

## A Review on Prediction of Covid-19 Cases using Machine Learning for Effective Public Health Management

Suberu Yusuf<sup>1</sup> Badamasi Imam Ya'u<sup>2</sup>, Kabiru Musa Ibrahim<sup>3</sup> Muhammed Ali Bizi<sup>4</sup> Abdullahi Mukhtar Ahmed<sup>4</sup>, Lawan Garba<sup>5</sup>

<sup>1</sup>Department of Computer Sciences, Federal Polytechnic, Bauchi, Nigeria

<sup>2</sup>Department of Mathematical Sciences, Abubakar Tafawa Balewa University, Bauchi, Nigeria

<sup>3</sup>Department of Computer Sciences, Federal Polytechnic, Damaturu, Nigeria

<sup>4</sup>Sunnah College of Education, Bauchi, Nigeria

### ABSTRACT

COVID-19 is a worldwide pandemic that has infected practically every country. At the moment, sustainable development in the field of public health is regarded as critical to ensuring a bright and prosperous future for people. However, prevalent disorders such as COVID-19 pose various hurdles to this endeavor, some of which are still unknown. A Shallow Single Layer Perceptron Neural Network (SSLPNN) and Gaussian Process Regression (GPR) model were used in this study for the classification and prediction of confirmed COVID-19 cases in five geographically diverse Asian regions with diverse settings and environmental conditions: China, South Korea, Japan, Saudi Arabia, and Pakistan. The input dataset included significant environmental and non-environmental factors, while the output dataset included confirmed COVID-19 cases. To discover patterns in the instances connected to fluctuations in the underlying variables, a correlation analysis was performed. This paper discusses some of the limitations of this model. The Shallow single layer perceptron neural network has a single layer of neurons and can only learn linear relationships between inputs and outputs. Convolutional Neural Network (CNN) methods will be introduced to address these issues. However, dynamic management has taken center stage in studies on the long-term growth of public health. However, dynamic management is dependent on proactive measures based on statistically validated methodologies, such as Artificial Intelligence (AI). In this study, a deep learning (CNN) model was trained to classify public health-related data, allowing the prediction of the number of confirmed COVID-19 cases in a particular location depending on parameter values. As a result, an autonomous prediction system aimed at determining the presence of COVID-19 in a person is required. A COVID-19 prediction model requires machine learning classification techniques, datasets, and machine learning software.

### ARTICLE INFO

Article History

Received: March, 2023

Received in revised form: April, 2023

Accepted: May, 2023

Published online: June, 2023

### KEYWORDS

Public health; sustainable development; artificial intelligence; SARSCoV-2; shallow single-layer perceptron neural network; binary classification; gaussian process regression. Deep learning, Convolutional neural Network.

### INTRODUCTION

The infectious disease Coronavirus Disease COVID-19 (2019) is caused by a new coronavirus that first surfaced in Wuhan, China, in December. Some people may recover from this respiratory ailment without having any particular care, especially if they have a robust immune system (Villanceno et al., 2021). Others, however, may be different. Older people, including those with existing co

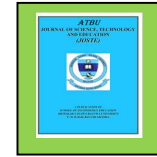
morbidities such as cardiovascular disease, diabetes, respiratory disease, and cancer, are more vulnerable (Majumdar et al., 2021). COVID-19 is a multisystemic disease, not merely a respiratory condition. According to recent research, this virus affects nearly all organs of the body, which is exacerbated by its extensive inflammatory response (Temgoua et al., 2020). According to the World Health Organization (WHO), frequent hand washing,

Corresponding author: Suberu Yusuf

✉ [yusufs@fotb.edu.ng](mailto:yusufs@fotb.edu.ng)

Department of Computer Sciences, Federal Polytechnic, Bauchi.

© 2023. Faculty of Tech. Education, ATBU Bauchi. All rights reserved



disinfection, social distancing, wearing masks, and not touching your face can help prevent infection (Ahmed et al., 2021). The WHO listed several symptoms, emphasizing that fever, a dry cough, and tiredness were the most common, while headaches, sore throat, diarrhea, conjunctivitis, loss of smell, and rashes were less common, and breathing problems, chest pain, and loss of speech and movement were serious.

As the situation worsens, suitable AI-based technologies must be investigated; a machine learning method leverages big data for pattern detection, explanation, and prediction based on input data (Garcia et al., 2019, Hassan et al., 2018). As a result, AI has the ability to create tools to combat COVID-19. We used SSLPNN and GPR in this work to forecast the classes to which unique case studies belonged as well as the number of confirmed COVID-19 cases in certain geographical locations. Climate and socioeconomic conditions, on the other hand, have a strong association with the incidence and transmission of infectious diseases (Esteva et al., 2017; Emrah et al., 2021). Nonetheless, this research will aid in the creation of public health policies for the management of sustainable development strategies.

#### **Dynamic Health Management System**

This paper examines how machine learning (ML)/deep learning (DL) technologies have changed industries such as manufacturing, transportation, and governance ML/DL algorithms are now influencing healthcare, an area that has generally been resistant to large-scale technology innovations (Latif et al., 2017). Recently, ML/DL approaches have demonstrated exceptional results in a variety of tasks, including the recognition of bodily organs from medical photographs (Yan.Z et al., 2016). To mention a few, classification of interstitial lung illnesses (Anthimopoulos et al., 2016), detection of lung nodules (Shen.et al., 2015), medical image reconstruction (Majumdar et al., 2021, Schlemper et al., 2017), and brain tumor segmentation (Havaei.et al., 2017) Intelligent software is projected to assist radiologists and physicians in examining patients in the near future (Bourzac.K et al., 2013), and machine

