A Review of the Machine Learning Algorithms for Covid-19 Case Analysis

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***Abstract*—The purpose of this article is to see how machine learning (ML) algorithms and applications are used in the COVID-19 inquiry and for other purposes. The available traditional methods for COVID-19 international epidemic prediction, researchers and authorities have given more attention to simple statistical and epidemiological methodologies. The inadequacy and absence of medical testing for diagnosing and identifying a solution is one of the key challenges in preventing the spread of COVID-19. A few statistical-based improvements are being strengthened to answer this challenge, resulting in a partial resolution up to a certain level. ML have advocated a wide range of intelligence-based approaches, frameworks, and equipment to cope with the issues of the medical industry. The application of inventive structure, such as ML and other in handling COVID-19 relevant outbreak difficulties, has been investigated in this article. The major goal of this article is to 1) Examining the impact of the data type and data nature, as well as obstacles in data processing for COVID-19. 2) Better grasp the importance of intelligent approaches like ML for the COVID-19 pandemic. 3) The development of improved ML algorithms and types of ML for COVID-19 prognosis. 4) Examining the effectiveness and influence of various strategies in COVID-19 pandemic. 5) To target on certain potential issues in COVID-19 diagnosis in order to motivate academics to innovate and expand their knowledge and research into additional COVID-19-affected industries.**

***Impact Statement*—The worldwide response to the COVID-19 epidemic will rely heavily on ML, defined broadly. This article enables ML researchers to quickly connect with the range of active research effort. We identify the key difficulties, potential paths for future work, and crucial community resources in particular. Given the multidisciplinary character of the problem, this review will aid data scientists in forming cross-disciplinary collaborations. We also educate strategists and policymakers on the advantages of ML and help them understand the obstacles, possibilities, and drawbacks of utilizing data science to battle the COVID-19 epidemic.**

***Index Terms*—COVID-19, intelligent system, machine learning (ML), mathematical model, ML tasks.**

Abbreviations

ML	Machine learning.
COV	Corona virus.
IBV	Infectious bronchitis virus.
HCOVs	Human corona viruses.
RT-PCR	Reverse transcription polymerase chain reaction.
AI	Artificial intelligence.
LCT	Lung computed tomography.
RL	Reinforcement learning.
CNN	Convolutional neural networks.
BOW	Bag of words.
IDF	Inverse document frequency.
TF	Term frequency.
PDR	Partial derivative regression.
NML	Nonlinear machine learning.
CHFS	Composite hybrid feature extraction.
GA	Genetic algorithm.
KNN	K-nearest neighbor.
LR	Logistics regression.
MEWS	Modified early warning score.
NB	Naive Bayes.
LiR	Linear regression.
ANFIS	Adaptive network-based fuzzy inference system.
MLP-ICA	Multi layered perceptron-imperialist competitive algorithm.
SVR	Support vector regression.
PLR	Polynomial regression.
LASSO	Least absolute shrinkage and selection operator.
STS	Semantic textual similarity.
VAR	Vector autoregression.
UL	Unlabeled.
MLP	Multilayer perceptron.
STS	Semantic textual similarity.

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I. Introduction

Corona virus is a genus of viruses, which infect animals, birds, and cause sickness. The term "corona" derives from the Latin word "corona," that means "crown," and alludes to the virus's outer spikes, which are club-shaped and crown-like. Corona viruses are large and live in close proximity to positive-strand ribonucleic acid (RNA) viruses. Corona virus (COV) is a member of the corona viridae family and belongs to the Ortho corona virinae subfamily. Corona viruses are classified into four generation: alpha, beta, gamma, and delta COVs, with alpha and beta COVs infecting mammals and gamma and delta COVs infecting birds, respectively [1]. COV was discovered in the late 1930s after a severe respiration virus in farm chickens was found with the infectious bronchitis virus to be infected [2]. After

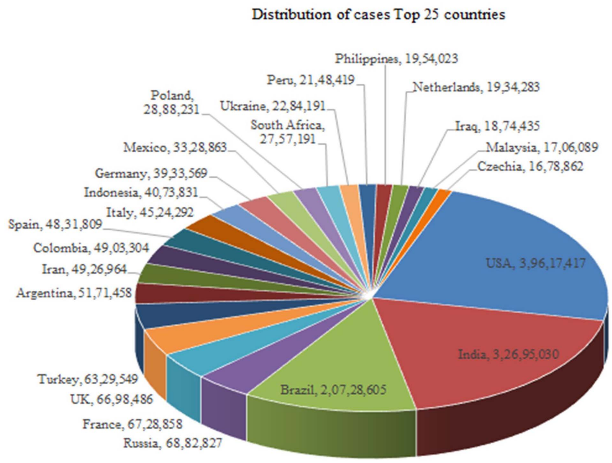

Fig. 1. COVID-19 cases distribution countries wise.

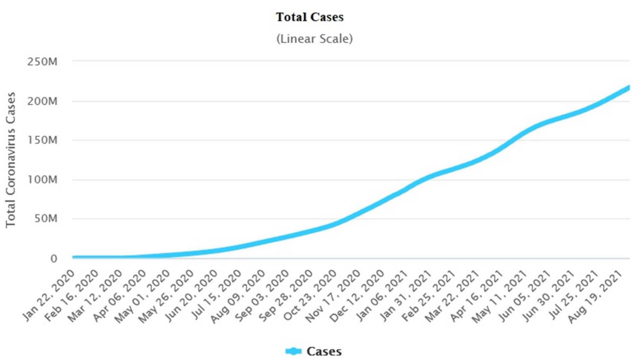

Fig. 2. Total Cases (worldwide): "Total Cases" = total cumulative count (216 926 538). This figure includes deaths and recovered or discharged patients.

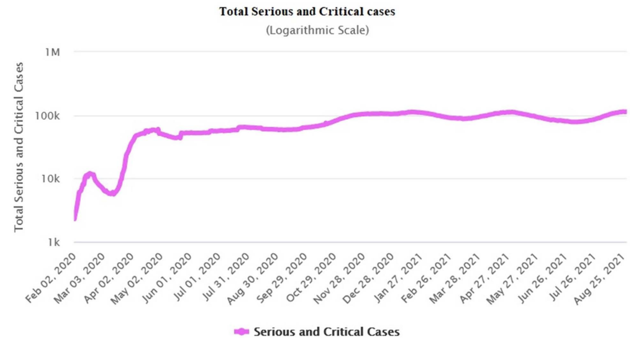

Fig. 3. Serious and critical cases.

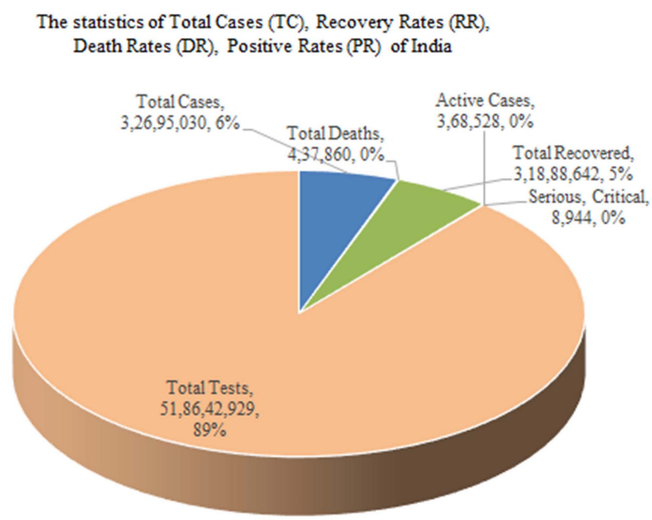

Fig. 4. Statistics of TC, total RR, total DR as well as total PR of India.

