Forecasting Covid-19 New Cases in Bahamas

[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 - **Caused by a novel coronavirus, COVID-19 has played havoc on many countries across the globe and the Bahamas have never been an exception. Just like the rest of the world, the country continues to live a restricted environment in order to prevent exposure to this highly infectious disease. In this research article, the ANN approach was used to model and forecast daily COVID-19 cases in Bahamas. This study is based on daily new cases of COVID-19 in Bahamas 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 show us that the model is stable in forecasting COVID-19 daily new infections in Bahamas. The results of the study indicate that daily COVID-19 cases in Bahamas are likely to hover around 55 cases per day over the out-of-sample period. We encourage government of the Bahamas to continue enforcing control and preventive measures such as mass-media sensitization, social distancing, face-mask wearing, contact tracing, disinfection and decontamination of infected areas, washing and sanitization of hands and so on as advised by the WHO.**

Keywords: ANN, COVID-19, Forecasting.

I. INTRODUCTION

COVID-19 is a deadly viral disease quickly spreading its roots in literally all parts of the world. Its common symptoms include fever, sore throat, coughing and difficulty in breathing. The first few cases appeared in Wuhan, China, and the gradually, cases started coming up in many other countries as well. Today, we see that this virus has infected millions of people around the world (Singhal *et al.*, 2020). The first case of COVID-19 in Bahamas was confirmed on 15 March 2020. Accurately modelling and forecasting the spread of confirmed COVID-19 cases is vital to understand and help decision makers to slow down or arrest its spreading (Velasquez & Lara, 2020). In this research, we attempt forecast daily confirmed COVID-19 cases in the country over the period January 1, 2020 to March 25, 2021; with an out-of-sample period of March 26, 2021 to July 31, 2021.

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 strict 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 Bahamas.

Data Issues

This study is based on daily new cases of COVID-19 in Bahamas 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).

III. FINDINGS OF THE STUDY

ANN Model Summary

Table 1: ANN model summary

Variable	B
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	0.115423
MSE	395.151507
MAE	14.739080

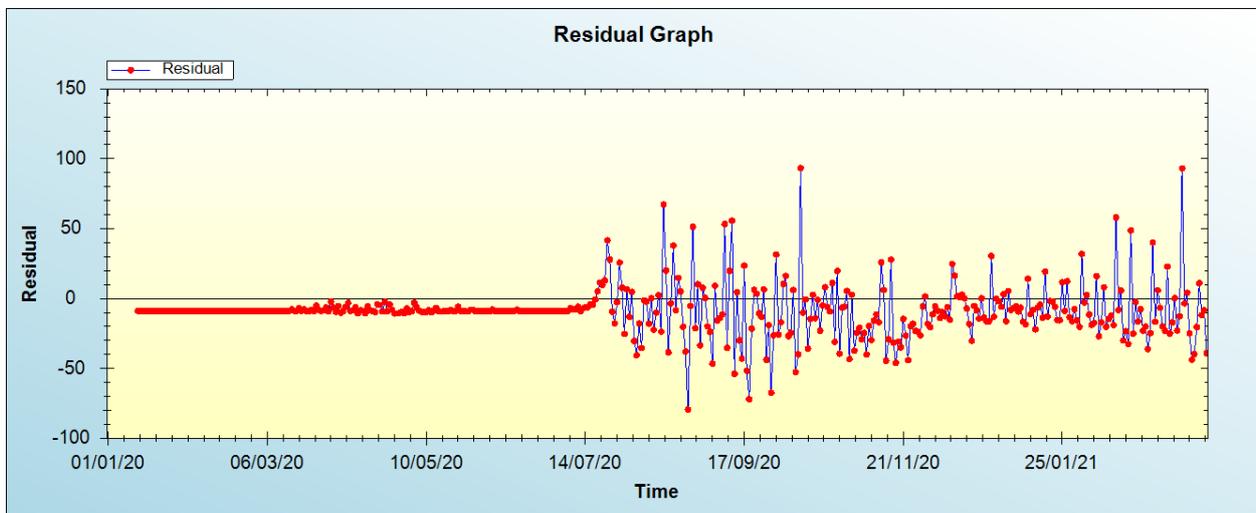*Residual Analysis for the Applied Model*