learning (ML) will transform medical research and practice (Xing.,et al., 2018). Clinical pathology (Bejnordi et al., 2017), radiology (Rajpurkar. et al., 2017), ophthalmology (Gulshan et al., 2016), and dermatology (Fatima. & Pasha, 2017) have emerged as exciting application areas for ML/DL models. According to some of these research, DL models outperform human physicians on average. The fact that DL models outperform humans has led to the development of computer-aided diagnosis systems. For example, the United States Food and Drug Administration (FDA) announced in 2018 the approval of an intelligent diagnosis system to detect certain diabetes-related eye problems from medical images that will not require any human intervention. The potential of ML models for healthcare applications is additionally aided by advancements in concurrently emerging technologies such as cloud/edge computing, mobile communication, and big data technology (Laatifi et al., 2022). ML/DL, when combined with these technologies, is capable of providing extremely accurate prediction outcomes and can aid in the development of human-centered intelligent solutions (Chen & Lin 2014). Along with other advantages such as enabling remote healthcare services in rural and low-income areas, these technologies have the potential to play a critical role in rejuvenating the healthcare business. Prognosis, diagnosis, therapy, and clinical workflow are the four key applications of healthcare that can benefit from ML/DL techniques.

#### **BENEFITS AND MOTIVATION**

AI encompasses a wide range of machine intelligence-based techniques and algorithms. It has a wide range of applications in research, including fuzzy logic theory, machine learning techniques, risk appraisal and hazard identification, meta-heuristic algorithms and classification, and clustering approaches (Shahzadi et al., 2020). SSLPNN is a form of neural network with less hidden layers that can be utilized for pattern recognition. While studies have demonstrated that a shallow network can fit any function in pattern recognition and problem prediction, it is also regarded as a less complicated artificial neural network. Despite the fact that the usage

Corresponding author: Suberu Yusuf

✉ [yusuufs@fotb.edu.ng](mailto:yusuufs@fotb.edu.ng)

Department of Computer Sciences, Federal Polytechnic, Bauchi.

© 2023. Faculty of Tech. Education, ATBU Bauchi. All rights reserved

of deep learning is fast expanding in several sectors of science, SSLPNN is still commonly utilized in regression situations.

## GENERAL BACKGROUND OF PREDICTION TECHNIQUES

This section presents a brief introduction on computational techniques employed in prediction of Covid -19 cases.

**CNN (Convolutional Neural Network):** LeCun first introduced the Convolutional Neural Network for image processing. CNNs have been utilized successfully in a variety of computer applications, including sequential data, Natural Language Processing (NLP), speech recognition, and image categorization. CNN is primarily concerned with learning abstract features, which is accomplished by stacking and alternating pooling and convolution layers. The CNN's convolution layers convolve the raw input data with numerous local filters, allowing it to alter local characteristics with subsequent pooling layers and a fixed length of raw input data.

**K-Nearest Neighbor (KNN):** This method is a simple and effective non-parametric methodology for classifying data. However, the performance of the KNN is affected by the distance measure utilized. We study 19 distance metrics in five categories to improve the performance of the KNN algorithm. To evaluate the suggested approach, some

efficient performance parameters are generated. When any L1 type metric is employed as a distance measure in the KNN, the suggested method achieves 98.4% precision, 99.2% recall, 98.8% F-measure, and 98.4% accuracy in a few seconds when any L1 type metric is used as a distance measure in the KNN.

**Logistic Regression:** logistic regression is a machine learning approach that can be used to solve classification problems. Pierre FrancaisVerhulst described the logistic function and its features in a work published in Proceedings of the Belgian Royal Academy by identifying three parameters and the curve flowing through these. (1845, Verhulst). It is a relatively simple machine learning method that is widely utilized. A statistical approach for predicting binary classes is logistic regression. In logistic regression, the maximum likelihood estimation model is utilized. In this case, the dependent variable follows the Bernoulli distribution. The logistic function, often known as the sigmoid function, is a 'S' shaped curve with values ranging from 0 to 1. If the curve reaches positive infinity, a 1 is expected, and a 0 is predicted if it reaches negative infinity. A logistic function is depicted in Figure 1. (1)  
The above equation is the representation of a logistic regression Figure 1: Representation of Logistic Regression Model, [www.google.com/imgres](http://www.google.com/imgres).

The above equation is the representation of a logistic regression

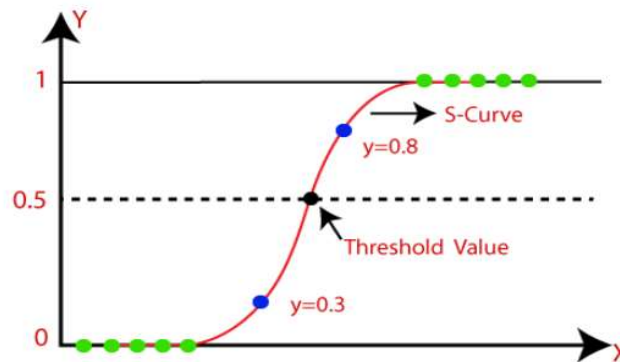


Figure 1: Representation of Logistic Regression Model.



**Enhanced KNN (EKNN):** This classifier outperforms regular KNN considerably. The second research topic added feature selection using ACO (Ant Colony Optimization) to the improved KNN algorithm. The results showed that the enhanced KNN classifier with the feature selection mechanism outperformed the enhanced KNN classifier without feature selection. This work proposes an upgraded KNN while aiming to discover an ideal value of  $k$  and investigating IoT-cloud-based applications. COVID – 19 detection

**Perceptron Multilayer MLP (Neural Network):** Multi-Layer Perceptron Neural Network is a type of feed forward network that is distinct from universal approximates. Because of its simplicity, MLP is included in the most extensively used Neural Network framework (Haykin, S. 2014). Its design is tiered, with units in each layer accepting input from the straight connected layer underneath it and transmitting output to units in the layer immediately above it. Many units in nearby levels are entirely connected to one another, yet no connections exist in the same layer. A multi-layer perceptron is another name for a two-layer neural network.