that in 1960s human corona viruses (HCOVs) was discovered. HCOVs can be transmitted to humans through respiratory tract infections that range from minor to fatal. Whereas a moderate illness is defined as a few cases of a common cold, a lethal infection is defined as severe acute respiratory syndrome (SARS) or middle east respiratory syndrome (MERS). Both SARS and MERS are Beta COVs, which cause a deadly and contagious respiratory disease. In December 2019, another pathogenic HCOV was discovered in Wuhan, China [3] and identified as a novel corona virus injury. With a population of almost 11 million people, Wuhan is the most important transportation hub [4]. The wild animal market in Wuhan is famous for selling bats, snakes, marmots, chickens, and other live animals, and most of the patients were discovered there before December. A total of 44 cases of pneumonia with an unknown cause were reported in Wuhan between December 31, 2019 to January 3, 2020. During the informed era, the cause of the virus was unknown. However, on January 7, 2020, WHO and the government of China detected the novel corona virus (November 2019), which is a member of the SARS virus family [5]. After January 17, 2020, Ncov-2019 was swiftly expanded in China's major cities, covering over 7000 cases. As a result, the government of China has taken severe efforts to prevent the spread of this precarious virus from 23 to 2020, including experimentally delaying publicly transit, issuing warnings to inhabitants not to leave their homes, and isolating the biggest afflicted cities. The WHO recognized the disease on January 30, 2020, as the new COVID-19 has spread to 18 nations via person-to-person transmission. As per available data from www.worldometer.com, COVID-19 has impacted 32 118 316 people worldwide as of September 24, 2020, and the WHO has labelled it a pandemic [6]–[8]. The United States has the most confirmed cases, with 7 139 553 persons worldwide affected. With 206 593 deaths, the death rate in the United States has risen. The sudden rise in active cases and death cases in the United States and India shocked the entire world. Similarly, many other nations, such as Brazil, India, Colombia, Russia, Spain, Peru, Mexico, Argentina, and Africa, are among the top ten countries that are badly affected by COVID-19, and their mortality and recovery rates are both high. Some of the statics shown in the following Figs. 1–3.

Similarly, in India, active cases have reached 3 11 05 270 patients, 30 300 762 patients have been recovered, and the death cases has been reached 4 13 640 by July 19, 2021. The statistics of total cases (TC), recovery rates (RR), death rate (DR), as well as Indian positive rate (PR) is shown in Fig. 4.

The lack of sufficient information on early-stage symptoms is a crucial factor in the spread of COVID-19. This has resulted in a situation where citizens are unaware that they are polluted and travel without understanding of disease transmission. As a result, the ubiquitous presence of COVID-19 necessitated the management of congested areas such as bus stops, airports, and train stations. It requires a variety of inspection tools, including thermal sensors, machine learning (ML) [9], and artificial intelligence (AI) [10]–[12]. Reverse transcription polymerase chain reaction (RT-PCR) was one of the standard procedures for diagnosing COVID-19 [13].

Short sensitivity, as well as time, cannot meet the criteria of swiftly finding and elevating positive instances, and this has become one of RT-significant PCR's drawbacks. As an alternative to this obstacle, X-ray imaging and computer tomography can give a quick screening to detect the problem. ML has lately acquired prominence and is fast developing in resolving numerous challenges such as speech and object recognition, picture classification, and so on, because of the problem's complexity in improving epidemiologic techniques. In comparison to other issue domains, the COVID-19 with ML experiments have been increased dramatically in just two months. This highlights the importance of comprehending the disease's severe character, as well as the need for high-level research employing relevant intelligent computer technologies [14].

Throughout the last decade, the rapid expansion of digital approaches has played a significant role for solving different difficulties in the health sector, as well as illness prevention. The availability of digital machinery to adequately dealing with COVID-19 is also being tracked as a part of the present global health emergency. In the field of health care, the prognosis of a patient's outcome is still a difficult topic. Predicting and diagnosing diseases has become more easier as ML approaches have grown in popularity. Self-learning ML can learn from machines and generate accurate predictions. ML has successfully predicted several diseases, including hepatitis [15], human immunodeficiency virus HIV [16], Ebola virus [17], and others. ML has also been used to combine and analyze large amounts of data from COVID-19 patients. To identify the affected individuals with personalized features, several ML algorithms are used. The success of ML is determined by the data visualization used.

Although ML has demonstrated its effectiveness in identifying diseases, gathering data, organizing health records, and so on, a few systematic models based on Ml have yet to be implemented due to a number of challenges, including a lack of identifying tools, a lack of medical tools, the use of biomedical data, heterogeneity, and so on. To address these issues, feature engineering has progressed by utilizing human inventiveness. However, several health philosophies that are consumed in the generalization of information have expounded on these shortcomings. It is possible that some health sector works will need to be suggested in unique ways. This issue could be overcome by using the ad hoc technique to illustrate the health composition. Nonetheless, supervised models are unable to forecast the most recent prototypes. Nonetheless, extracting relevant data while building predictors can be simple with representation learning [18].

The pandemic's quick spread has resulted in major health-care difficulties, necessitating immediate responses to mitigate the effects. In dealing with the problem, AI has a wide range of applications [19]. COVID-19 is a worldwide pandemic disease, which has presented a threat to human existence. In systematic reviews, ML training methods and other statistical modeling are used by computers to complete many tasks without precise commands were discovered [20]. ML approach are currently employed for prognosis all around the world due to their accuracy. Ml approaches, on the other hand, face a number of obstacles, such as the new internet database's poor quality. One of the issues in training a model or selecting the optimal ML model for prediction, for example, is determining the suitable parameters. To produce predictions based on the available dataset, researchers utilized the better Ml approach, which is fit in the database [21]. Most of the ML technique could be used for data analytics and for extracting hidden patterns [22]. ML techniques are meant to find complicated patterns and interfaces in data when there are unknown and sophisticated risk factor correlation patterns [23].

The rest of this article is organized as follows. Section II describes the associated work done related to COVID-19. Section III describes the different approaches of ML. ML methodology used for COVID-19 briefly explained in Section IV. Article selection strategy and a search method for the literature describes in Section V. Different ML approach for COVID-19 explain in Section VI-I. COVID-19 data processing challenges using intelligent computing approaches describes in Section VII. Discussion and implications explained in Section VIII. Limitations and future scope are described in Section IX. Finally, Section X concludes this article.

II. Associated Work

The COVID-19 virus, which is produced by the SARS-COV-2 viruses, which is require remarkable return of unique strength and competence in above 250 nations throughout the universe. During the first four months of the pandemic, the number of people influenced fluctuated from 2 to 20 million, with 250 000 deaths. All governments around the world took severe efforts to limited the rapid spreading of the COVID-19 illness among individuals, including placing more than 100 of millions of people under quarantine [24]. All of these attempts, however, are limited due to the difficulty in distinguishing between positive and negative people available symptoms of COVID-19. As a result, SARS–CoV-2 viral detection tests are thought to be critical in identifying positive cases of infection and restricting the virus's transmission [25]. The most useful and critical modalities for diagnosing the COVID-19 stage and potential dangers to the patient's lungs are radiology and imaging, notably a chest CT scan [26]. To limit person-to-person transference and improve patient care, COVID-19 must be discovered early. Separation and quarantine of healthy persons from diseased or suspected COVID-19 carriers has recently been discovered to be the most effective technique of preventing COVID-19 transmission [27]. The role of ML techniques in COVID-19 diagnosis revealed important insights, such as whether a lung computed tomography scan is used as a first alternative or screening testing for actual reversed transcriptase polymerase chain reaction (RT–PCR), and the dissimilarity between COVID-19 pneumonitis as wee as

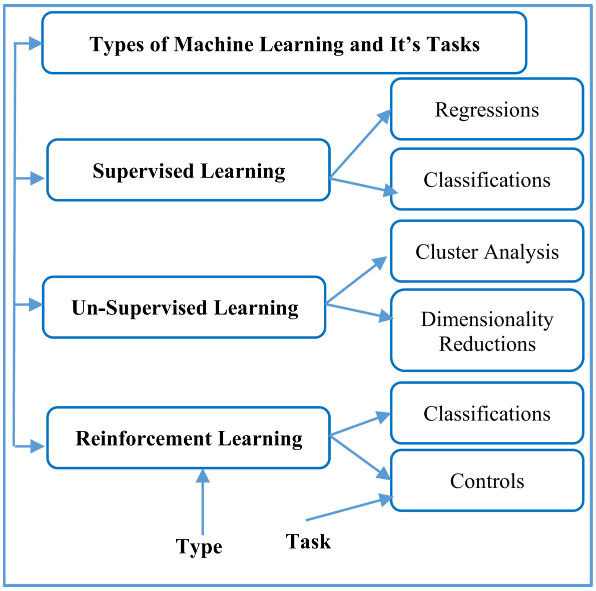

Fig. 5. Different ML type and task.

other viral pneumonitis used a computed tomography scan of the lungs [28].