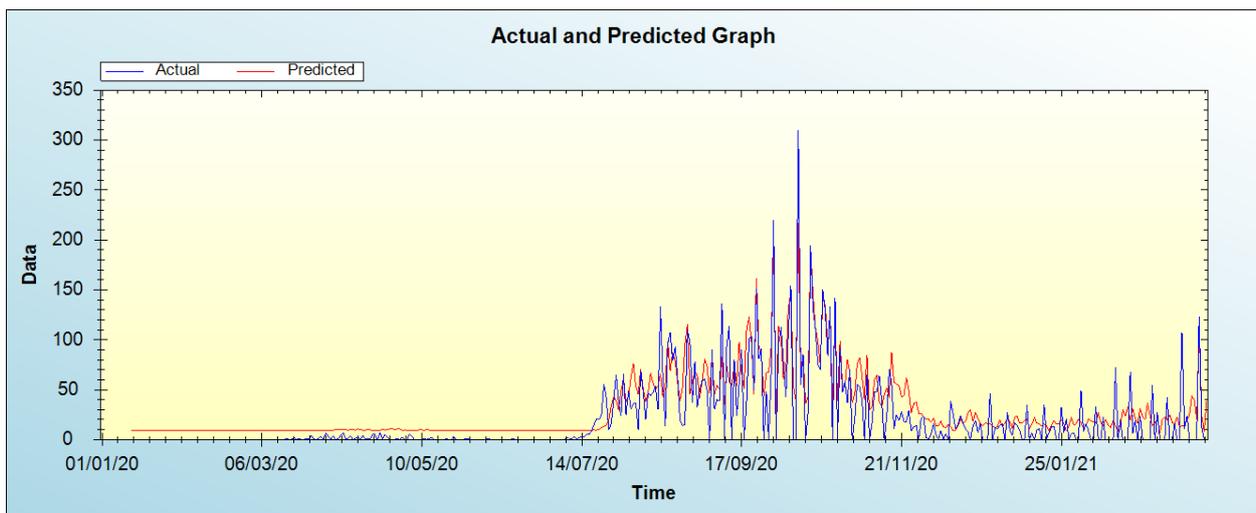**Figure 1: Residual analysis**

In-sample Forecast for B

Figure 2: In-sample forecast for the B series

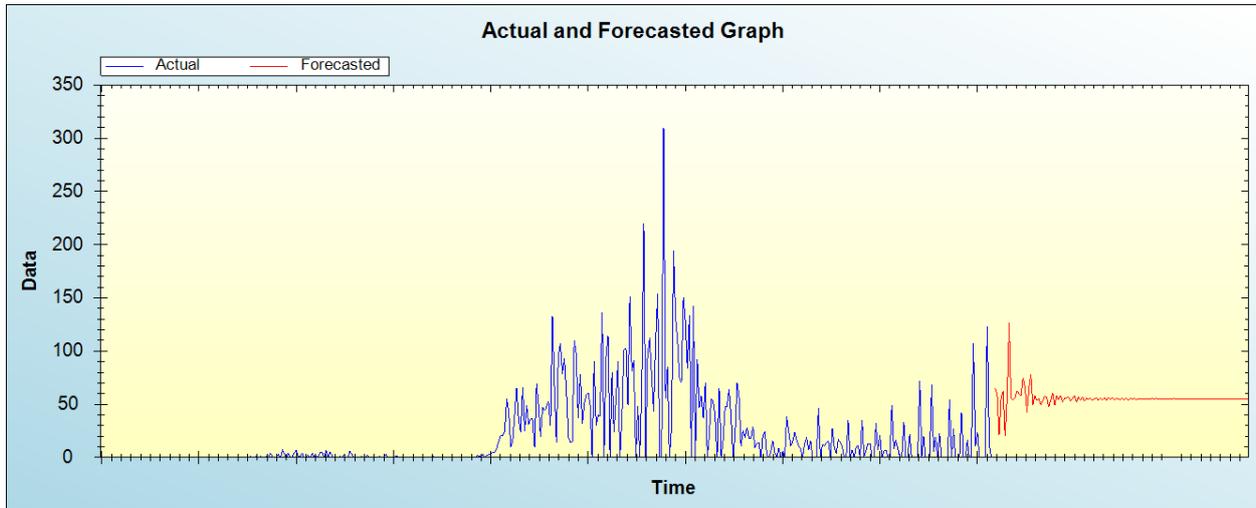*Out-of-Sample Forecast for B: Actual and Forecasted Graph*