**Bayesian Regularized Artificial Neural Network:** This model is more robust than traditional back-propagation nets and can decrease or eliminate the requirement for extensive cross validation. Bayesian Regularization is a mathematical procedure that converts a nonlinear regression into a well-posed statistical issue, similar to ridge regression. The benefits of Bayesian regularization artificial neural networks are that the models are durable and the validation procedure that scaled is unnecessary in traditional regression approaches such as back propagation.

## MACHINE LEARNING IN PUBLIC HEALTH MANAGEMENT SYSTEMS.

### *Machine Learning Applications in Prognosis*

In clinical practice, prognosis is the process of predicting the predicted progression of an illness. It also includes determining whether symptoms and signs associated with a specific disease will worsen, improve, or

remain stable over time, as well as determining potential associated health problems, complications, ability to perform routine activities, and the likelihood of survival. As in the clinical setting, multi-modal patient data, such as phenotypic, genomic, proteomic, pathology test results, and medical pictures, is collected, which can empower ML models to facilitate illness prognosis, diagnosis, and therapy (Collins.& Yao 2018). For example, ML models have been extensively developed for the detection and classification of many types of cancer, including as brain tumors (Muhammad & Usman2020) and lung nodules (Zhu et al., 2018). However, current translational research efforts that aim to enable personalized therapy have capitalized on the potential uses of ML for disease prognosis, i.e., prediction of disease symptoms, risks, survival, and recurrence.

### *Machine Learning Applications in Diagnosis*

Electronic Health Records (EHRs)

On a daily basis, hospitals and other healthcare service providers generate a vast number of electronic health records (EHRs), which contain organized and unstructured data and a complete medication history of individuals. ML-based approaches have been used to extract clinical aspects to aid in the diagnosis process (Jensen et al., 2012). For example, Wang et al. (2018) offer a semi-supervised technique for extracting diagnosis information from unstructured EHRs. (Zheng 2017) describes the application of ML for diabetes diagnosis from EHRs. In (Nestor & Boag, 2019), the authors examined the robustness of features using EHRs data for the year of care for each record for two tasks, namely, mortality prediction and length-of-stay prediction, and found that prediction performance degrades when ML models are trained on historical data and tested on unseen (future) data.

### *Treatment Applications of Machine Learning*

Image interpretation

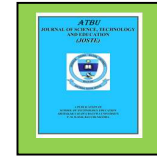
As previously noted, medical pictures are frequently employed in everyday clinical practice, and their analysis and interpretation are performed by skilled physicians and

Corresponding author: Suberu Yusuf

✉ [yusufs@fptb.edu.ng](mailto:yusufs@fptb.edu.ng)

Department of Computer Sciences, Federal Polytechnic, Bauchi.

© 2023. Faculty of Tech. Education, ATBU Bauchi. All rights reserved



radiologists. They generate textual radiology reports on each body part evaluated in the study to recount the findings relating the images being studied. However, drafting such a report can be difficult in some situations, such as for less experienced radiologists and healthcare providers in remote locations where healthcare services are of poor quality. On the other hand, for expert radiologists and pathologists, preparing high-quality reports can be time-consuming and tiresome, which is worsened by the enormous number of patients that attend every day. As a result, different academics have sought to address this issue utilizing natural language processing (NLP) and machine learning (ML) techniques. A natural language processing-based strategy for annotating clinical radiological reports is proposed in (Zhu et al 2018). A multi-task ML-based framework for automatic labeling and description of medical images is suggested (Xue 2018). An end-to-end architecture constructed with the incorporation of CNN is described in a comparable study (Wang et al.,2018) for thorax disease classification and reporting in chest X-rays. In (Xue 2018), a

unique multi-modal model for autonomous report production is constructed using CNN and a long short term memory (LSTM) network.

### **Machine Learning Applications in Clinical Workflows**

Prediction and diagnosis of disease

One of the most promising uses of ML is the early prediction and diagnosis of diseases using medical data. Several researches have emphasized the potential of predictive healthcare for disease treatment in real time. For example, (Weng et al., 2017) analyzed the situation of cardiovascular risk prediction utilizing multiple ML algorithms with clinical data and concluded that ML techniques enhanced prediction efficacy. (Fatima. & Pasha 2017) presents a survey of numerous ML techniques for the detection and diagnosis of various diseases (such as diabetes, dengue, hepatitis, heart, and liver). (Cruz & Wishart 2006) emphasize the promise of utilizing ML-based approaches for cancer prediction and prognosis.

**Table 1:** The Summary of Related Work Based on Proposed Technique, Baseline Techniques, Findings and Limitations

Authors	Algorithm	Method Description	Findings	Weakness/Gaps
Anthimopoulos et al. ,(2016)	Multi layered perceptron, MLP; and adaptive network-based fuzzy inference system, ANFIS) model.	Machine learning Method. was applied	It was observed that MLP and ANFIS give high ability for long-term prediction.	Advancement of global models with generalization ability would not be feasible.
Jua´rez et al(2021)	Neural Network (NN), Logistic Regression (LR), Support Vector Machine (SVM) and k-Nearest Neighbors(KNN)	Hybrid machine-learning-assisted frequent hypothesis-testing are used	It has been observed that the LR and KNN methods lead to relatively balanced values for both metrics, whereas KNN and SVM present a slight asymmetry with the sensitivity higher than the	The KNN, LR and SVM do not favor the efficient identification of high-risk patients during the emergency-department triage process and it lead to incorrect result.

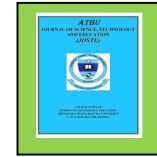
Corresponding author: Suberu Yusuf

✉ [yusufs@fotb.edu.ng](mailto:yusufs@fotb.edu.ng)

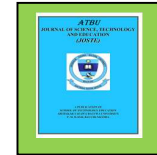
Department of Computer Sciences, Federal Polytechnic, Bauchi.