III. Approaches of ML

ML is the best rising technique for classification [29]. ML is a method for discovering previously unknown functions, relationships, or structures between input and output variables. Typically, explicit algorithms via automated learning processes have a hard time detecting these relationships [30]. ML algorithms are used to forecast the number of confirmed illnesses and deaths in the next months [31]. There are two parts to ML. The first section employs a genetic algorithm to determine the best weight of database fusion of different node perception outcomes and delete impractical nodes, while the second employs a fault identification neural network to find fault nodes [32].

ML is a branch of AI that includes supervised, unsupervised, and reinforcement learning [33]. Common ML models including clustering, classification, dimensionality reduction, regression, reward maximization, and anomaly detection [34].

In the supervised learning paradigm, ML algorithms are trained on labelled datasets, which means that each input has a ground-truth output (continuous or discrete). On the other hand, there is no ground-truth output in unlabeled [35], and the algorithm usually aim to discovered patterns in the dataset. Aim of Reinforcement to improve the cumulative reward, which is most suitable for successive decision-making issues [36]. Unsupervised learning, as shown in Fig. 5, involves clustering analysis and dimensional reduction, whereas supervised learning considers regression and classification. Classification and control are also a part of RL.

A. ML for COVID-19

Recently, three independent perspectives on work on edge detection and computing of (COVID-19) cases have been published. Among the perspectives of view are machine-learning algorithms that recognize (COVID-19) instances (see Table I). ML algorithms for activity recognition and edge computing approaches are examples of imaging processes that can inspire ML approaches, which can assist radiologists in analyzing composite imaging and texture dataset.

TABLE I
PAPER SELECTION PROCESS AND SEARCH STRATEGY

Different Source	Total Search Query	Applying the selection standard	Total quality evaluation	Total full article reading
IEEE Xplore	45	23	20	3
Elsevier	206	135	124	11
Plos One	97	68	65	3
Springer	123	87	82	5
Science Direct	265	168	164	4
Taylor & Francis	58	38	36	2
Wiley	36	23	20	3
OMIC	128	65	63	2
Hindawi	148	72	70	2
MDPI	26	13	11	2
Total	**1132**	**692**	**655**	**37**

For the innovative COVID-19, there are different model, which are capable of analyzing medical imaging and distinguishing COVID-19 [37]. ML is one of best technologies that has been successfully considered to a variety of medical fields for the detection of the new evaluation, diagnosis, genotype phenotype associations, prognosis, sickness classification, transcriptome, and death ratio minimization.

The approach of automatic categorization of COVID-19 may be employed by analyzing universal attributes extraction structure of ML to build the more accurate feature, which is a critical model of learning. Convolutional neural networks (CNN), DenseNet, MobileNet, ResNet, Xception, Inception-ResNetV2, InceptionV3, NASNet, and VGGNet were picked from a range of deep CNN. The categorization was subsequently accomplished by feeding the collected features into various Ml classifiers, which identified them as COVID-19 or other illnesses cases [35].

Progressive ML algorithms can integrate and evaluate a large amount of data from COVID-19 patients to provide the best understanding of the viral spread pattern, improve diagnostic accuracy, develop new and effective treatment options, and even identify people at chance of the disease based on physiological and genetic characteristics [38]. The prediction of future COVID-19 cases detail analysis using AI, ML, and DL summarize and the authors concluded that AI, ML as well as DL are the key technologies, which can help healthcare organizations to support decision making in real-time to control the spread of the pandemic [104].

IV. Article Selection and a Search Method for the Literature

ML, deep learning, and other intelligent systems have been employed practically everywhere in the world. Many research articles are being conducted with the assistance of these intelligent systems on a daily basis, and various publications are

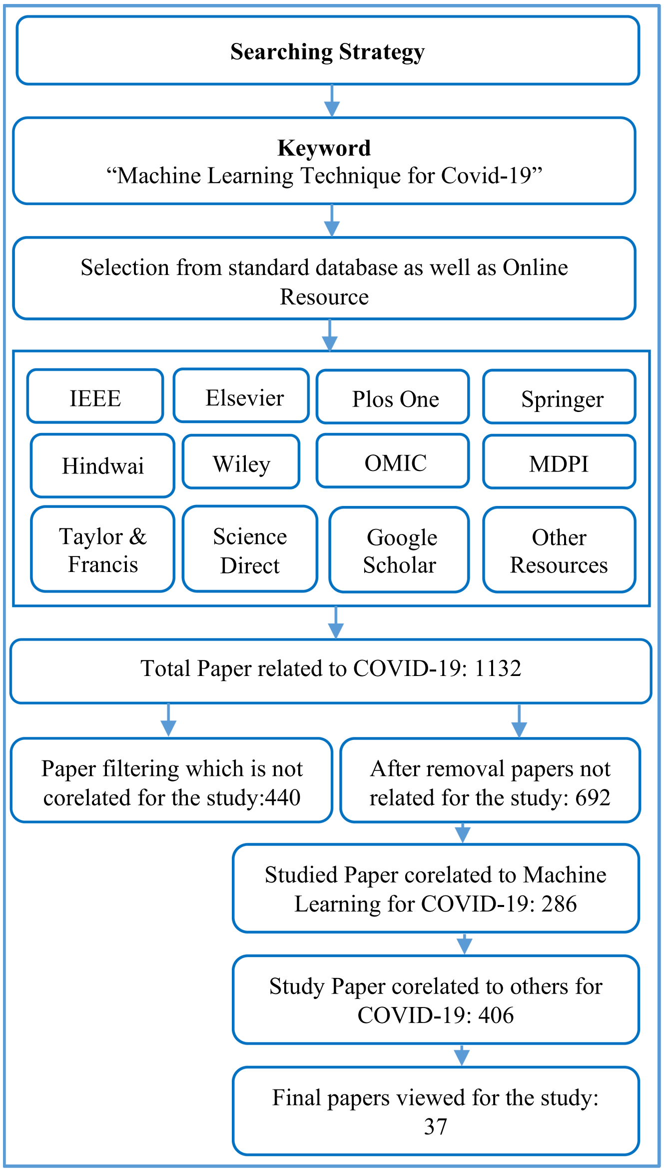

Fig. 6. Paper explores strategy functionality for the study.

being published in reputable web databases. These intelligent systems, particularly ML and DL, are used in a variety of applications including IoT, healthcare, and cyber physical systems. Following the discovery of a pandemic COVID-19 ebullition in China (Wuhan) in December 2019, the importance of these intelligent technologies in resolving COVID-19 issues has risen dramatically. Since its acknowledgment, a growing number of research projects have been launched on a daily basis. Using these criteria as inspiration, an examination of the degrees of use of ML approach for solving COVID-19 methodology is presented in this article.

We employed an exclusive article searching approach for papers gathering to accomplish this. Keywords "ML technique for COVID-19" have been searched on dissimilar sources such as IEEE Xplore, Elsevier, Google Scholar, Springer, and another database. Fig. 6 depicts the technique for finding papers. Many papers connected to COVID-19 can be located using a keyword search. We only examined publications relating to ML techniques because our focus is on ML approaches. For filtering papers, we employed both inclusion and exclusion strategies.

Inclusion the following are the procedures for filtering papers relevant to COVID-19.

1) Papers relating to ML methods used to solve COVID-19 challenges will be considered.
2) Papers on COVID-19 news, practice guidelines, datasets, biological processes, and other topics are being considered.

Also examined are the following exclusion procedures for refine research papers relevant to COVID-19.

1) COVID-19 related papers or abstract but not accessible.
2) COVID-19 papers have been published in survey reports, reviews, and other venues.
3) Papers, which are not relevant to COVID-19.

