluate the learning model machine	t-Test and analysis of a single factor. Model <i>XGBoost</i> to predict the level of anxiety students 1 month after the beginning of the new semester.	Model XGBoost has an accuracy of better predictions compared with the regression model stepwise multiple traditional, in predicting the status anxiety of the students.
Mondal, et.al (2021)	As much as 14.567 tweets in India that is divided into 9.567 as training data and 5000 test data.	Perform the classification of tweets related to Covid-19 in three categories.	Model of machine learning compared with the model deep learning	Score F1 model machine learning is 0.93 and model of deep learning is to 0.92
Salvador & Cardenas (2020)	102 cases in the northeast region of Mexico. (The Dataset from Kaggle.com)	the classification of the level of stress experienced by professional kn caused by Covid-19.	Decision Tree C. 50	Classifications showed good performance (6 of 102 case of classification) or the accuracy reached 94.1% are.
Hu and Sokolova (2021)	As much As 1.005 respondents were obtained from a dataset of Covid-19 Mental Health National <i>Survey</i> which is extracted from the 6 series survey in Canada during May-December 2020	Find the potential factors that affect the mental health of someone during the pandemic Covid-19.	The algorithm used is Gradient Boosting, Random Forest, Decision Tree, SVM, Logistic Regression, and Naïve Bayes. An explanation for the results of prediction algorithms using a post-hoc system LIME. Using ante-hoc system Gini Importance to analyze two models of machine learning that has the best performance.	Gradient Boosting and Random Forest performance prediction of the most well compared to other algorithms, with an accuracy of each 68,19% and 68,08%. LIME and Gini plays an important role in explaining the results of the predictions of the algorithms of machine learning.
Asthi, et.al (2020)	As much As 17764 adults from different groups of gender and socio-economic status in the United States respondents	to Identify the factors that have a significant impact on kn mental during the pandemic Covid-19.	Using Bayesian Network and integrate it with the approach of machine learning classic for modeling the level of kn mental.	Orang with chronic medical conditions are more prone to mental disorders during the pandemic Covid. Other factors that lead to mental stress are: work from home, home schooling, and lack of communication with peers.

Bantuan the economy during the pandemic fight to reduce mental pressure. Acuration of prediction reached 80%.

Herbert, et.al (2021)	As much As 220 students of Egyptian and German respondents through survei online in May 2020.	Meshow the relationship between personality and subjective experience during the pandemic, which is not captured by the analysis of the descriptive or correlation data.	Gradient Boosting Regression (GBR) and Support Vector Regression (SVR)	, the big Five personality traits of students and the nature of anxiety can be predicted from variables, psychological). Prediction accuracy shows that the predictions of all the attributes of the properties have the same level of error.
Prout, et.al (2020)	As much As 2.787 respondents were sampled through survei online.	Identify the predictors of psychological distress during the pandemic Cpvind-19	Random Forest to identify predictors of mental distress is the strongest. Regression Trees to identify individuals with greater risk of anxiety, depression, and pressure after trauma.	Two predictor variables that most influence on the symptoms of anxiety, depression, and post traumatic stress pandemic is emotion regulation-somatization and the mechanisms of defense.
Salehin, et.al (2021)	As much As 10 thousands of samples obtained through an online questionnaire using google form	to Identify changes in the behavior of psychiatric due to quarantine panjang during the pandemic Covid-19.	Naiv Bayes for the analysis of sentiment. SVM for the classification of kn mental respondents. Logistic regression and Decision Tree to predict the impact of the quarantine.	Accuracy Naiv Bayes, Logistic Regression, and SVM respectively were: 88%, 78%, and 71%.
Jha, et.al (2021)	As many As were 17.764 sample of adults in the United States through survei online.	Study the level of influence of factors that may indicate the tendency of mental disorders during the pandemic Covid-19	Bayesian Network to identify the key factors that affect kn mental during the pandemic Covid-19. Using supervised machine learning to estimate the people that are in the best vulnerable mentally during the pandemic.	Insulation social, digital communication, work and study from home, identified as factors that induce mental illness during the pandemic. While communication face-to-face regularly with friends and family, a healthy social life, and social security is a factor kunci in caring

for people with a History of mental illness. Prediction accuracy of machine learning reaches 80%.

