



Applications of Artificial Intelligence in COVID-19 Pandemic

Mohammad Al-Shoqran¹  and Samer Shorman² 

¹ Mathematical Sciences, Languages and General Studies Department, Ahlia University,
Manama, Bahrain

malshoqran@ahlia.edu.bh

² Department of Computer Science, Applied Science University, Eker, Bahrain
samer.shorman@asu.edu.bh

Abstract. COVID-19 pandemic is the most notable world crisis in the modern era that originated from Wuhan, china in late 2019 has affected all the nations and triggered a global economic crisis. As well artificial Intelligence (AI) plays an important role in the estimate and expectation of the next phase and they are helpful for searches operation. Covide19 structure was studied in multiple research papers that studied the impact of artificial intelligence and how to apply its algorithms to predict Covid19 directions and cases. This study addresses significant issues on Covid19 which will study the impact of Total Cases and Serious-cases on Total Deaths using artificial intelligence language-python to implement linear regression on some countries data. Likewise used the content analysis to determine the strengths and advantages of using AI on COVID19. In addition to explaining the role of artificial intelligence on COVID19.

Keywords: Artificial intelligence (AI) · COVID-19 pandemic · Linear regression · Python

1 Introduction

Since the emergence of the COVID-19 pandemic at the end of 2019, 219 countries around the world affected 97,422,123 confirmed cases and 2,086,159 deaths, on the twenty-first of January 2021 (website, worldometers.info) see [16]. Most of them have taken a quick response and many varied Procedures to limit the spread of this disease and to try to find a treatment or a vaccine for it. And they used different methods in this regard. One of the most important things is the use of artificial intelligence against this pandemic because it is one of the most powerful methods for dealing with the “Covid-19” pandemic, whether to limit the spread of the pandemic or in diagnostic operations. also, when using artificial intelligence to produce a vaccine or in drug manufacturing methods.

In the literature, many researchers have been studied the role of artificial intelligence and its application in many reals life fields such as the role of artificial intelligence in smart universities and how it would be the education in the future based on AI applications [3]. The use of Artificial intelligence has already helped many countries to limit the

spread of the pandemic. In addition, Artificial intelligence has been used to provide a safer environment for doctors and nurses, and healthcare providers. Also, artificial intelligence has been used to detect the high temperature of people and to discover the gathering places in public places through special robots and so on [11]. Countries of the world have taken many procedures to limit the spread of the pandemic. Among these procedures for example social distancing, not leaving the house except for necessity, wearing masks, using sterilizers, keeping away from gatherings, and many other procedures.

Artificial intelligence played an important role in teaching and learning by providing an appropriate virtual environment in distance education, which helped a lot in the continuation of education and evaluation processes for students in various educational stages. Artificial intelligence applications around the world have also contributed to the development of medicine and health care systems by improving diagnostic processes and contributing to disease prevention. This great achievement would have not been without global and human efforts that had been combined in finding a solution to this pandemic.

Artificial intelligence is significant in efforts made in solving various problems facing the world, and it is expected that artificial intelligence will change the shape of the world in the future and will contribute to providing new job opportunities that were not previously known. Up to this moment, human efforts to confront this pandemic have not stopped, some vaccines have finally been distributed and many others are being developed, as the battle against COVID-19 is not over yet, so that artificial intelligence must be used more and more widely in this regard especially. This study presents a review for different articles related to the employment of AI to deal with COVID-19 such as (see Fig. 1) and to highlight the main method and techniques that are used and implemented, with advantages and disadvantages of those articles.

All the above confirms the importance of using artificial intelligence in solving various problems facing the world, and it is expected that artificial intelligence will change the shape of the world in the future and will contribute to providing new job opportunities that were not previously known. Up to this moment, human efforts to confront this pandemic have not stopped, some vaccines have finally been distributed and many others are being developed, as the battle against COVID-19 is not over yet, so that artificial intelligence must be used more and more widely in this regard especially. This investigation presents an analytical review for some papers related to applications of artificial intelligence in the covid-19 pandemic to highlight the main techniques that are implemented in this regard combined with the Strengths and Weaknesses of these papers.

This study arranged as follows: The first section includes a general introduction of the study. The second section contains the research methodology. The third section deals with a review of some scientific articles related to the topic of this study, as well the fourth section includes an analysis and interpretation of data related to artificial intelligence applications and the COVID-19 pandemic, the last section contains the most important results and recommendations.