All publications that are necessary to employ in this article are considered once these inclusion and exclusion processes have been applied. For the final analysis, a total of 81 papers were considered. Out of the 81 papers, 37 are ML related, and the remaining 44 are unrelated. These 81 publications were culled from a variety of sources, such as IEEE explorer, Elsevier, science direct, Springer, MDPI, Wiley, Taylor and Francis, Hindawi, Google Scholar, Plos One, OMIC, and others. The dataset utilized, method employed, as an input type of text as well as image is used, anticipated outcomes, and utilization levels are all retrieved from each publication examined for the review. According to the exclusion and inclusion criteria, the total number of research was limited to (1132) papers from all databases. The constraint involves considering the research publication of the year (2019–2021), the article types original papers published as journal articles in english only. The publications are organized by author name, year of publication, country, dataset used, method employed, and end results in (see Table II).

V. ML Approach for COVID-19

ML is a type of ML that uses algorithms for self-learning and prediction. The affected people are identified using ML algorithms based on physiological and personalized features. Inadequate the application of ML for anticipating, screening, and identifying innovative COVID-19 associated research has been summarized in this part.

Randhawa *et al.* [79] devised a ML technique for the identification of COVID-19 genomes. The authors developed a decision tree approach, and for performance evaluation, they used publically accessible COVID-19 data with Sarbecovirus and Betacorona virus. Classification accuracy, prediction accuracy, and other evaluation metrics are addressed, and based on experimental studies, the proposed model has a 100% accuracy rate. With the use of an advance ML technique known as CNN, Apostolopoulos, and Mpesiana created a current ML technique for the detecting of COVID-19 (CNNs) [80]. The X-ray Image dataset was used to measure the proposed ML model's accuracy, performance, specificity, and sensitivity, were regarded as performance

TABLE II
ML ARTICLES DESCRIBING THE DATASET, THE AUTHOR'S IDENTITY, THE NATION OF PUBLISHING, THE METHOD USED IN THE ARTICLE, AND THE FINDINGS FOR ANALYZING THE COVID-19 DISEASE

S. No.	Author	Country	Datasets used	Methods applied	Task and Algorithm used	Results
1	Khanday *et al.* [38]	India	212 reports by GitHub	Machine Learning algorithm	Logistic Regression, Naive Bayes and Classification used	According to the study, logistic regressions and multinomial Nia"ve Bayes are 96% more accurate than commonly used algorithms.
2	Burdick *et al.* [39]	USA	197 patients of United States health systems	Support vector Kuhntucker model	Logistic Regression, Classification	Their findings revealed that this algorithm has a higher diagnostic odds ratio (12.58) for anticipating ventilation and effectively triaging patients than a comparator early warning system, such as the Modified Early Warning Score (MEWS), which had (0.78) sensitivity, whereas this algorithm had (0.90) sensitivity, resulting in higher specificity (p 0.05), It also indicates that it is capable of accurately identifying 16 percent more patients than a commonly used scoring method, resulting in fewer false positive findings.
3	Varun *et al.* [40]	USA	Total reported cases are 184,319	Machine Learning algorithm	Convolutional Neural Networks, Classifications	In response to the crisis, New York City's medical and academic centres issued a call to action to AI researchers to leverage their electronic medical record data to better understand SARS-COV-2 patients. Due to a shortage of ventilators and a reported need for a quick and accurate method of triaging patients at risk for respiratory failure, our goal was to develop a machine-learning algorithm for frontline physicians in the emergency department and inpatient floors to better risk-assess patients and predict who would require intubation and mechanical ventilation.
4	Luca *et al.* [41]	Italy	85 dataset of chest X-rays	Machine Learning algorithm	K-nearest neighbours' classifier	Authors present a method for automatically detecting COVID-19 disease by analysing medical photos in this publication. We use supervised machine learning methods to develop a model using 85 chest X-rays that are freely available for research reasons. The experiment demonstrates that the proposed technique is efficient in distinguishing between COVID-19 disease and other lung diseases.
5	Constantin *et al.* [42]	Germany	500 chest CTs dataset and 152 datasets of COVID-19 patients	Support vector Kuhntucker model	Convolutional Neural Network, Classifications	The researchers discovered that combining ML with a clinically embedded software platform allowing for speedier development, deployment, and adoption in medical practise. Finally, they developed a fully automated lung segmentation and opacity measurement approach that was ready for medical usage and performed at human levels even in difficult situations in just ten days.
6	Lamiaa *et al.* [43]	Egypt	5000 cases of COVID-19	Machine Learning algorithm	Linear Regression model	The results demonstrated that the specified models, such as exponential, 4, 5, and 6 degree polynomial regression models, are brilliant, especially the 4 degree model, which will aid the government in planning operations for one month. They also included a well-known log that will rise through the regression model, resulting in the epidemic peak and end in 2020. There is also a final report on the total number of COVID-19 patients.
7	Dan *et al.* [44]	Israel	Total 6995 patients in Sheba Medical Centre	Support vector Kuhntucker model	Artificial Neural Network and Classifications	The most relevant variables in the models were the APACHE II score, white blood cell count, time from onset of symptoms to admission, oxygen saturation, and blood lymphocytes count. Machine-learning algorithms exhibited excellent efficacy in predicting significant COVID-19 when compared to the most effective strategies available. As a result, artificial intelligence might be utilised to accurately predict COVID-19 patient risk, enhance patient triage and in hospital allocation, better prioritise medical resources and improve overall COVID-19 pandemic management.
8	Joep *et al.* [45]	Netherlands	Total 319 patients	Gradient Boosting algorithm	Logistic regression and classification	The CO-RADS scoring system on chest CT provides a sensitive and specific approach for diagnosing COVID-19, especially if RT–PCR testing are rare during an outbreak. Combining a predictive machine-learning model with diagnostic chest CT for COVID-19 could increase accuracy even more. To improve the model, they look into more possible predictors. However, because up to 9% of RT–PCR positive patients are not diagnosed by chest CT or our machine-learning model, RT–PCR should remain the gold standard of testing.
9	Christopher *et al.* [46]	Germany	Total 368 independent variables	Machine Learning algorithm	Naive Bayes and Classifications	They mainly focused on variables and factors that increasing COVID-19 incidence in Germany, using the multi method ESDA technique, which also provides an appropriate insight into spatial and spatial non stationaries of COVID-19 occurrence. Variables like infrastructure, built environment densities, and socioeconomic factors all showed a link with COVID-19 after being examined on a county level in Germany. Their findings suggest that avoiding needless travel and social isolation can be effective approaches to limit contamination.
10	Hoyt *et al.* [47]	U.S.	Total 290 patients	Support vector Kuhntucker model	Logistic Regression and Classification	In the entire population, the findings revealed no link between mortality and therapy, although hydroxychloroquine was connected to a statistically significant (p = 0.011) improvement in survival, with an adjusted hazard ratio of 0.29 and a confidence interval (CI) of 0.11–0.75. Despite the fact that the algorithm predicted an adjusted survival of 82.6 percent in the treated group and 51.2 percent in the untreated group, the algorithm detected a 31 percent improvement in the COVID-19 population after machine learning applications, demonstrating the critical role of machine learning in medicine.

TABLE II
(CONTINUED.)