© 2023. Faculty of Tech. Education, ATBU Bauchi. All rights reserved





				specificity.	
Turabieh al,(2021)	et J48 Decision Tree, Random Forest, Support Vector Machine, K-Nearest Neighbors and Naive Bayes algorithms		WEKA machine learning software are used using 10-fold cross validation and compared according to major accuracy measures, correctly or incorrectly classified instances, kappa, mean absolute error, and time taken to build the model.	The obtained result shows that Support Vector Machine using Pearson VII universal kernel outweighs other algorithms by attaining 98.81% accuracy and a mean absolute error of 0.012.	It was observed that accuracy alone is not enough to choose the best model to be used, and other performance results of the model must be taken into consideration, in order to improve the accuracy of the classifiers.
Laatifi et al (2022)	et al Reduction algorithm and machine learning model		Machine learning approach with feature selection are used	learning model with high accuracy	The size of dataset used was the main drawback of the model
Ahmad et al (2021)	et al Shallow Single Layer perceptron Neural Network (SSLPNN) and Gussian Process Regression		Design based on environmental and non-environmental factors. Two approaches was used analysis of correlations between the confirmed cases and several environmental factors.	Study indicate that population density and human development index levels can also be associated with the number of COVID-19 cases in an area this model has accuracy of 87.96% accuracy.	The model achieved certain level of prediction. However, the metrics of evaluation such as accuracy require improvement
Villanceno et al (2021)	et al Harris hawks optimization (HHO) to optimize the Fuzzy K-nearest neighbor		The Parameter Optimization and feature Selection of Binary	It was observed that the HHO can be wrapped with other popular	The scope was not limited to binary model of HHO



	(FKNN),	model of Harris hawks optimization (HHO) is used.	learning methods such as extreme learning machines support vector machines and convolutional neural networks for the COVID-19 diagnosis task.	
Aljameel et al (2021)	Three classification algorithms, namely, logistic regression (LR), random forest (RF), and extreme gradient boosting (XGB).	The synthetic minority oversampling technique (SMOTE) was used.	The synthetic minority oversampling technique (SMOTE) was used to alleviate the data imbalance.	Data Imbalance is a major of the challenges in data analysis and usually leads to model overfitting.
Majumdar et al (2021)	logistic regression, decision tree, support vector machine, naive Bayes, and artificial neural network model	An epidemiology dataset for positive and negative COVID-19 cases in Mexico were developed and used.	It was observed that the performance evaluation of the models showed that decision tree model has the highest accuracy of 94.99% while the Support Vector Machine Model has the highest sensitivity of 93.34% and Naïve Bayes Model has the highest specificity of 94.30%	The Accuracy alone is not enough to choose the best model to be used, and other performance results of the model must be taken into consideration. In order to improve the accuracy, sensitivity and specificity of the classifier.
Rangarajan et al (2021)	Regression-based machine learning models was applied	A cloud-based machine learning short-term forecasting method was used.	This model achieved 93.4% and 95.8% detection accuracy respectively	It was observed that forecasting model does not give an accurate result of infected cases daily.

Corresponding author: Suberu Yusuf

✉ [yusufs@fptb.edu.ng](mailto:yusufs@fptb.edu.ng)

Department of Computer Sciences, Federal Polytechnic, Bauchi.

© 2023. Faculty of Tech. Education, ATBU Bauchi. All rights reserved

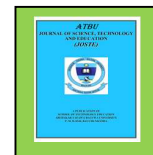


Rajpurkar.P (2017)	Enhanced KNN(K Nearest neighbor ) Algorithms	eKNN algorithms was applied without feature selection mechanism	The back –end data analysis can be utilized to build an IoT-based front – end Covid 19 screening system	An improved KNN attempting to find the optimal value of k and studying IoT – based COVID-19 detection
Lorenzonil et al (2021)	Three super learner Algorithm for prediction was applied	Learner Algorithms for prediction of COVID19 in ICU with a training balanced accuracy	The balanced accuracy ranged between 0.72 and 0.90.in the researched was obtained.	Data incompleteness is a major drawback.
Ye. H al(2021)	Gradient – boosting machine model to predict SAR-COV -2 infection	Machine learning approach was established to trained data from the subsequent week (47,401 tested individuals of whom 3624 were confirmed to have Covid-19)	The model predicted COVID -19 tested result with high accuracy using binary feature sex age less than 60 years, known contact with an infected individual and the appearance of five initial clinical symptoms	Difference in reporting symptoms is a possible limitation of the model
Arslan & Hassan (2021)	K-nearest neighbor Algorithms proposed	The method based on K-nearest neighbor (KNN) classification	It was observed that this method achieves 98.4% precious, 99.2% recall. 98.8% i-measure. And 98.4% accuracy in a few seconds when any L1 types metric is measure as a distance measure in KNN.	The time to analyzed the data of patients is the major drawback of this model
Zech et al (2018)	The selected algorithms was implemented i.e Decision	The Python sklearn libraries were used to	It was observed that k nearest neighbors has obtained better	Other types of classification or segmentation can be applied to achieve a

Corresponding author: Suberu Yusuf  
 ✉ [yusufs@fotb.edu.ng](mailto:yusufs@fotb.edu.ng)