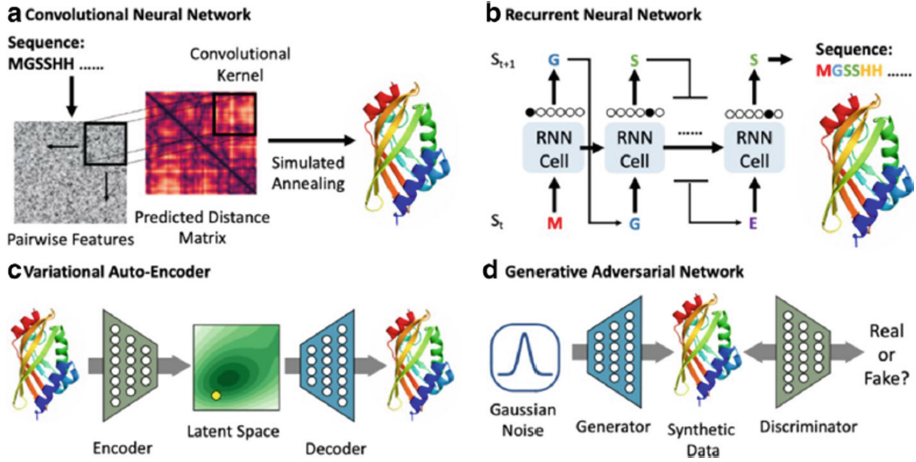


Fig. 1. Artificial intelligence algorithm neural network into Portion modeling [12].

2 Research Methodology

Research Methodology shows and explains the method of obtaining the scientific results in clear and regular steps by clarifying the research conducted method to achieve the objectives and to explain the methods of obtaining the results. This study is based on an analytical descriptive study by analysing the content of some previous studies related to the applications of artificial intelligence to find a solution to COVID-19 pandemic from aside, on the other hand, to present and analyse some related data. In addition to some graphical presentation with their explanations. Also, to present and analyse some related data using linear regression model [6, 11].

3 Articles Review

Artificial intelligence with Covid19 has been studied intensely by many researchers during 2020, this section contains the analysis for some articles related to the applications of artificial intelligence and its algorithms on the COVID-19 pandemic (see Table 1).

Based on the content analysis for some selected articles related to applications of artificial intelligence in a covid-19 pandemic, we noted that most of these articles have been focused on trying to how to minimize the effects of the COVID-19 pandemic, whether in the medical aspects related to doctors, nurses, and medical staff on the one hand, and on the other hand to mitigate the economic effects that affected on many people and countries around the world. where this is done by finding and using some artificial intelligence tools and applications to help in the following aspects especially, cases diagnosis, cases treatment, and contact tracking of the discovered cases to contribute to controlling this pandemic. In conclusion, through the results and numbers have been obtained in these studies, we can say that artificial intelligence applications played a good role in fighting against this pandemic.

Table 1. Literature review of applications of artificial intelligence in covid-19.

Articles	Strengths and advantages	Weaknesses and disadvantages
[1]	<p>The paper discussed a computational method to discover new candidate drugs or vaccines. the authors focused on COVID-19 drug and vaccine development using AI and the potential of intelligent training for discovering therapeutics of it. Also, they presented (Corona DB-AI), which is a dataset of compounds, peptides, and epitopes discovered from silico or vitro that can be used in the training models regarding finding a treatment of COVID-19.in conclusion, the authors believe that computational models are capable to obtain a reliable therapy. also, they noticed that the main protease and the viral spike protein have been the most popular options of drug discovery and vaccine development. and they collected a dataset titled Corona DB-AI</p>	<p>There is no sufficient information or examples on how to extract mathematical models, in terms of finding a solution based on the data-driven</p>
[2]	<p>The study polled the opinions of experts to show existence gaps, useful technologies in terms of emergency management. Results indicated that various IT-systems like artificial intelligence, online service, computational methods, and IoT could have different applications to manage an outbreak. They assure on the role of IT in reducing the effect of crises effects. So that the authors classified these applications as follows:</p> <ul style="list-style-type: none"> • diagnosis and prediction • treatment • protection • management goals <p>In conclusion, the authors assure on the role of IT in minimization of the crisis harms and risk management. And the role of strategic planning in improving the public health responses to outbreaks, economic damages</p>	<p>The authors have some results without clear convenient evidence, so we suggest using more scientific research tools to reinforce their profs or results</p>
[4]	<p>The review discussed how AI and Big Data applications help in finding a solution to the pandemic such as:</p> <ul style="list-style-type: none"> • A Quick Pandemic Alert • Diagnosis and Tracking of COVID-19 cases • Identification of a potential therapeutic treatment • Facilitating the Implementation of Public Health Interventions • Enhancing cities and favoring the development of healthy, smart, resilient cities <p>the review classified the Possible applications of AI and Big Data in terms of COVID-19 outbreak management as sort, mid, and long terms time. in addition to examples on each like:</p> <ul style="list-style-type: none"> • AI can aperient epidemiological data collection, decision-making, and risk assessment • Accomplishment of public health interventions • Identification of specific diagnostic features • Identification of the existing drugs <p>The review concluded that AI and Big Data can be applied to follow the prevalence of coronavirus in real-time</p>	<p>It would be better if more examples of the AI and Big data applications against COVID-19, in addition, to explain the working mechanism</p>