11	María.*et al.* [48]	International	Food for each of the 170 countries	Machine Learning algorithm	K-means clustering	According to the data, countries with the highest death rates consume more fats, whereas those with the lowest death rates consume more grains and have a lower overall average calorie intake.
12	Shinwoo *et al.* [49]	U.S.A.	Toal 790 Korean immigrants	Machine Learning algorithm	Artificial Neural Network, Classifications	Artificial Neural Network (ANN) analysis, a statistical model capable of investigating complex non-linear interactions of variables, was applied. The algorithm has properly predicted a person's flexibility, familiarity with everyday discernments, and racial actions toward Asians in the United States since the beginning of the COVID-19 epidemic, offering critical advice for public health. practitioners
13	Yigrem.*et al.* [50]	Southern Ethiopia	Total 244 samples	Machine Learning algorithm	Logistic Regression, Classification	More than half of the study participants reported coronavirus disease-related stress, showing that there is a strong association between COVID-19-related stress and health-care employees.
14	Abolfazl *et al.* [51]	U.S.A.	Total database of 57 candidate from the US Centres for Disease and Control and Johns Hopkins University	Machine Learning algorithm	Artificial Neural Networks, Classification	According to Getis-Ord Gi, the results showed that the supplied model (logistic regression) demonstrated that these components and factors define the presence/absence of the COVID-19 hotspot in a geographic information system (p 0.05). As a result, the findings were useful in identifying the impact of potential risk variables connected to COVID-19 for public health decision-makers.
15	Rustam F *et al.* [52]	Pakistan	Time Series COVID-19 database	LR, LASSO, SVM, ER	Texture data is used as input and supervised learning such as Linear Regression, LASSO Regression, Support Vector Machine, Exponential Smoothing used	ES outperforms all other models, followed by LR and LASSO, which are also good at projecting new confirmed instances.
16	Sharma S [53]	India	CT Image database	Residual Neural Network	Image data is used as input and custom vision software of Microsoft azure based on machine learning techniques is used	91% accuracy achieved
	Peng Y, Nagata MH [54]	Brazil	various countries COVID-19 data	Support Vector Regression (SVR)	Text data is used as input and Support vector regression and kernel functions used	It is clear that caution is required when using Machine Learning.
17	Ardabili SF *et al.* [55]	Germany	5 countries COVID data	MLP, ANFIS	Time-series data as an input and Genetic Algorithm and Particle Swarm Optimization and supervised learning algorithm is used	High generalization
18	Nemati M *et al.* [56]	USA	1,182 hospitalized patients COVID-19 dataset	SVM	Text data is used as input	Significant results have been achieved in predicting recovery time
19	Sun CLF *et al.* [57]	USA	COVID-19 patients' data of Massachusetts, Georgia, and New Jersey	Gradient Boosting algorithm	Texture data is used as input	Better prediction rate
20	Burdick H *et al.* [58]	USA	COVID-19 Patient Dataset	Machine Learning algorithm	Text data is used as input and ML and MEWS used	Good prediction rate
21	Kavadi DP *et al.* [59]	India	Indian COVID-19 Dataset	Support vector Kuhntucker model	Text data is used as input and propose a partial derivative regression and non linear machine learning (PDR-NML) method is used	Better prediction rate
22	Banerjee A *et al.* [60]	UK	D-19 data from Midstream	ANN	Text data is used as input	A higher rate of infection detection prediction is attained.
23	Wang P *et al.* [61]	China	COVID-19 Data	Logistic Model + Prophet method	Time-series data as an input and Fb Prophet model used	Good prediction rate
24	Han Z *et al.* [62]	China	CT datasets	AD3D-MIL algorithm (A Deep 3D-Multiple Instance Learning)	Image data is used as input and attention-based deep 3D multiple instance learning (AD3D-MIL) is used	An accuracy of 97.9% is obtained
25	Vaid S *et al.* [63]	Canada	JHU CSSE database	developed a machine-learning model to uncover hidden patterns based on reported cases and to predict potential infections.	Text data is used as input	Good prediction rate
26	Elaziz MA *et al.* [64]	Egypt	Two chest X-ray COVID-19 dataset	KNN (K Nearest Neighbour) + Manta-Ray Foraging Optimization (MRFO)	Image data is used as input and CNN used	For two datasets, accuracy of 96.09% and 98.09% was obtained.
27	Ahamad MM *et al.* [65]	Bangladesh	Patient COVID-19 data	Extreme Gradient Boosting, Decision Tree, Random Forest (RF), SVM, Gradient Boosting Machine	Text data is used as input and Random Forest, XGBoost, Gradient Boosting Machine and SVM is used	XGB outperformed other proposed methods

TABLE II
(CONTINUED.)

28	Brinati D *et al.* [66] Hasan N [67]	Italy Wuhan	time series COVID-19 dataset	Ensemble Empirical Mode Decomposition (EEMD) + ANN)	Text data is used as input and Support Vector Machines and Random Forest algorithm used	Better prediction rate
29	Farid AA *et al.* [68]	Egypt	CT images COVID-19 dataset	SVM, NB, CNN, RF, as well as JRIP	Image data is used as input and Composite hybrid feature extraction (CHFS) used	The proposed CHFS has a higher prediction rate than CNN.
30	Shaban WM *et al.* [69]	Egypt	CT images COVID-19 dataset	Enhanced KNN	Image data is used as input and Genetic Algorithm (GA) and K-Nearest Neighbour (EKNN) classifier is used	Good detection rate
31	Ou S *et al.* [70]	China	Pandemic COVID-19 data	Neural Network	Text data is used as input and Support Vector Machines and Random Forest algorithm used	Good identification rate
32	Samuel J *et al.* [71]	USA	COVID-19 dataset	LR, Naive Bayes (NB), Linear Regression (LiR), KNN	Text data is used as input and Logistics regression (LR) and K-Nearest Neighbour (KNN) is used	NB outperformed other techniques
33	Pinter G *et al.* [72]	Germany	COVID-19 dataset of Hungary data	ANFIS (Adaptive Network-based Fuzzy Inference System) & MLP-ICA (Multi Layered Perceptron-Imperialist Competitive Algorithm)	Text data is used as input and adaptive network-based fuzzy inference system (ANFIS) and multi-layered perceptron-imperialist competitive algorithm (MLP-ICA) are used	Good prediction rate
34	Carrillo-Larco RM *et al.* [73]	UK	COVID-19 patients' data	K-Means algorithm	Text data is used as input and unsupervised machine learning used	Better classification rate
35	Bentez-Pena S *et al.* [74]	Spain	patients' COVID-19 data	RF and Support Vector Regression (SVR)	Text data is used as input	High prediction rate
36	Zhong L *et al.* [75]	China	patient COVID-19	SVM, KNN, RF, LR	Text data is used as input	Better severity detection
			blood sample data			
37	Yadav M *et al.* [76]	India	COVID-19 Synthetic dataset	SVR	Text data is used as input and Support Vector Regression (SVR) is used	Polynomial Regression (PLR), SVR Outperformed LiR,
38	Chang *et al.* [101]	Australia	COVID-19 dataset	ABM approach	Australian Census-based Epidemic Model	Agent based modelling using a fine-grained computational simulation applied
39	Zhang *et al.* [102]	Africa	Africa CDC dataset	PHSM data (Oxford COVID-19 Government Response Tracker dataset)	Text data is used as input	Descriptive analyses were done to establish the different cases
40	Andrikopoulos *et al.* [103]	Australia	COVID-19 dataset	Australian Centre for Behavioural Research in Diabetes (ACBRD), Diabetes Australia adapted a resource developed	Text data is used as input	It is clear that people with diabetes are at greater risk of serious health impacts in pandemics such as COVID-19 than people without diabetes

parameters [81]–[83]. Later, experimental investigations were carried out, and the constructed CNN architecture was found to have a high detection rate. Kang *et al.* [86] developed a novel COVID-19 automatic analysis pipeline that may entirely change the retrieved features from CT images. The authors developed a structured latent image that may encode data from multiple feature characteristics in order to investigate them by recalling images from various investigations. To obtain matching data for the COVID-19 analysis, the authors used both K-nearest neighbor (KNN) and NB techniques.

