International Research Journal of Innovations in Engineering and Technology (IRJIET)

ISSN (online): 2581-3048

Volume 5, Issue 6, pp 485-490, June-2021

https://doi.org/10.47001/IRJIET/2021.506084

Forecasting Covid-19 New Cases in Senegal

[1]Dr. Smartson. P. NYONI, [2]Mr. Thabani NYONI, [3]Mr. Tatenda. A. CHIHOHO

[1]ZICHIRe Project, University of Zimbabwe, Harare, Zimbabwe
[2]SAGIT Innovation Center, Harare, Zimbabwe
[3]Independent Health Economist, Harare, Zimbabwe

***Abstract* - COVID-19 has caused serious devastations to human populations across the world and Senegal, just like other African countries; has been affected too. In this article, the ANN model was applied to forecast COVID-19 cases in Senegal. This study is based on daily new cases of COVID-19 in Senegal for the period 1 January 2020 – 25 March 2021. The out-of-sample forecast covers the period 26 March 2021 – 31 July 2021. The residuals and forecast evaluation criteria (Error, MSE and MAE) of the applied model indicate that the model is stable in forecasting daily COVID-19 cases in the country. The results of the study indicate that daily COVID-19 cases in Senegal are likely to decline significantly over the out-of-sample period. We encourage the government of Senegal to continue applying all World Health Organization (WHO) recommended control and preventive measures such as social distancing, sanitizing hands, washing of hands, face-mask wearing as well as vaccinations.**

Keywords: ANN, COVID-19, Forecasting.

I. INTRODUCTION

Coronaviruses are a group of viruses that cause infection ranging from a usual cold to Severe Acute Respiratory Syndrome (SARS). The current coronavirus disease (COVID-19) was first reported in Wuhan, China, on 31 December 2019. Its common symptoms are cold, fever, breathings problems and shortness of breath. In more critical cases, pneumonia, kidney failure, severe acute respiratory syndrome and even loss of life have also been reported (WHO, 2020). The virus may spread from bats to humans through another intermediate host and cause severe respiratory syndrome (Li *et al*., 2020), characterized by strong human-to-human transmission trough the air (Guan *et al*., 2020). What makes COVID-19 so strange and frightening is the intensity of the virus and yet unknown mechanism (Kavadi *et al*., 2020). The infectivity of COVID-19 is far much greater than of influenza, with an estimated basic reproduction number of 2.28 (Zhang *et al*., 2020). The number of infections worldwide is still increasing (Wang *et al*., 2020). Studies on forecasting COVID-19 daily cases in Senegal are very important for strategizing in the fight against the pandemic and yet the government has not yet presented any official COVID-19 predictive model in the country. This study will contribute differently to the existing body of literature in the sense that we make use of the Artificial Neural Networks (ANN) model, a deep learning technique suitable for forecasting complex data sets such as COVID-19 data sets. Our results are envisioned to compliment government efforts in the fight against COVID-19 in Senegal.

II. METHODOLOGY

The Artificial Neural Network (ANN) approach, which is flexible and capable of nonlinear modeling; will be applied in this study. The ANN is a data processing system consisting of a large number of highly interconnected processing elements in architecture inspired by the way biological nervous systems of the brain appear like. Since no explicit guidelines exist for the determination of the ANN structure, the study applies the popular ANN (12, 12, 1) model based on the hyperbolic tangent activation function. This paper applies the Artificial Neural Network (ANN) approach in predicting new COVID-19 cases in Senegal.

Data Issues

This study is based on daily new cases of COVID-19 in Senegal for the period 1 January 2020 – 25 March 2021.The out-of-sample forecast covers the period 26 March 2021 – 31 July 2021.All the data employed in this research paper was gathered from the Johns Hopkins University (USA).

International Research Journal of Innovations in Engineering and Technology (IRJIET)
ISSN (online): 2581-3048
Volume 5, Issue 6, pp 485-490, June-2021
https://doi.org/10.47001/IRJIET/2021.506084

III. FINDINGS OF THE STUDY

ANN Model Summary

Table 1: ANN model summary

Variable	S
Observations	438 (After Adjusting Endpoints)
Neural Network Architecture:	
Input Layer Neurons	12
Hidden Layer Neurons	12
Output Layer Neurons	1
Activation Function	Hyperbolic Tangent Function
Back Propagation Learning:	
Learning Rate	0.005
Momentum	0.05
Criteria:	
Error	0.127648
MSE	1073.419871
MAE	21.625272