Al-Wesabi, et.al (2021)	Total of 938 cases with 7 attributes and 5 classes using the DASS-21 Dataset.	Investigate the level of depression, anxiety, and stress of the students during the lockdown due to the pandemic Covid-19.	Model predictions IFSSML-DAS, which consists of sub-processes: data pre-processing, FSS, classification, and parameter tuning. Techniques GGWO-FSS for the selection of a subset of optimal features, BSO-LSSVM for classification, and the BSO for the tuning parameters.	The accuracy of the model IFSSML-DAS proposed to achieve 0.99 on Dataset Depression, 0,981 on a Dataset of Anxiety, and 0,973 on a Dataset of Stress.
Kumar (2021)	Total of 395 respondents from India via questionnaires kn mental era of pandemic Covid-19.	Perform predictive analysis to identify the effects of the pandemic on the mental health of the people of India.	Multinomial Naive Bayes to detect the onset of certain psychological disorders in two forms, namely anxiety disorders and disorders of mood.	The results of the classification accuracy reached 92,15%. This result is better than Decision Tree, Support Vector Machine, K-NNand Logistic Regression.
Victor, et.al (2020)	As many As 35,000 message taken from tweets and facebook, and other platforms.	Estimate the depression of the Bengali community through pstingan tweets and chats on multiple social media platforms.	Logistic Regression, Support Vector Machine, Decision Tree, Naïve Bayes, K-NNand Random Forest.	Hasil each algorithm hampir the same. The average best accuracy for the test data 90%, and 91% for the training data.
Samuelson, et.al (2021)	As much As 467 sample of American adults (33,14% of men and 63,6% of women.	Explore the risk factors and resilience of the function kn mental during the pandemic Covid-19.	Using the algorithm of ensemble methods: Random Forest and eXtreme Gradient Boosting; Support Vector Machine with Radial Basis Functional Kernel; and Elastic Net Regularized Regression.	There is no difference between the algorithm in predicting the results of mental health based on the confidence intervals BCA 95%.Factors prediktor resilience most powerful for all the results is CSE (Coping Skill Efficacy).
Elhai, et.al (2021)	As much As 908 adults in Eastern China were recruited through survei based the web in a cross sectional study during	Check out the vulnerability factors associated with anxiety and fear, from various aspects such as	GLMnet (lasso, ridge, and elastic net regression); Random Forest, XGBTree, and SVMRadial.	For models of anxiety, the Algorithm lasso gives the best performance on the training sample size. While the three algorithms

	social distancing applied.	psychopathology, sosidemografi, and variable which is related to the exposure to the virus.		combined is better than other algorithms on the test sample. To model the fear of death, the algorithm regression elastic net and lasso produces the value of the best accuracy.
Low, et.al (2020)	As much As 826.961 posting in the <i>Reddit Mental Health Dataset</i> for 2018 to 2020.	Characterize the changes in the different groups of mental health during the early stages of the pandemic Covid-19.	Supervised machine learning to classify posting in the group of mental health, and using the method of unsupervised to uncover the types of concerns before and setumah pandemic.	Modeling successfully classify posts related to mental health and identify posts that contains potentially risky behavior. Modeling grouping managed to uncover trends change themes of mental health before and during a pandemic in a variety of community groups.
Flesia, et.al (2020)	As much As 2053 adults Italian b aspects of sociodemographic and psychological nature yanerdasarkan stable during the period from 20 to 31 March 2020 .	Identify individuals who are prone to stress due to the pandemic Cpvid-19 based on the features sociodemographic and psychological nature of the community.	Regresi logistics, Naïve Bayes, Support Vector Machine, and Random Forest.	Area ROC model classifiers are at a value of 0.70 to 0,78. The sensitivity of the Random Forest low compared to other algorithms. Factors female gender, age, and income affect the level of stress during the pandemic. The stability of emotionality, self-control, and coping skills, to be protective factors that are important to kn mental in the pandemic.
Choi, et.al (2020)	As many As 790 sample of Korean immigrant who aged above 18 years and spread across 42 U.S. states through an online survey.	Find out the predictive ability of the variable discrimination, coping mechanisms, and factors of sociodemographic against psychological distress Korean immigrant in the United States in the middle	Artificial Neural Network (ANN) is used to test the predictability of the variable-predictor variables.	ANN can predict the psychological pressure (high and low) of the individual with the value of the ROC 0,806. The value of the sensitivity reach 80,6 % and AUC of up to 0.9. Variable pediktor the most important are: resistance personal,

Ren, et.al (2021)	Total of 478 samples obtained from the survei online to college students in China between 14 and 20 September 2020.	of the Pandemic Covid-19. Evaluate the psychological impact (anxiety and depression) outbreak of Covid-19 after the school opened kn as well as the factors associated with it.	The method of The Synthetic Minority Oversampling Technique (SMOTE) to overcome ketidakseimbthinking data. Techniques Akaike Information Criterion (AIC) and Multivariate Logistic Regression to explore factors that influence the anxiety and depression of the respondents.	discrimination, and social support. Significant factors: the frequency of the latihan, alcohol use, re-opening the school, has a friend who has been infected, quarantine, measure the temperature of regularly, the quality of sleep, a holiday book, and the family economy. The value of AUC and ROC for anxiety and depression on the test set of each is to 0.885 and 0,806.
Ryu, et.al (2021)	Total of 142 patients of psychiatric outpatient care in Madrid, Spain respondents use a smartphone.	Evaluate the usage patterns of two types of social media apps of the patient's psychiatric outpatient care during the outbreak of Covid-19.	The combination of model Hidden Markov and Logistic Regression to mempredikasi anxiety in clinical and non-clinical data based on the time-series.	At the level of the individual, the group with clinical anxiety showed increased use of communication apps a little more than a group of non-clinical. The accuracy of the model machine learning achieve 62,30 % and the value of the ROC is 0.70.
Machuca, et.al (2020)	As many As 50,000 posting the highest of tweets in English were taken each month (January-July 2020).	Perform sentiment analysis of English through posting tweets during the pandemic Covid-19.	Logistic Regression for mengkalisifikasi sentiment positive or negativef of posting tweets that were analyzed.	Model machine learning produces a classification accuracy amounted to 78.5%.