The proposed model can be used for a variety of classifiers to ensure correctness. The authors achieved a 95% accuracy rate, a 96.6% specificity rate, and a 93.2% sensitivity rate. Cheng *et al.* [100] developed a ML-based method for predicting COVID patients' ICU transfers. Nursing assessments, laboratory data, electrocardiograms, and time series were used as input types in the authors' random forest (RF) model. The suggested model has demonstrated the importance of shock, inflammation, respiratory failure and renal in the progression of COVID-19. It had 72.8% sensitivity, 76.3% specificity, 79.9% AUC, and 76.2% accuracy, according to the researchers. The researchers stated that the ML based forecasting methods can be used as a testing tool to recognize the scourge of COVID-19 patients and to improve hospital resources by transporting more effective care based on the results of the experiments. Khanday *et al.* [38] suggested a strategy for detecting pandemics based on clinical text data. Using both ensemble and standard ML algorithms, the authors were able to categorize textual clinical data into four separate classifications. The researchers used 212 clinical records that were classified into four categories: ARDS, SARS, COVID, and both COVID and ARDS. They used different feature to feed the ensemble with features such as report length, bag of words and or inverse document frequency or term frequency, as well as traditional ML classifiers. The author reported that Logistic regression and multinomial Naive Bayes delivered better results with precision, recall, f1score, and accuracy rates of 94%, 96%, 95%, and 96.2%, respectively. Assaf *et al.* [44] employed ML approaches to accurately estimate COVID-19 risk variables. Different medical center shows of COVID-19 patients were used in the demonstration review. The researchers have only ejected severe covid19 patients at the admission stage because to poor arterial oxygen and oxygen saturation. They compared three different ML approaches for anticipating patient descent to the APACHE-II risk computing score and currently recommended predictors. They looked at 6995 individuals and discovered 162 of them needed to be admitted to the hospital, with 25 of them suffering from severe covid19. The authors found that the predicted models outperformed 92.0% accuracy, 88.0% sensitivity, and 92.7% specificity rates, respectively, based on experimental findings. Table I also presents several other uses of ML for overcoming COVID-19 problems.

VI. COVID-19 Data Processing Challenges Using Intelligent Computing Approaches

The breakout of the COVID-19 epidemic has had an economic and social effect on billions of people across the world. Because these methods have been widely employed in a different application ranging from bioinformatics to image processing the pandemic has encouraged scientists to employ intelligent computer methods in the detection, prevention, and evaluation of COVID-19. The successful implementation of scientific methodologies requires data, whether closed-source or open-source [77]–[78]. Open-source data deliver outstanding quality, transparency, and versatility. Open-source data are thought to be more relevant for COVID-19 detection in the current COVID-19 epidemic. As a result, diagnosing and forecasting COVID-19 from text data like COVID-19 reports and social media dataset, as well as medical imaging like chest X-rays and computer geographics scans, necessitates a mix of intelligent computation technique and open-source data. While epidemiological studies of COVID-19 case describe can be used to analyze virus transmission forecasts, intelligent computer approaches can defeat the constraints of RT-PCR examine kits in identifying COVID-19 from medical imaging. Policymakers can also benefit from social data mining while conducting socioeconomic research.

Although leveraging intelligent computing methods and open source dataset to identify the COVID-19 pandemic provides effective answers, there are significant obstacles to overcome. One of the most pressing issues is improving the quality of medical images for use in clinical practice, as most studies believe that using medical images to diagnose COVID-19 is ineffective. Patients who positive tested for RT-PCR should have a normal chest scan when admitted. As a result, researchers have said that RTPCR should only be used as a primary source of verification and identification, whereas medical imaging should only be used as a secondary diagnosis approach [79]. As a result, demonstrating the association between radiography and RT-PCR testing is a challenge [80]–[81]. The progress of contact fewer work flows to safeguard medical practitioners from COVID-19 influenced individuals is another problem [80].

The majority of the datasets used in the diagnostic are small. As a result, larger datasets are necessary to provide higher observations and accuracy when employing deep learning algorithms. Textual data from online origins may be used to conduct an effective epidemiological analysis of COVID-19. Because most research only looked at a few factors, the analysis of these epidemiological findings is inaccurate. As a result, in order to produce reliable projections, the research analyst must first determine the virus's regional, national, and international spread. Furthermore, considerations such as the deployment of quarantine measures and the distinction between deaths induced by coronavirus and deaths sourced by unidentified disease must be measured when predicting COVID-19 using textual data.

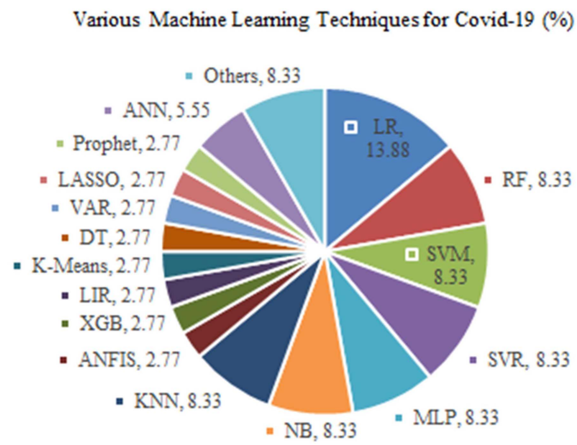

Fig. 7. Usage different level of ML methods for COVID-19.

A. Critical Analysis

ML has become a rapidly expanding mode in healthcare, as it has in other real-world applications. Sensors in wearable components display real-time patients' dataset such as health status, blood sugar level, heart rate, blood pressure, and other critical signs. Health professionals could be used this information to assess each person's health and anticipate the occurrence of disorders in the future. ML approaches are disseminating novel affectivities and chances, making it easier for researchers, physicians, and clinicians to anticipate and understand diseases and advance people's lives.

B. Popular ML Methods

We discovered that many ML articles were used to resolve COVID-19 disputes out of all the articles included for this study. We analyzed the utilization levels of ML approaches among them based on these ML articles. MLP, KNN, SVM, RF, ANFIS, NB, LR, LIR, and other algorithms were discovered, and their statistics are shown in Fig. 7. ML approaches, such as LR, MLP, NB, SVM, KNN, and RF, were mostly employed for COVID-19, which is the top six among other ML methods, according to the analysis done for Fig. 8. In our opinion, the main motivations for using ML approaches, as shown in Fig. 8, have been recognized and articulated. SVMs have mostly been used to classify features. SVM has also equaled employed for COVID-19 associated concerns because it has delivered an effective accuracy rate in several instances. It is also worth noting that SVM is a powerful binary classifier. ANFIS, a ML approach, was also applied. It has been determined that one of the most compelling reasons to use this strategy is that it effectively combines NN and fuzzy

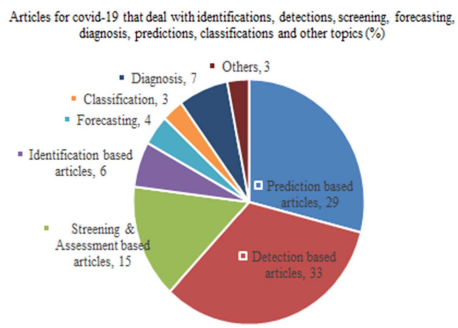

Fig. 8. Articles for covid-19 that deal with identifications, detections, screening, forecasting, diagnosis, predictions, classifications, and other topics (%).

logic. As a result, ANFIS was used to deal with the unclear data from the COVID-19 epidemic.

Furthermore, for new COVID-19 data fitting and classification, approaches, such as XGB, NB, AdaBoost, and others, are used. LASSO and RF have also been used to fit COVID-19 associated dataset because they have been shown to be helpful in addressing with fitness functions difficulties. One of the well-known approaches, decision trees, has been predominantly employed for the categorization of COVID-19 genomes because it has proven to be useful in finding modules. It is also been used to keep track of the number of clusters in COVID-19 data to minimize the number of calls. Since it has been proved to be beneficial in data-driven analysis, the K-means technique has been utilized to group heterogeneous elements into COVID-19 clusters.

Other ML algorithms, including as LR and vector autoregression, have also been widely used in a variety of applications, including regression analytic of COVID-19 dataset, as well as predicting and forecasting's COVID-19 time series dataset. In a number of studies, multilayer perceptron (MLP), a type of neural network, has been found to be useful in information processing. As a result, this approach has been used to anticipate the COVID-19 outbreak. As a result, we have given essential arguments for the use of each technique revealed in this research effort, in our opinion.

C. Different ML and Similar Methods Publication Analysis

For searching different keyword such as ("COVID-19", "ML technique for COVID-19") were conducted in the usual online databases "IEEE Xplore, Elsevier, Google Scholar, Springer" in order to extract pertinent research articles for this article. We discovered 1132 publications connected to COVID-19 based on searched keywords. We collect 655 research papers among the 692 papers after excluding those that were unrelated to our review process. Following the exclusion, 81 articles are chosen as being related to the subject. We also acknowledged other resources, which are connected to COVID-19, for instance dataset and the kind of data utilized for COVID-19, in addition to these 81 papers. There was a total of 81 papers used in this article.