Department of Computer Sciences, Federal Polytechnic, Bauchi.  
 © 2023. Faculty of Tech. Education, ATBU Bauchi. All rights reserved  
 209





		tree, K nearest neighbor, random forest neural network and Support vector machines	implement the selected algorithms ,evaluate and determine which algorithm is the one that obtains the best results,	results in precision with an average accuracy of 0.91 for the heart disease dataset.	better prediction of the chosen dataset.
Jua' rez et al (2021)	CNN, Decision tree, KNN, Naive Bayes.		Classification and feature selection algorithm and four different classifier.	It was discovered that CNN with BGA was able to predict the COVID-19 with accuracy 80%. Than other different classifiers.	There is need to perform a deep analysis and examine different wrapper feature selections.
Lorenzonil et al (2021)	Logistic Regression model		Machine learning frame works i.e logistics regression	Logistic regression model has given the 92% accuracy based on the dataset, the system was trained.	It was observed that Deep learning mechanism for COVID-19 prediction need to be considered in future work
Satu et al (2021)	Convolutional Neural Network(CNN)		Stochastic Gradient Descent Momentum (SGDM) is used as the optimization method.	CNN model achieves an overall classification accuracy of 99.20% after 90 iterations	The major drawback is time consuming and susceptible to sampling error and therefore inefficient.

## DISCUSSION

This study looked at the association between COVID-19 cases and various environmental, ecological, and socioeconomic parameters, and it developed a model system based on these variables to classify and forecast infection rates. COVID-19 has caused widespread alarm. To predict the influence of these elements and assist policymakers in taking appropriate choices in the future, scientific techniques must be identified and developed.

Weather variables such as temperature, humidity, wind speed, and air quality can all have an impact on virus survival. According to research, temperature and

humidity have a significant impact on COVID-19 transmission (Chen et al 2020). Temperature and humidity have also been linked to COVID19 mortality (Zhao et al., 2020). We found a statistically significant positive link between pollution, air quality index, and the number of positive COVID-19 cases in a location in our study. Poor air quality has been linked to an increase in the prevalence of several diseases, including asthma, bronchitis, lung and heart disease, and many respiratory allergies (Brauer.M 2010). Air pollution is also a major issue in China, where the pandemic began (Kinney et al., 2020), establishing a link between poor air quality and COVID-19 (Dutheil et al, 2020).

Corresponding author: Suberu Yusuf

✉ [yusufs@fptb.edu.ng](mailto:yusufs@fptb.edu.ng)

Department of Computer Sciences, Federal Polytechnic, Bauchi.

© 2023. Faculty of Tech. Education, ATBU Bauchi. All rights reserved

Despite tremendous advances in medical research, infectious diseases continue to be a main cause of death. The short-term reaction from medical research will be restricted for a unique disease like COVID-19 that lacks normal recommendations for treatment and vaccine. We may, however, use mathematical methods to better comprehend and predict the effects of such disorders. AI has been frequently used in recent years to better understand infectious diseases and anticipate epidemics (Agrebi. & Larbi 2020.). Several studies have reported on the use of neural networks to predict disease outbreaks, including foot and mouth disease, influenza, epidemic diarrhea, Ebola virus, Rift Valley fever virus, Nipah virus, and SARS (Philemon et al., 2019, Forna et al., 2016). A recent study used neural network models to predict the probability of COVID-19 cases in a certain country based on weather patterns, with encouraging results (Haykin et al., 2004).

## CONCLUSION

Previous research into the effects of climatic conditions on epidemic diseases and public health (Martin et al., 2008, Pirouz et al., 2020) supports our findings. A recent examination of confirmed COVID-19 cases utilizing artificial intelligence and regression analysis revealed the role of climatic conditions in the COVID-19 outbreak (Bezirtzoglou et al., 2011). The Shallower single layer perceptron neural network (SSLPNN) model may predict certain things. Despite this, the model only has one neuron layer that learns linear correlations between inputs and outputs. Single layer neural networks, according to Thakur and Konde (2021), are incapable of learning non-linear correlations, which are frequently required to handle increasingly complex issues. According to (Thakur & Konde 2021), Convolution Neural Network (CNN) techniques will be introduced to improve the accuracy of the model for improved prediction evaluation. Overall, machine learning is a novel technique that may be used to forecast future trends in COVID-19 instances based on unique ecological and socioeconomic parameters.

## REFERENCES

Agrebi, S. and A. Larbi, (2020). "Use of artificial intelligence in infectious

- diseases," *Artificial Intelligence in Precision Health*, pp. 415–438, 2020
- Ahmad, F.; Saleh, N. A; Mamoona, H. S; Wasim, A. K. & Kashaf, J. (2021). Prediction of COVID-19 Casas using Machine Learning for Effective Public Health Management. *Computers, Materials & Continua*. DOI:10.32604/cmc.2021.013067.
- Aljameel, S. S, I. U. Khan, N. A. slam, M. Aljabri, E. S. Alsumi (2021). Machine Learning-Based Model to Predict the Disease Severity and Outcome in COVID-19 Patients I; [saljameel@iau.edu.sa](mailto:saljameel@iau.edu.sa) Received 1 February 2021; Revised 6 March 2021; Accepted 10 April 2021; Published 20 April 2021
- Anthimopoulos, M. S. Christodoulidis, L. Ebner, A. Christe and S. Mougiakakou (2016), "Lung pattern classification for interstitial lung diseases using a deep convolutional neural network", *IEEE Trans. Med. Imag.,* vol. 35, no. 5, pp. 1207-1216, May 2016. Show in Context View Article
- Ardabili, S. F., A. Mosavi, P. Ghamisi, F. Ferdinand, Annamaria R. Varkonyi-Koczy, U. Reuter, T. Rabczuk, M. Atkinson (2020). Machine learning. Multi layered perceptron, MLP; and adaptive network-based fuzzy inference system, ANFIS) model. Received: 8 September 2020; Accepted: 27 September 2020; Published: MDPI 1, october, 2020.
- Arslan, H. & Hassan, A. (2021). A new COVID-19 Detection Method from Human Genome Sequences using CPG Island features & KNN Classifier. *Engineering Science and Technology an international Journal* 24(2021)839-847.
- Baker, T. S. F. Dutheil, and V. Navel, (2020). "COVID-19 as a factor influencing air pollution?," *Environmental Pollution*, vol. 263, pp. 114466, 2020.
- Bejnordi, B. E. (2017). "Diagnostic assessment of deep learning algorithms for detection of lymph node metastases in women with breast cancer", *J. Amer. Med. Assoc.*,

Corresponding author: Suberu Yusuf

✉ [yusufs@fotb.edu.ng](mailto:yusufs@fotb.edu.ng)

Department of Computer Sciences, Federal Polytechnic, Bauchi.