(continued)

Table 1. (continued)

Articles	Strengths and advantages	Weaknesses and disadvantages
[6]	<p>The survey summarized the applications of AI in clinical management with fighting against COVID-19 and Big Data applications in terms of identification coronavirus the authors classified AI techniques in clinical data analysis, such as: neural systems, SVM, etc. Also, the paper discussed the role of using AI-oriented cloud computing in fighting against various like COVID-19. in addition to a discussion about how AI in fighting against similar viruses</p> <p>Artificial intelligence is a powerful tool in differentiating between Early diseases due to COVID-19 and Computer-based intelligence Computer-based intelligence is useful for suitable medical checkups and it Can follow COVID-19 emergencies by different scales</p>	<p>However, the survey is very strong and powerful. But it would be great if the authors give more explanation on how to overcome the difficulties in deep learning</p>
[7]	<p>This paper showed how to combat COVID-19 using Artificial Intelligence, by illustrating Deep Learning techniques, Generative Adversarial Networks, Long and Short-Term Memory, and Extreme Learning Machine And it showed that one of the most important advantages of AI- platforms are to speed up the process of treatment and diagnosis of the disease of Covid-19. these platforms help AI experts to analyze big datasets and they assist physicians in terms of Improving the data analyzed to deal with the virus speedily and accurately</p> <p>Also, the paper discussed a mechanism of choosing the suitable models of prediction and estimation for desired parameters using clinical and non-clinical datasets. The paper is desirable because of its potential in creating a workspace during physicians and AI experts could work together</p>	<p>The paper did not suggest mechanisms or ways to encourage the wider use of these methods, and how to increase the confidence in reliance on it and to increase its accuracy</p>
[8]	<p>This paper aimed to widely review the role of Machine Learning and AI regarding screening, forecasting, and drug development COVID-19. Using an information selective assessment was implemented on a database related to the applications of AI and ML on Covid-19. the paper discussed a few challenges while using AL and ML algorithms in real-life problems. The paper concluded that the development in ML and AI has improved screening, forecasting, and vaccine/drug development, etc. process against this pandemic</p>	<p>In data analysis(results) There is a need to show how the accuracy and the error have been obtained</p>
[10]	<p>This paper covered the role of Smart technology with the spread of COVID-19 such as robotics, and sensor technology Also, the paper discussed the drone technology-driven and robotics methods that have been used to assisting health systems, and disinfection procedures, etc. mask and sensor technologies are demonstrated, including a manufacturing method such as optical sensing and 3D printing</p> <p>The results illustrated the use of smartphone applications Connecting large masses can be configured to handling emergency situations. In addition, how these applications help to understand the impact of technology on society and how it can be tuned to respond in emergency cases. The paper gave a deep investigation of the new innovations in sensor technology, and mask during the Pandemic</p>	<p>It would be great if the authors suggest a solution to the expected threats like the impact of the pandemic on the economy And the technology impact on the daily real life, work, and audience psychology</p>

(continued)

Table 1. (continued)

Articles	Strengths and advantages	Weaknesses and disadvantages
[14]	<p>This investigation discussed the role of the Internet of Things (IoT) in increasing patient satisfaction and reducing the readmission rate in hospitals by employing interconnected networks</p> <p>The discussion of the results illustrates the effects of implementing IoT on reducing healthcare costs and improving treatment outcomes for the affected patient. This is done by clarifying the role of twelve IoT applications such as:</p> <ul style="list-style-type: none"> • Rapid COVID-19 screening • Internet-connected hospital • Accurate forecasting of the virus <p>The paper concluded that IoT is beneficial for a patient with COVID-19 in terms of symptoms identification and provides better treatment and IoT is helpful to predict the future situation of this illness</p>	<p>It would be great if the study suggested an explanation of the economic cost of these applications by measuring their economic impact, benefit, and ability to confront the pandemic</p>

4 The Experiment

In this experiment, we apply Linear A multiple linear regression analysis was carried out to examine the relationship of the response variable (confirmed cases and serious-cases) with the regression (total deaths cases). The experiment variables distributed into X as two input variables (or independent variables, which represents in this experiment by total cases and serious cases). While the Y is the output/dependent variable (which represents in this experiment by total deaths). There are two main ways to perform linear regression in python with statsmodels and scikit-learn libraries, in this experiment will use both to validate the results. In this experiment, we adopt the Ordinary Least Squares (OLS) as a model and the Least Squares as a method, which means fit a regression line that would minimize the square of the distance from the regression line.