Residual Analysis for the Applied Model

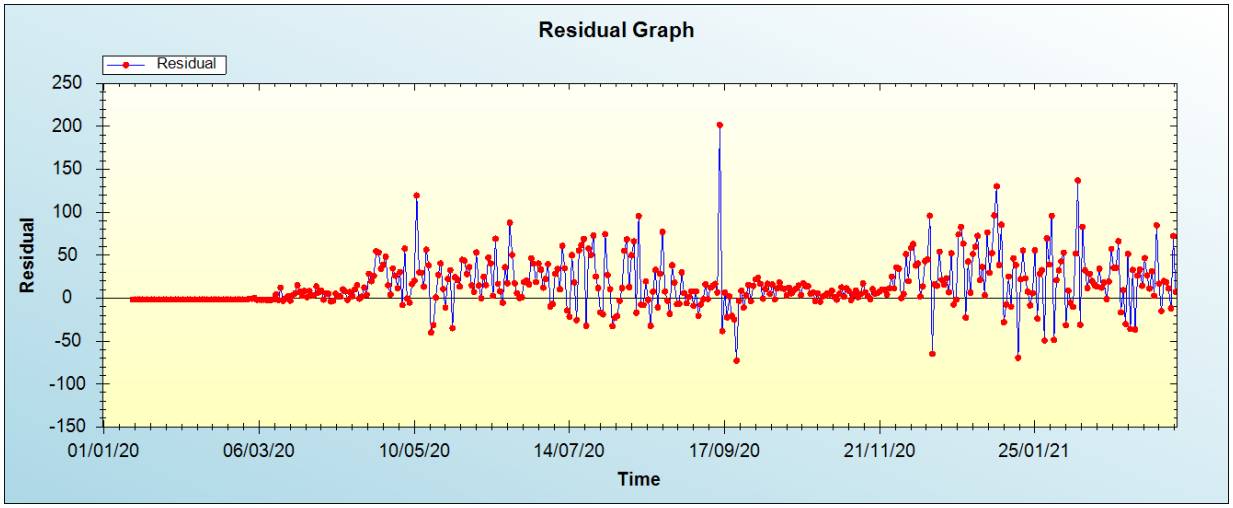

Figure 1: Residual analysis

In-sample Forecast for S

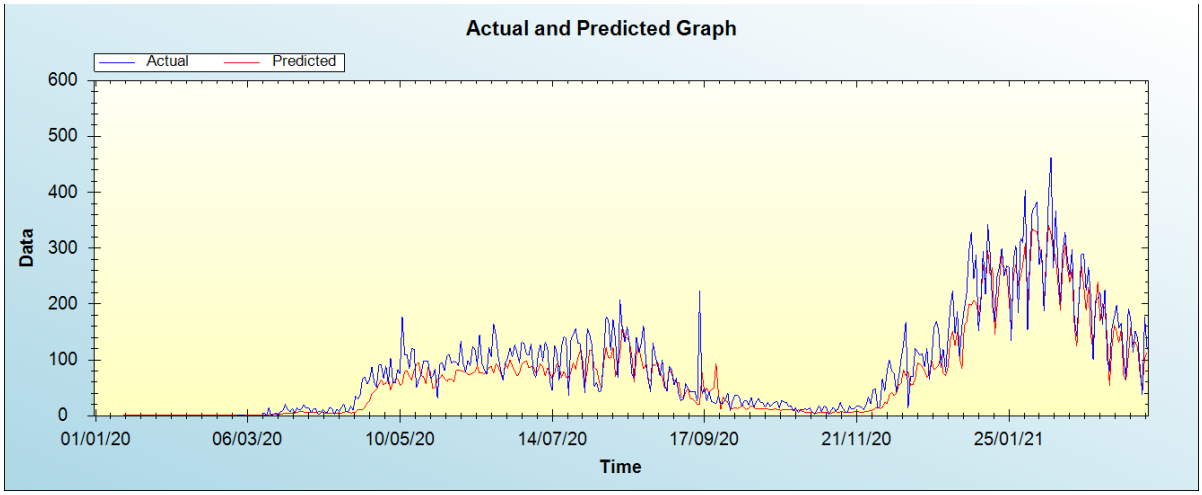

Figure 2: In-sample forecast for the S series

International Research Journal of Innovations in Engineering and Technology (IRJIET)
ISSN (online): 2581-3048
Volume 5, Issue 6, pp 485-490, June-2021
https://doi.org/10.47001/IRJIET/2021.506084