© 2023. Faculty of Tech. Education, ATBU Bauchi. All rights reserved



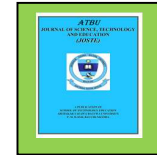
- vol. 318, no. 22, pp. 2199-2210, 2017. Show in  
Context CrossRef Google Scholar
- Bezirtzoglou., C Dekas.K and Charvalos.,E (2011). "Climate changes, environment and infection: Facts, scenarios and growing awareness from the public health community within Europe," *Anaerobe*, vol. 17, no. 6, pp. 337–340, 2011
- Bourzac. K. (2013). "The computer will see you now", *Nature*, vol. 502, no. 3, pp. S92-S94, 2013. Show in  
Context CrossRef Google Scholar
- Brauer, (2010). "How much, how long, what, and where: Air pollution exposure assessment for epidemiologic studies of respiratory disease," in Proc. of the American Thoracic Society, vol. 7, no. 2, pp. 111–115, 2010.
- Chen,B H. Liang, X. Yuan, Y. Hu, M. Xu et al., "Roles of meteorological conditions in COVID-19 transmission on a worldwide scale," *medRxiv*, 2020.
- Chen, Q. M. Z. He, P. L. Kinney, T. Li, C. Sun et al., "Short-and intermediate-term exposure to NO<sub>2</sub> and mortality: A multi-county analysis in China," *Environmental Pollution*, vol. 261, pp. 114165, 2020.
- Chen, X. W. and X. Lin (2014.) "Big data deep learning: Challenges and perspectives", *IEEE Access*, vol. 2, pp. 514-525, 2014. Show in  
Context View Article
- Collins, A. and Y. Yao (2018), "Machine learning approaches: Data integration for disease prediction and prognosis", *Applied Comput. Genomics*, pp. 137-141, 2018. Show in  
Context CrossRef Google Scholar
- Chowdhury, E .R Q. S. U. Ibrahim, M. S. Bari, M. J. Alam, S. J. Dunachie et al., "The association between temperature, rainfall and humidity with common climate-sensitive infectious diseases in Bangladesh," *PLoS One*, vol. 13, no. 6, pp. 1–17, 2018
- Cruz, J. A. and D. S. Wishart (2006), "Applications of machine learning in cancer prediction and prognosis", *Cancer Informat.*, vol. 2, pp. 59-77, 2006. Show in  
Context CrossRef Google Scholar
- Esteva, A. B. Kuppel, S. Thrun, (2017) "Dermatologist-level classification of skin cancer with deep neural networks" *Nature*, vol. 542, no. 7639, pp. 115 118, 2017. Show in context
- Emrah, I. (2021). International Conference Data science and Applied (ICONDATA21)
- Fatima M. and M. Pasha,(2017). "Survey of machine learning algorithms for disease diagnostic", *J. Intell. Learn. Syst. Appl.*, vol. 9, no. 1, pp. 1-16, 2017. Show in  
Context CrossRef Google Scholar
- Forna, A P. Nouvellet, I. Dorigatti and C. A. (2016).Donnelly, "Case fatality ratio estimates for the 2013–2016 West African Ebola epidemic: Application of boosted regression trees for imputation," *International Journal of Infectious Diseases*, vol. 79, no. 12, pp. 128, 2019.
- Garcia .C -Vidal, G. Sanjuan, P. Puerta-Alcalde, E. Moreno-Garcia and A. Soriano, "Artificial intelligence to support clinical decision-making processes," *EBioMedicine*, vol. 46, pp. 27–29, 2019.
- Gulshan .V ,L.Peng, M. Coram, MC.Stumpe Wu.Jama(2016). "Development and validation of a deep learning algorithm for detection of diabetic retinopathy in retinal fundus photographs", *J. Amer. Med. Assoc.*, vol. 316, no. 22, pp. 2402-2410, 2016. Show in  
Context CrossRef Google Scholar
- Hassan T. and F. Ahmad, "Transaction and identity authentication security model for e-banking: Confluence of quantum cryptography and AI, in Int. Conf. on Intelligent Technologies and Applications, pp. 338–347, 2018.
- Havaei, M. et al.,(2017). "Brain tumor segmentation with deep neural networks", *Med. Image Anal.*, vol. 35, pp. 18-31, 2017. Show in  
Context CrossRef Google Scholar

Corresponding author: Suberu Yusuf

✉ [yusufs@fptb.edu.ng](mailto:yusufs@fptb.edu.ng)

Department of Computer Sciences, Federal Polytechnic, Bauchi.