Because COVID-19 emerged in such a very short duration, most researchers have focused their efforts on COVID-19 detection, identification, and prediction utilizing sophisticated ML algorithms. We discovered that important researchers publish detection-based publications first, followed by prediction based research, from all of the articles we obtained. According to our findings, the top three article categories are 31% for COVID-19 detection, 27% for COVID-19 prediction, and 17% for COVID-19 screening and assessment using intelligent methodologies. The results of this investigation are shown in Fig. 8.

Various researchers have conducted and continue to perform studies in order to detect, forecast, predict, and gather data on active, recovered and death causes of COVID-19 approximately the world since the outbreak in January 2020. The majority of those research works, according to our findings in this article, are mostly focused on using ML and mathematical model. Several models have demonstrated their effectiveness in predicting and forecasting the COVID-19 utilizing existing COVID-19 related data. Even if the COVID-19 pandemic is considered as a terrifying condition in its essence, the future is uncertain. Many individuals are undecided because they are unexpected with the spreadable virus, as well as the variegated, diverse, and vivid human deeds, governments engagement, and difficult situations. The situation's final ambiguity has the potential to confound the forecast accuracy aim.

VII. Discussions and Implications

The COVID-19 epidemic has become a major national security concern in various countries. To get insight into the repercussions and spread of this deadly disease, accurate epidemic prediction models must be developed. This article examines a variety of clever strategies for COVID-19 prognosis. ML approaches have previously demonstrated their efficacy in better understanding viral propagation patterns. Advanced features of ML have enhanced diagnostic speed as well as accuracy, created new efficient therapy improvements, and recognized the large number of affected individuals with physiological attribute [24]. The clinical data and health conditions of COVID-19 patients were studied using ML and other approaches in order to not only recognize any consistent attribute for risk evaluation, but also to classify risk and forecast the balanced trained of present disease dealing and COVID-19 defense. To deal the constantly increasing number of COVID-19 patients around the world, a viable therapeutic technique is urgently required. Because there is no viable treatments for COVID-19, developing an efficient enhancement to create or repurpose a new clinically approved medicine against COVID-19 is becoming increasingly vital.

An ML-based relocation structure was modified at the time to prioritize available drugs for COVID-19 medical trials [82]. In addition, used a drug distinguish feature based on ML to aim to bring out novel drug-like compound against COVID-19 [99]. At this time, numerous efforts have been made to improve analytical achievements using ML [83], [84]. A few examples are as follows: Using a CRISPR based virus recognition system, the ML based transmission of SARS-CoV-2 was validated with great sensitivity and speed [54].

Similarly, because COVID-19 emerged in such a short period of time, many researchers have focused their efforts on detecting and predicting COVID-19 using advanced ML techniques such as taxonomic categorization of COVID-19 genomes, among others [79]. While current research has primarily focused on detection and identification, there are many others areas to noticed and investigate encourage. Afterward the beginning of the pandemic, many doctors and researchers throughout the world have refined many strategies for predicting COVID-19 in various places. However, the bulk of strategies fail due to a lack of exact answers capable of predicting the COVID-19. Each model employs a variety of procedures, constructs a variety of claims, generates a variety of outcomes, and combats uncertainty in a variety of ways.

The information on COVID-19 trends around the world includes healthcare requirements, recovered, social distancing, pressure, tainted, as well as coming cases, and much more. Furthermore, in an era when technique appropriateness is critical, there was no such recognized liability. The majority of statistic revealed that the methods for estimating the number of deaths case caused by COVID-19 were inconsistent. All predicting approaches have shown a wide range of predicted differences due to a lack of exact information. Similarly, discrepancies in prediction can be explained by the forecast of approaching results based on data from specific cases. Apart from the spread of lethal diseases, social isolation, and demographics, many additional aspects such as disability, chronic sickness, inadequate immunity, and so on must be considered. The main disadvantage for researchers is that they are unable to accurately predict pandemics. As a result, in order to generate more predictions, a new study must be conducted to improve prediction methodologies and tools for the majority of biological data. The COVID-19 epidemic is spreading day by day, despite different procedures, precautions, and research publications. As of July 19, 2021, the total number of confirmed cases was 191 231 992, with 174 185 489 recoveries and 4 105 868 death fatalities worldwide. The majority of cases, particularly in India, are expected to continue to expand as social distancing procedures are calmed before pronouncing a constant rejection in new cases.

A. Various Approaches for Assisting in COVID-19 Containment

Various forecast approaches, remedies, and precautions adopted by each individual can temporarily halt the pandemic's spread, assisting in COVID-19 containment. No one knows when this epidemic will come to an end. This lethal disease is unrivalled in terms of its ease of transmission, a slew of symptoms that spread from one person to the next in a poisonous manner, and the scale of the epidemic has wracked the world. The pandemic may be brought to a halt because citizens have grown tired of terror and have been taught to live with a sickness, as previous outbreaks have done in the past. Humans have been exposed to a variety of terrible diseases, including Ebola, smallpox, influenza, and many others. However, all of these diseases have been eradicated following different deaths as a result of the implementation of policy measures, quarantines, and the eradication of a few diseases as a result of the development of vaccinations. The strategies used in the early plagues have become rules for a world looking for new ways to update strength and a feeling of normalcy.

COVID-19's continuations are expected to be short, but its termination will necessitate a comprehensive agreement that ensures early disease prevention, including new medicines to alleviate symptoms, social protective measures, and a vaccine. Furthermore, different researcher must work on a variety of issues in order to develop drugs. Vaccines are, thus, the long-term approach to stopping this outbreak, which could take months or even years to fully resolve. If the drug is made available all over the world, the pandemic is likely to spread to people who are not now unwell or recovering. The vaccines and natural exemptions will be grouped together to defend the bulk of the populations. So, based on our findings, we can be confident that this space may be organically fielded by detecting drugs utilizing a collection of known illness treatments, such as sars-1, Spanish flu, and others using ML approaches. The importance of ML for COVID-19 has been demonstrated in this article. We have concentrated on a thorough examination of ML approaches for COVID-19, as well as their applications.

B. Limitations of ML

According to our findings, various limitations of ML, such as a lack of recognizing equipment, the use of biomedical data, heterogeneity, and a lack of medical equipment, rendered ML approaches more potent and suited for predicting the COVID-19 pandemic. ML approaches are suited for COVID-19 prediction because they can aid in the improved identification of infections by health systems. Multiple researches with trustworthy data on increasing the efficaciousness of medical check-ups by anticipating adverse consequences and discovering novel ways to accomplish it have been exceeded by ML technologies. When ML was compared with COVID-19 prediction, the majority of ML attributes such as recognition, lack of human involvement, and superior performance built it a more efficient and admired approaches.

This eruption has been labelled a public health emergency by the World Health Organization. Every part of life is affected by technological improvements, and the medical field is one of the most directly linked to people's daily lives [85]. AI has lately been enclosed to the medical area, and it has showed promise in health care because to the high precision of data processing that allows for precise decision-making. By incorporating AI algorithms into the disease's diagnosis, researchers from all over the world aimed to ameliorate clinical diagnosing and slow the virus's spread. This review paper evaluates the outcomes of a variety of AI algorithms used in research to determine, which method is the most accurate and enhances COVID-19 diagnosis the most. There were 37 original articles used in this article, all of which use supervised learning as the major approach, albeit the methods used dissented depending on the research goal. More than half of the study participants reported coronavirus disease-related felt stress, demonstrating a strong association between health-care workers and COVID-19-related perceived stress [50].

VIII. Limitations and Future Scope

This article examines the use of ML methods to COVID-19. The primary goal of this survey was to examine the global impact of this epidemic, as well as the motivation for using ML approaches to COVID-19. We went through all of the ML models used in COVID-19, as well as the effective incentives. Likewise, aside from prediction and identifications, the need for more study in other areas was also highlighted previously. Based on the findings of this article, we highly suggest that many more studies be done using ML on COVID-19 data using approaches that have not previously been deployed. In order to undertake further advanced research, it is also necessary to solve the issues of COVID-19 data scarcity. COVID-19 has a significant influence on a number of industries. More than 200 nations have been recognized as having COVID-19 instances.