Out-of-Sample Forecast for S: Actual and Forecasted Graph

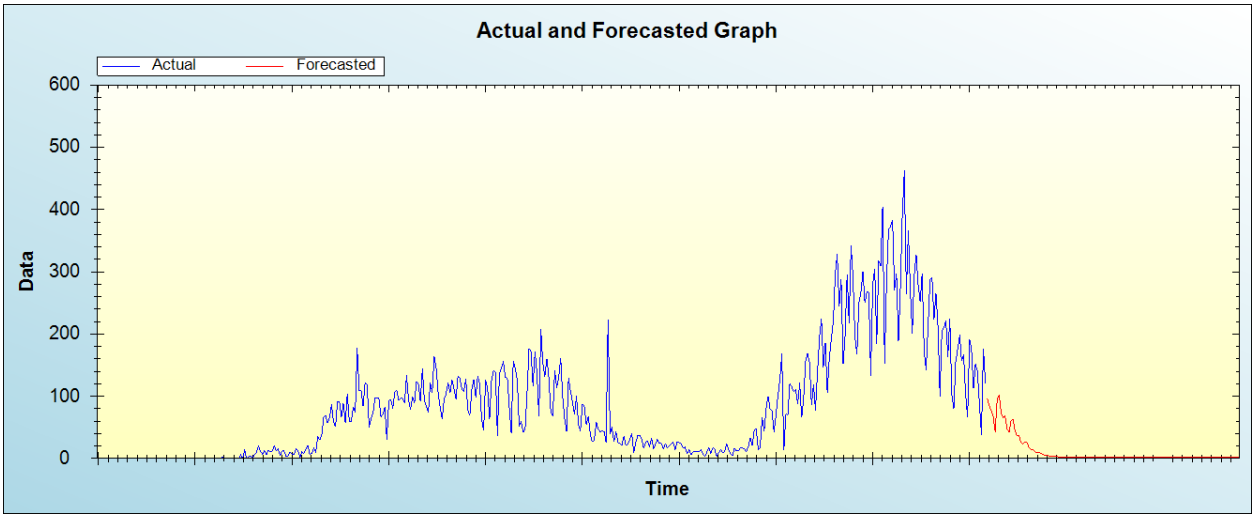

Figure 3: Out-of-sample forecast for S: actual and forecasted graph

Out-of-Sample Forecast for S: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Date	Forecasts
26/03/21	96.0453
27/03/21	84.2531
28/03/21	77.2980
29/03/21	66.7835
30/03/21	43.0281
31/03/21	96.2451
01/04/21	101.5474
02/04/21	72.0015
03/04/21	65.1889
04/04/21	68.4952
05/04/21	47.1605
06/04/21	42.3326
07/04/21	60.5045
08/04/21	63.1748
09/04/21	44.5962
10/04/21	37.0434
11/04/21	36.9328
12/04/21	25.8687
13/04/21	23.7107
14/04/21	27.2824
15/04/21	26.3136
16/04/21	17.9726
17/04/21	14.8526
18/04/21	13.9054
19/04/21	10.9585
20/04/21	9.5708
21/04/21	9.4932
22/04/21	8.3717
23/04/21	6.1663
24/04/21	5.3107
25/04/21	4.9889
26/04/21	4.3096
27/04/21	3.8712

ISSN (online): 2581-3048
Volume 5, Issue 6, pp 485-490, June-2021
https://doi.org/10.47001/IRJIET/2021.506084

28/04/21	3.7513
29/04/21	3.4424
30/04/21	3.0174
01/05/21	2.8602
02/05/21	2.8142
03/05/21	2.7115
04/05/21	2.6470
05/05/21	2.6426
06/05/21	2.5977
07/05/21	2.5364
08/05/21	2.5251
09/05/21	2.5332
10/05/21	2.5282
11/05/21	2.5272
12/05/21	2.5338
13/05/21	2.5308
14/05/21	2.5245
15/05/21	2.5268
16/05/21	2.5320
17/05/21	2.5338
18/05/21	2.5353
19/05/21	2.5375
20/05/21	2.5375
21/05/21	2.5368
22/05/21	2.5378
23/05/21	2.5391
24/05/21	2.5396
25/05/21	2.5399
26/05/21	2.5403
27/05/21	2.5402
28/05/21	2.5401
29/05/21	2.5402
30/05/21	2.5405
31/05/21	2.5405
01/06/21	2.5405
02/06/21	2.5406
03/06/21	2.5405
04/06/21	2.5405
05/06/21	2.5405
06/06/21	2.5405
07/06/21	2.5405
08/06/21	2.5405
09/06/21	2.5405
10/06/21	2.5405
11/06/21	2.5405
12/06/21	2.5405
13/06/21	2.5405
14/06/21	2.5405
15/06/21	2.5405
16/06/21	2.5405
17/06/21	2.5405
18/06/21	2.5405
19/06/21	2.5405
20/06/21	2.5405
21/06/21	2.5405
22/06/21	2.5405
23/06/21	2.5405
24/06/21	2.5405
25/06/21	2.5405
26/06/21	2.5405
27/06/21	2.5405
28/06/21	2.5405
29/06/21	2.5405
30/06/21	2.5405