The assumptions include the following: if the total cases and serious-cases are increased then the dependent variable, which is total deaths, will be increased with excluding the other variables. In this study, data were extracted from the world health organization (WHO) (website, covid19.who.int.) see [15] and worldometers.info/coronavirus websites on the seventeenth of January - 2021. THE dataset was collected in an excel file (see Table 2) and analysed with the Spyder (python 3.7). The variables of interest include confirmed total cases and serious-cases and total deaths variable. As well consider the general linear regression model: The following OLS Regression Results (see Table 3).

Table 2. Dataset for countries and Total Cases Serious-cases Total Deaths

Country	Total cases	Serious cases	Total deaths
Iraq	603,739	128	12,906
Pakistan	506,701	2,340	10,717

(continued)

Table 2. (continued)

Country	Total cases	Serious cases	Total deaths
Saudi Arabia	363,949	312	6,295
Jordan	308,670	187	4,043
japan	286,752	864	4,044
UAE	232,982	191	711
Lebanon	222,391	585	1,629
Kuwait	154,841	50	945
Palestine	148,968	95	1,630
Qatar	146,068	26	246
Malaysia	141,533	190	559
Oman	130,944	23	1,508
Bahrain	95,879	15	356
china	87,591	18	4,634
Yemen	2,105	23	612

Table 3. OLS Regression Results based on statsmodels and scikit-learn libraries.

[*statsmodels]						
Dep. Variable:	Total_deaths		R-squared:	0.804		
Model:	OLS		Adj. R-squared:	0.771		
Method:	Least Squares		F-statistic:	24.61		
Date:	Thu, 21 Jan 2021		Prob (F-statistic):	5.67e-05		
Time:	10:32:20		Log-Likelihood:	-132.57		
No. Observations:	15		AIC:	271.1		
Df Residuals:	12		BIC:	273.3		
Df Model:	2					
COVARIANCE TYPE:						
	coef	std err	t	P> t	[0.025	0.975]
constant	-1483.0481	860.275	-1.724	0.110		-3357.426
391.329						
Total cases	0.0208	0.004	5.673	0.000	0.013	0.029
Serious-cases	0.3012	0.990	0.304	0.766	-1.857	2.459
Omnibus:	5.022		Durbin-Watson:	0.897		
Prob (Omnibus):	0.081		Jarque-Bera (JB):	2.432		
Skew:	0.914		Prob (JB):	0.296		
Kurtosis:	3.742		Cond. No.	4.96e+05		
[*scikit-learn]						
Intercept:	-1483.0481251317397					
Coefficients:	[0.0208442 0.3012144]					
	nonrobust					

5 Interpreting the Regression Results

Well highlighted several important components within the results from Table 3: standard errors assume that the covariance matrix of the errors is correctly specified. r-squared We can see here that this model has a much higher R-squared value (0.804) which meaning that this model explains 80.4% of the variance in our dependent variable. adjusted. As well, r-squared reflects the fit of the model. r-squared values (0.771) range from 0 to 1, where a higher value generally indicates a better fit, assuming certain conditions are met. constant coefficient is your y-intercept (Intercept: -1483.0481251317397). it means that if both the Total cases and Serious-cases coefficients are zero, then the expected output (i.e., the y Total deaths) would be equal to the constant coefficient. Total cases coefficient (0.0208442) represents the change in the output Total deaths (y) due to a change of one unit in the Total cases It means that as the Total cases variable increases by 1, the predicted value of Total deaths increase by 0.0208442. Serious-cases coefficient (0.3012144) represents the change in the output Total deaths (y) due to a change of one unit in the Serious-cases.