© 2023. Faculty of Tech. Education, ATBU Bauchi. All rights reserved



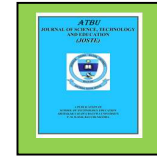
- Haykin, S. and N. Network, *A comprehensive foundation*. Neural networks, 2004. 2(2004): p. 41.
- Huapaya . H. D, C. Rodrigue, D. Esenarro, (2020). Comparative analysis of supervised machine learning algorithms for heart disease detection. 3C Tecnología. Glosas de innovación aplicadas a la pyme. Edición Especial, Abril 2020, 233-247.  
<http://doi.org/10.17993/3ctecno.2020>
- Jensen P. B., L. J. Jensen and S. Brunak (2012), "Mining electronic health records: Towards better research applications and clinical care", *Nature Rev. Genetics*, vol. 13, no. 6, pp. 395-405, 2012. Show in Context CrossRef Google Scholar
- Jua´rez A. Q , Armando T.-Go´mez , I. Hoyo-Ulloa , Roberto de J. Leo´n-Montiel, Al. B. U´Ren(2021). Identification of high-risk COVID-19 patients using machine learning. PLoS ONE 16(9): e0257234.  
<https://doi.org/10.1371/journal.pone.0257234> Published: September 20, 2021
- Laatifi, M.; Samira, D.; Abdulaziz, B; Hind E. ; Jaafar, J.; Younes, Zaid; Bonabid, E.O; Maria, N. (2022). Machine Learning Approaches in COVID-19 severity risk Prediction in Morocco. *Journal of Big Data*.  
<https://doi.org/10.1986/s40537-021-00557-0>.
- Latif,. S J. Qadir, S. Farooq and M. Imran, (2017). "How 5G wireless (and concomitant technologies) will revolutionize healthcare", *Future Internet*, vol. 9, no. 4, pp. 93, 2017. Show in Context CrossRef Google Scholar
- Lorenzoni, G. N. Sella , A. Boscolo , D. Azzolina1 , P. Bartolotta1 , L. Pasin , T. Pettenuzzo , Alessandro D. Cassai , F. Baratto , F. Toffoletto , S.De Rosa , G. Fullin , M.Peta , P. Rosi , E. Polati, A. Zanella, G. Grasselli, A.Pesenti, P. Navalesi, D. Gregor (2021). *Journal of Anesthesia, Analgesia and Critical Care* (2021) 1:3 <https://doi.org/10.1186/s44158-021-00002>
- Majumdar, A. B.; Sombuhra, G.; Dharpal, S. & Sourav, M. (2021). An Intelligent System for Prediction of COVID-19 Case using Machine Learning Framework- Logistic Regression. *Journal of Physics* 1797(2021) 012011. DOI: 10.1088/1742-6596/i/012011.
- Martin, V. Chevalier, V. Ceccato, P. Anyamba, L. De Simone et al.(2008) . "The impact of climate change on the epidemiology and control of rift valley fever," *Revue Scientifique et Technique*, vol. 27, no. 2, pp. 413–426, 2008.
- Ma.Y, Y. Zhao, J. Liu, X. He, B. Wang et al., "Effects of temperature variation and humidity on the mortality of COVID-19 in Wuhan," *medRxiv*, 2020.
- Muhammad, L. J., Islam, M. M, Usman, S. S, (2020). Predictive data mining models for novel coronavirus (COVID-19) infected patients' recovery. *Springer Nat Comput Sci*. 2020. <https://doi.org/10.1007/s42979-020-00216-w>.
- Nestor, M. McDermott, W. Boag,(2019). "Feature robustness in non-stationary health records: Caveats to deployable model performance in common clinical machine learning tasks", 2019. Show in Context Google Scholar
- Philemon, M. D. Z. Ismail and J. Dare,(2019), "A review of epidemic forecasting using artificial neural networks," *International Journal of Epidemiology*, vol. 6, no. 3, pp. 132–143, 2019.
- Pirouz. B. Shaffiee, S. Haghshenas, S. Shaffiee Haghshenas and P. Piro, "Investigating a serious challenge in the sustainable development process: Analysis of confirmed cases of COVID-19 (new type of coronavirus) through a binary classification using artificial intelligence and regression analysis," *Sustainability*, vol. 12, no. 6, pp. 2427, 2020.
- Rajpurkar. P. (2017), "Chexnet: Radiologist-level pneumonia detection on chest x-

Corresponding author: Suberu Yusuf

✉ [yusufs@fotb.edu.ng](mailto:yusufs@fotb.edu.ng)

Department of Computer Sciences, Federal Polytechnic, Bauchi.