International Research Journal of Innovations in Engineering and Technology (IRJIET)
ISSN (online): 2581-3048
Volume 5, Issue 6, pp 485-490, June-2021
https://doi.org/10.47001/IRJIET/2021.506084

01/07/21	2.5405
02/07/21	2.5405
03/07/21	2.5405
04/07/21	2.5405
05/07/21	2.5405
06/07/21	2.5405
07/07/21	2.5405
08/07/21	2.5405
09/07/21	2.5405
10/07/21	2.5405
11/07/21	2.5405
12/07/21	2.5405
13/07/21	2.5405
14/07/21	2.5405
15/07/21	2.5405
16/07/21	2.5405
17/07/21	2.5405
18/07/21	2.5405
19/07/21	2.5405
20/07/21	2.5405
21/07/21	2.5405
22/07/21	2.5405
23/07/21	2.5405
24/07/21	2.5405
25/07/21	2.5405
26/07/21	2.5405
27/07/21	2.5405
28/07/21	2.5405
29/07/21	2.5405
30/07/21	2.5405
31/07/21	2.5405

The main results of the study are shown in table 1. It is clear that the model is stable as confirmed by evaluation criterion as well as the residual plot of the model shown in figure 1. It is projected that daily COVID-19 cases in Senegal are likely to decline significantly over the out-of-sample period.

IV. CONCLUSION & RECOMMENDATIONS

Predicting the trend of COVID-19 is an extremely vital challenge, especially for developing countries such as Senegal whose health systems is fragile and could be overwhelmed by catastrophic increases in daily COVID-19 case volumes. The paper employed an ANN technique based on the hyperbolic tangent function as the activation function. It is projected that daily COVID-19 cases in Senegal are likely to decline significantly over the out-of-sample period. We encourage the government of Senegal to continue applying all World Health Organization (WHO) recommended control and preventive measures such as social distancing, sanitizing hands, washing of hands, face-mask wearing as well as vaccinations. Even-though our model does not indicate a possibility of the pandemic ending soon in Senegal, it does give a green light on the possibility of getting "on top" of the virus.

REFERENCES

[1] Guan, W., et al. (2020). Clinical Characteristics of Coronavirus Disease 2019 in China, New England Journal of Medicine, pp: 1 – 14.
[2] Kavadi, D. P., et al. (2020). Partial Derivative Nonlinear Global Pandemic Machine Learning Prediction of COVID-19, Chaos, Solitons and Fractals, 139 (2020): 1 – 7.
[3] Li, X., et al. (2020). Evolutionary History, Potential Intermediate Animal Host, and Cross Species Analyses of SARS-CoV-2, Journal of Medical Virology, pp: 1 – 9.
[4] Wang, P., et al. (2020). Prediction of Epidemic Trends in COVID-19 With Logistic Model and Machine Learning Technics, Chaos, Solitons and Fractals, 139 (2020): 1 – 7.
[5] WHO (2020). Coronavirus, WHO, Geneva.

ISSN (online): 2581-3048
Volume 5, Issue 6, pp 485-490, June-2021
https://doi.org/10.47001/IRJIET/2021.506084

[6] Zhang, S., et al. (2020). Estimation of the Reproductive Number of Novel Coronavirus (COVID-19) and the Probable Outbreak Size on the Diamond Princess Cruise ship: A Data Driven Analysis, International Journal of Infectious Diseases, 93: 201 – 204.

Citation of this Article:

Dr. Smartson. P. NYONI, Mr. Thabani NYONI, Mr. Tatenda. A. CHIHOHO, "Forecasting Covid-19 New Cases in Senegal" Published in *International Research Journal of Innovations in Engineering and Technology - IRJIET*, Volume 5, Issue 6, pp 485-490, June 2021. Article DOI https://doi.org/10.47001/IRJIET/2021.506084

****