## Discussion

The most important invention of this review is showed great potential possessed by machine learning, deep learning, and AI as a whole to support the optimization of promotion and management of mental health in the era of the pandemic. Article review shows how the approach of machine learning can be used for a variety of applications and use. The Review gives the result that the third scope of the potential utilization of machine learning put forward by Hernan, et.al (2019) can be done, starting from the function description, prediction, and causal inference (Jiang et al., 2020). Thus, the utilization of machine learning in the effort to mental health can be done starting from the promotion, early detection, a better understanding of mental health conditions of people in the pandemic, up to handling that more optimal.

The utilization of machine learning for handling mental health in the era of pandemics seems to be dominated by sentiment analysis through posting on social media. Actually, applications such as it is done before the onset of the pandemic. Saha, et.al (2016) for example, has proposed a framework classification health mental online associated with depression at the community level(Saha et al., 2016). The selection of tweets as a source of data that most populer very reasonable because the amount is very large. The cause of course because twitter to be a leader in the use of social media in terms of the discourse surrounding Covid-19, then followed with Sina Weibo, then followed by other platforms (Tsao et al., 2021). Twitter is considered to be more suitable to be used as the source of the data related to expressions that describe the behavior of the psychology of the user (Qiao, 2020).

Aspects of the methods and approach, the results of the review show many variations of the technique utilization of machine learning. In addition, it is also possibly done merge algorithms or synergize the method of supervised machine learning and unsupervised machine learning. The combination of the method of clustering and classification shown in (Pandey, 2021)(The et al., 2021) give pretty good results. This is in line with the method of study previous to analyze mental health in a

group of different targets. In the first stage performed clustering to determine the number of the group and the label, followed by a classification method to predict the mental health of the individual by using algorithms such as SVM, KNN, and Random Forest (Srividya et al., 2018).

Other important findings are the trend in the possibility of understanding more objective, comprehensive, and real-time against the mental development of the population in the future and post the pandemic. It is driven by the development of more advanced technology that allows the application of EMA (Ecological Momentary Assessment) better. Aside from the interview and the inventory being subjective, data on mental health can also be obtained from a variety of sources, including signal biologist-physiological (Srividya et al., 2018). The implementation of EMA-based machine learning is also increasingly possible because the technology devices such as smartphones or smartwatches are equipped with a sensor that is valuable economical, has a small error, and is able to generate signals associated with the parameters of the mental health of users. The variation of the sensor which completes the device is wearable, such as the accelerometer, gyroscopes, Global Positioning System (GPS), pressure sensor, heart rate sensor, pedometer, speaker, and camera (P. Kumar et al., 2021). In addition to the sensors on your smartphone and smartwatch, also there are Electrocardiogram (ECG), Electroencephalography (EEG), and Photoplethysmography (PPG)(Gedam & Paul, 2021)(Vuppapapati et al., 2018).

Related to this, the study previously demonstrated the application of machine learning that uses biomarkers can provide the performance of classification with high sensitivity, as well as specivicity above 80% (Sharma & Verbeke, 2020). Jin et.al (2020), even designeg a system multi-sensor itself that is intended to collect data social signals in the form of the combined signal sounds and movement, as well as monitor continuously mental health conditions of the users by using the method of deep learning (Luo & Woo, 2020).

The performance of machine learning in the classification, prediction, and disclosure of

new knowledge looks pretty good. The result of this is influenced by various factors, starting from the quantity and quality of the data used, the technique of extraction of selected features, the accuracy of the algorithms used, as well as methods of use of the newest techniques of machine learning are there. In addition, the increased ability of the machine both from the aspect of speed and work capacity also affects the smoothness of the analysis.

The utilization of machine learning or deep learning on the efforts of mental health in the era of a pandemic is very dependent on the availability and adequacy of data. This is because of the management of the pandemic optimally, the very need of the cycle quick feedback in the form of learning-based data (data-driven learning) to respond to the effectiveness of each step. Therefore, the efforts of data sharing are very important enhanced to support the handling of the pandemic-based AI, especially to increase the size, inclusiveness, history, and the nature of the real-time from the dataset.(Syrowatka et al., n.d.)

Nevertheless, this article has limitations in terms of the scope of the study that become the raw material for the review. Articles that review is limited only to the results of the studies that have been published or have been accepted for publication, whereas it is very likely there are a lot of research and efforts of implementation has been done related to the use of machine learning for handling mental health in the era of pandemic Covid-19 that are not netted through this review.

## CONCLUSIONS

A Review of the whole article has eligibility to uncover a number of potential possessed by *machine learning*, *deep learning*, and AI ranging from the use of the function description, prediction, and causal inference. With this ability, the utilization can be used to support a variety of promotional efforts and the handling of mental health in the era of the pandemic in better.

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