In addition, from Table 3, the standard deviation - std err reflects the level of accuracy of the coefficients. The lower it is, the higher is the level of accuracy. $p > |t|$ is your p-value. A p-value of less than 0.05 is statistically significant. Confidence interval represents the range in which our coefficients are likely to fall (with a likelihood of 95%). Moreover, the condition number is large, $4.96e+05$. This might indicate that there are strong multicollinearity or other numerical problems. t and P-value there is 95% confidence intervals for the total cases (meaning we predict at a 95% confidence that the value of total cases is between 0.013 to 0.029). As well there is 95% confidence intervals for the Serious-cases (meaning we predict at a 95% percent confidence that the value of Serious-cases is between -1.857 to 2.459). Likewise, the skew value is (0.914) which considers if the value between -1 and -0.5 or between 0.5 and 1 , the data are moderately skewed. kurtosis value is (3.742) with >3 is called leptokurtic. Compared to a normal distribution, its tails are longer, and the peak is higher.

6 Conclusion

COVID-19 pandemic still outbreaks around the world with new strains of Coronavirus, furthermore, the positive news rise with vaccines is increased and some of the people vaccinated. This research has concluded some findings, based on the content analysis of some articles that are related to Artificial Intelligence techniques such as python. This work shows that Total Cases Serious-cases affect the Total Deaths of covid-19 and should follow the health sector instructions and personal and institutional responses to the pandemic until a vaccine is widely available. Finally, based on these results, we expect that there will be a significant change in the Total Cases Serious-cases scale, if the majority of people adherence to precautionary measures to prevent the spread of the disease, especially for people who have chronic diseases or respiratory diseases. The future work will focus on the other factors that may influence Total Deaths and how to avoid them.

References

1. Arshadi, A.K., Webb, J., Salem, M., Cruz, E., Calad-Thomson, S., Ghadirian, N., Collins, J., Diez-Cecilia, E., Kelly, B., Goodarzi, H., Yuan, J.S.: Artificial intelligence for COVID-19 drug discovery and vaccine development. *Front. Artif. Intell.* **3**, 65 (2020)
2. Asadzadeh, A., Pakkhoo, S., Saeidabad, M.M., Khezri, H., Ferdousi, R.: Information technology in emergency management of COVID-19 outbreak. *Inform. Med. Unlocked* 100475 (2020)
3. Al-Shoqran, M., Shorman, S.: A review on smart universities and artificial intelligence. In: *The Fourth Industrial Revolution: Implementation of Artificial Intelligence for Growing Business Success*, chap. 16, 1st edn. XII. Part of book series: *Studies in Computational Intelligence*, vol. 935 (2021). ISBN 978-3-030-62795-9. Series ISSN 1860-949X
4. Bragazzi, N.L., Dai, H., Damiani, G., Behzadifar, M., Martini, M., Wu, J.: How big data and artificial intelligence can help better manage the COVID-19 pandemic. *Int. J. Environ. Res. Public Health* **17**(9), 3176 (2020)
5. Hussain, A.A., Bouachir, O., Al-Turjman, F., Aloqaily, M.: AI techniques for COVID-19. *IEEE Access* **8**, 128776–128795 (2020)
6. Jamshidi, M., Lalbakhsh, A., Talla, J., Peroutka, Z., Hadjilooei, F., Lalbakhsh, P., Jamshidi, M., La Spada, L., Mirmozafari, M., Dehghani, M., Sabet, A.: Artificial intelligence and COVID-19: deep learning approaches for diagnosis and treatment. *IEEE Access* **8**, 109581–109595 (2020)
7. Lalmuanawma, S., Hussain, J., Chhakchuak, L.: Applications of machine learning and artificial intelligence for Covid-19 (SARS-CoV-2) pandemic: a review. *Chaos Solitons Fractals* 110059 (2020)
8. Maurya, M.R., Sadasivuni, K.K., Al-Maadeed, S.A.S.: *Smart Technologies Driven Approaches to Tackle COVID-19 Pandemic* (2020)
9. Shino, E., Binder, M.: Defying the Rally During COVID-19 pandemic: a regression discontinuity approach. *Soc. Sci. Q.* **101**(5), 1979–1994 (2020)
10. Shorten, C., Khoshgoftaar, T.M., Furht, B.: Deep learning applications for COVID-19. *J. Big Data* **8**(1), 1–54 (2021). <https://doi.org/10.1186/s40537-020-00392-9>
11. Ting, D.S.W., Carin, L., Dzau, V., Wong, T.Y.: Digital technology and COVID-19. *Nat. Med.* **26**(4), 459–461 (2020)
12. Website of world health organization (WHO) Coronavirus Disease (COVID-19) Dashboard. <https://covid19.who.int/>. Accessed 17 Jan 2021
13. Website: <https://www.worldometers.info/coronavirus/countries-where-coronavirus-has-spread/>. Accessed 21 Jan 2021