© 2023. Faculty of Tech. Education, ATBU Bauchi. All rights reserved



- rays with deep learning", 2017. Show in Context Google Scholar
- Rangarajan, A.; Krishnaswamy, R.; Krishnan, H. (2021) A preliminary analysis of AI based smartphone application for diagnosis of COVID-19 using chest X-ray images. *Expert Syst. Appl.* 2021, 183, 1–11.
- Rees, E V. Ng, P. Gachon, A. Mawudeku, D. Mckenney et al., "Risk assessment strategies for early detection and prediction of infectious disease outbreaks associated with climate change," *Canada Communicable Disease Reports*, vol. 45, no. 5, pp. 119–126, 2019.
- Satu, M. S.; Howlader, K.C.; Mahmud, M.; Kaiser, M.S.; Shariful Islam, S.M.; Quinn, J.M.W.; Alyami, S.A.; Moni, M.A. (2021). Short-Term Prediction of COVID-19 Cases Using Machine Learning Models. *Appl. Sci.* 2021, 11, 4266. <https://doi.org/10.3390/app11094266>
- Schlemper, J. Caballero, J. V. Hajnal, A. Price and D. Rueckert, (2017). "A deep cascade of convolutional neural networks for MR image reconstruction", *Proc. Int. Conf. Inf. Process. Med. Imag.*, pp. 647-658, 2017. Show in Context CrossRef Google Scholar
- Shahzadi, S. B. Khaliq, M. Rizwan and F. Ahmad, "Security of cloud computing using adaptive neural fuzzy inference system," *Security and Communication Networks*, vol. 2020, no. 8, pp. 1–15, 2020.
- Shen, W, M. Zhou, F. Yang, C. Yang and J. Tian (2015). "Multi-scale convolutional neural networks for lung nodule classification", *Proc. Int. Conf. Inf. Process. Med. Imag.*, pp. 588-599, 2015. Show in Context CrossRef Google Scholar
- Temgoua, M. N.; Endomba, F.T.; Nkeck, J.R.; Kenfack, G.U.; Tochie, J.N.; Essouma, M. (2020). Coronavirus Disease 2019 (COVID-19) as a Multi-Systemic Disease and its Impact in Low- and Middle-Income Countries (LMICs). *SN Compr. Clin. Med.* 2020, 2, 1377–1387.
- Thakur, A. & Konde .A (2021). Fundamental of Neural Networks, International journals for research in applied science of Engineering Technology (IJRASET) Vol. 9, Aug 2021. 2321-9653
- Turabieh, H.; Karaa, W.B.A.(2021). Predicting the existence of COVID-19 using machine learning based on laboratory findings. In *Proceedings of the 2021 International Conference of Women in Data Science at Taif University, Taif, Saudi Arabia*, 30–31 March 2021.
- Verhulst, P. F. *Recherches mathématiques sur la loi d'accroissement de la population*, *Mém. Acad. R. Bruxelles* 18 (1845), 3-39.
- Villanceno, C. N; Macrohon, J. J. E; Inbarag, X. A' Jeng, J. H' Hsieh, J. G.(2021) COVID-19 Prediction Applying Supervised Machine Learning algorithm with Comparative Analysis using WEKA. *MDPI publisher Switzerland* dVol.14(201). <https://doi.org/10.3390/a114076201>.
- Wang. X. Peng, Y, Lu, Z. Lu and R. M. (2018) Summers, "Tienet: Text-image embedding network for common thorax disease classification and reporting in chest x-rays", *Proc. IEEE Conf. Comput. Vis. Pattern Recognit.*, pp. 9049-9058, 2018. Show in Context View Article Google Scholar
- Weng, S. F, J. Reys, J. Kai, J. M. Garibaldi and N. Qureshi, (2017). "Can machine-learning improve cardiovascular risk prediction using routine clinical data", *PLoS One*, vol. 12, no. 4, 2017. Show in Context CrossRef Google Scholar
- Xing, L. E. A. Krupinski and J. Cai, (2018). "Artificial intelligence will soon change the landscape of medical physics research and practice", *Med. Phys.*, vol. 45, no. 5, pp. 1791-1793, 2018. Show in Context CrossRef Google Scholar
- Xing, L. E. A. Krupinski and J. Cai, (2018). "Artificial intelligence will soon change the landscape of medical physics research and practice", *Med.*

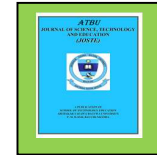
Corresponding author: Suberu Yusuf

✉ [yusufs@fptb.edu.ng](mailto:yusufs@fptb.edu.ng)

Department of Computer Sciences, Federal Polytechnic, Bauchi.

© 2023. Faculty of Tech. Education, ATBU Bauchi. All rights reserved





- Phys.*, vol. 45, no. 5, pp. 1791-1793, 2018. Show in Context CrossRef Google Scholar
- Xue, Y. (2018). "Multimodal recurrent model with attention for automated radiology report generation", *Proc. Int. Conf. Med. Image Comput. Comput.-Assisted Intervention*, pp. 457-466, 2018 Show in Context CrossRef Google Scholar
- Yan, Z. (2016). "Multi-instance deep learning: Discover discriminative local anatomies for bodypart recognition", *IEEE Trans. Med. Imag.*, vol. 35, no. 5, pp. 1332-1343, May 2016. Show in Context View Article Google Scholar
- Yeh, P. Wu, T. Zhu, Z. Xiao, X. Zhang, L. Zheng, R. Zheng, Y. Sun, W. Zhou, Q. Fu, X. Ye, A. Chen, S. Zheng, A. A. Heidari, M. Wang, J. Zhu, H. Chen, (2021). Diagnosing Coronavirus Disease 2019 (COVID-19): Efficient Harris Hawks-Inspired Fuzzy K-Nearest Neighbor Prediction Methods Received December 23, 2020, accepted January 15, 2021, date of publication January 19, 2021, date of current version February 1, 2021.
- Zech, J. M. Pain, J. Titano, M. Badgele, J. Schefflein, A. Anthony Costa, J. Bedreson, J. Lehar, E. Kael Qermann (2018). "Natural language-based machine learning models for the annotation of clinical radiology reports", *Radiology*, vol. 287, no. 2, pp. 570-580, 2018. Show in Context CrossRef Google Scholar
- Zheng (2017). "A machine learning-based framework to identify type 2 diabetes through electronic health records", *Int. J. Med. Informat.*, vol. 97, pp. 120-127, Show in Context CrossRef Google Scholar
- Zhu, W. C. Liu, W. Fan and X. Xie, (2018). "Deeplung: Deep 3D dual path nets for automated pulmonary nodule detection and classification", *Proc. IEEE Winter Conf. Appl. Comput. Vis.*, pp. 673-681, 2018. Show in Context View Article Google Scholar
- Zoabi, Y.; Shira, D.R; Noam, S, (2020). Machine Learning-based on symptoms. *Npj Digital Medicine* (2021) 4.3. <https://doi.org/10.1038/sa41746-020-00372-6>. <https://www.google.com/imgres?imgurl=https%3A%2F%2Fstatic.javatpoint.com%2Ftutorial%2Fmachinelearning%2Fimages%2Flogistic-regressioninmachinelearning.png&imgrefurl=https%3A%2F%2Fwww.javatpoint.com%2Flogisticregressioninmachinelearning&tbid=LuaHnfur76i8eM&vet=12ahUKEwj15cyjtbfrAhU0j0sFHVTPBVwQMvgMegUIARDmAQ..i&docid=maklIDmuc8naWM&w=500&h=300&q=logistic%20regression&ved=2ahUKEwj15cyjtbfrAhU0j0sFHVTPBVwQMvgMegUIARDmAQ>