We mainly focused on the most pressing issues present in the literatures as well as potential study paths for future research.

1) Because the evidences of COVID-19, disease and other respiratoria illnesses are so standardized, establishing an appropriate DL model that can accurately identify COVID-19 remains a problem [86].
2) A key difficulty for COVID-19 is the lack of a high-quality dataset. This can be attributed to a variety of factors, considering such as 1) different sources and unpublished data; 2) the dispersed cause of COVID-19 data; and 3) data secrecy concerns that limitation of dataset availability [87]. To extend the available different datasets and speed AI research for COVID-19, collaboration across all medical organizations around the world is critical.
3) Variability in the testing procedure between nations and hospitals is a major problem that might result in nonuniformness in the labeling operations.
4) The COVID-19 infectious is quickly mutating in dissimilar parts of the world. As a result, data obtained in one location may not be adequate for inferring interferences in another. [88].
5) Medical personnel are the first line of defense in the fight against the epidemic. To protect children from infections, additional contact-free screening, and diagnosis methods are urgently needed.
6) The majority of current deep learning models were trained on two-dimensional (2-D) pictures. However, because the majority of CT and MRI scan pictures are 3-D, appending another attribute is necessary to maximize the effect of the image [89], [90].
7) As a result of the similar operations of combining medical imaging dataset, the data diversity grows, necessitating the requirement to verify the resilience of ML produced models.
8) The majority of the COVID-19 datasets accessible are small. As a result, transfer discovering is a promising future research path which might aid in the detection of anomalies in tiny datasets while also producing reliable predictions and impressive outcomes [91].
9) According to the research, there appears to be a link among COVID-19 transmission and various medicals problem. As a result, a patient's record of various diseases (kidney, diabetes, heart disease, liver, etc.) can be considered into account in both the COVID-19 forecasting and detecting processes in order to offer a precise and reliable prediction model [61], [92], [93].
10) When equated to exploiting with IoT device, building complicated ML models, analyzing, and interpreting large data requires a lot of computing power. As a result, fog and edge computing may be useful in addressing these problems [94].
11) To improve the interpretation of data gathered from various sensors, several preprocessing processes are necessary (i.e., quality improvement, data cleaning, outlier detection, etc.) [95], [96], [97].
12) Recently NLP applications have restricted the value of a diagnostic scheme like this. To transfer performance to a given domain context, working with methods that assess semantic textual similarity is necessary (i.e., COVID-19) [98].
13) Because it combines diverse data, data fusion is difficult[1]. It does, however, increase the functioning of the models that arise. In the article, there are several fusion procedures. As a result, adaptive multimodels are critical for handling data from numerous sensors [99].
14) To improve the functioning of working on sound data and X-ray, more complex approaches are required.
15) The explain ability and interpretability of ML approaches is a major problem. Medical professionals must understand, which characteristics are used to identify COVID-19 from non-COVID-19.[2] ML should also look at methods to predict infections before symptoms develop. In COVID-19 prediction, diagnosis, screening, and other different ML methodology have showed promising results. However, the majority of these models have not been tested in a real-world setting (e.g., hospitals, emerging service) to demonstrate their efficacy in combating the COVID-19 epidemic. As a result, many challenges must be overcome in order to spread such diagnosing models, include 1) network security consistence in order to allow more authentic communications and desired data on the networks; 2) fog, edge and cloud computing adaptation; and 3) privacy and security issues relating to patient's dataset.

ML is a cutting-edge method with several applications in prediction. For the COVID-19 pandemic, this method will be used to detect high-risk individuals, as well as their mortality rate and other anomalies. It can be used to better understand the virus's nature and forecast future problems.

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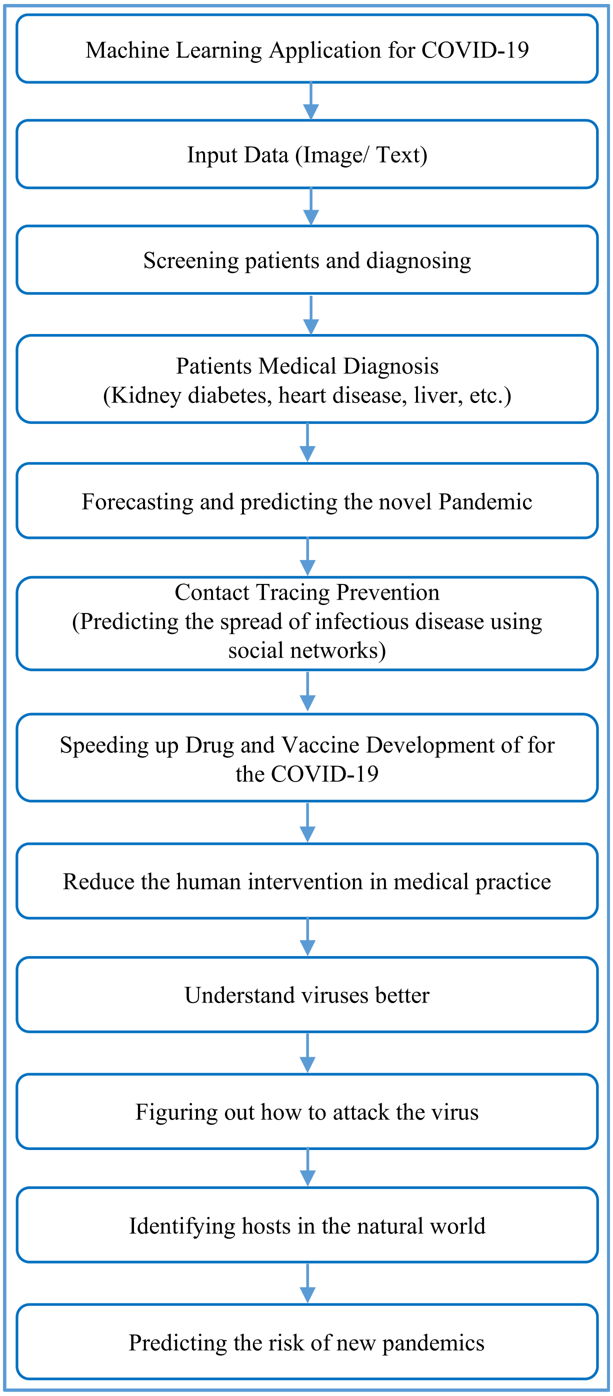

Fig. 9. Flowchart for significant applications of ML for COVID-19 pandemic.

Fig. 9 depicts how ML may enhance treatment, medication, screening and prediction, forecasting, contact tracking, and drug/vaccine development for the COVID-19 pandemic while reducing human participation in medical practice.

IX. Conclusion

In this article, we mainly focused on the use of different ML applications in COVID-19 disease for different purposes using various algorithms. Based on the findings of this article, it appears that ML have been utilized mostly for COVID-19 forecasting, detection, identification, and screening from December 2019 to the present. ML methods such as LR, RF, KNN, and SVM have been employed to solve COVID-19 difficulties. However, complex ML algorithms such as encouraging, bagging, stacking, and others must be included. Other ML approaches, for example Bayesian networks such as decision tree algorithms such as C4.0, Gaussian Naive Bayes and different clustering algorithm like K-Means, Hierarchical, and K-Medians, must also be used with COVID-19 dataset for successfully classified and detecting the dissimilar symptom. It is also worth noting that ANNs like back propagation, perceptron, and radial basis function based NN must be used with COVID-19 data. CNN and its derivatives have been effectively used to resolve COVID-19 concerns in the instance of DL.

This article examines the methodology of ML algorithms to COVID-19. The primary goal of this survey is to examine the global effect of this pandemic, as well as the motivation for enforcing ML techniques to COVID-19. We went over all of the ML models used in COVID-19, as well as the effective incentives. Similarly, aside from prediction and identifications, the need for more research in other areas was also emphasized above. Based on the findings of the survey, we highly suggest that many more studies be undertaken using ML on COVID-19 data using methodologies that have not yet been deployed. In order to perform further advanced research, it is also necessary to overcome the difficulties of COVID-19 data scarcity.

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