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

Out-of-Sample Forecast for B: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Day/Month/Year	Forecasts
26/03/21	64.5084
27/03/21	59.7134
28/03/21	21.2769
29/03/21	56.4914
30/03/21	61.9305
31/03/21	20.6633
01/04/21	56.8325
02/04/21	125.9035
03/04/21	55.3487
04/04/21	53.9362
05/04/21	55.7001
06/04/21	62.7305
07/04/21	59.8219
08/04/21	58.1522
09/04/21	74.8013
10/04/21	66.3922
11/04/21	42.8328
12/04/21	64.4238
13/04/21	78.2808
14/04/21	48.9311
15/04/21	58.1746
16/04/21	53.4390
17/04/21	55.5022
18/04/21	49.6572
19/04/21	52.8029
20/04/21	57.8108
21/04/21	56.3950
22/04/21	47.5535
23/04/21	53.8069
24/04/21	60.9996
25/04/21	49.3359
26/04/21	57.9091
27/04/21	54.4905
28/04/21	58.1039
29/04/21	52.3755
30/04/21	55.5638
01/05/21	56.2357

02/05/21	57.2125
03/05/21	53.1155
04/05/21	55.5719
05/05/21	57.8461
06/05/21	52.0362
07/05/21	56.6731
08/05/21	53.5976
09/05/21	56.9256
10/05/21	52.8580
11/05/21	55.6037
12/05/21	54.3338
13/05/21	55.7739
14/05/21	53.4951
15/05/21	55.1884
16/05/21	55.9293
17/05/21	53.4661
18/05/21	56.0713
19/05/21	53.8512
20/05/21	56.4038
21/05/21	53.6071
22/05/21	55.9927
23/05/21	54.3361
24/05/21	55.8433
25/05/21	54.1253
26/05/21	55.3761
27/05/21	55.2483
28/05/21	54.3251
29/05/21	55.6116
30/05/21	54.1885
31/05/21	55.8568
01/06/21	53.9394
02/06/21	55.7468
03/06/21	54.2361
04/06/21	55.6215
05/06/21	54.2723
06/06/21	55.3435
07/06/21	54.8763
08/06/21	54.7281
09/06/21	55.2656
10/06/21	54.5002
11/06/21	55.5281
12/06/21	54.2919
13/06/21	55.5767
14/06/21	54.3726
15/06/21	55.5111
16/06/21	54.4281
17/06/21	55.3366
18/06/21	54.7552
19/06/21	54.9535
20/06/21	55.0505
21/06/21	54.7152
22/06/21	55.2729
23/06/21	54.5236
24/06/21	55.3773
25/06/21	54.5014
26/06/21	55.3717
27/06/21	54.5299
28/06/21	55.2784
29/06/21	54.7133
30/06/21	55.0511
01/07/21	54.9268
02/07/21	54.8598
03/07/21	55.1094
04/07/21	54.6981

05/07/21	55.2262
06/07/21	54.6338
07/07/21	55.2585
08/07/21	54.6302
09/07/21	55.2179
10/07/21	54.7248
11/07/21	55.0851
12/07/21	54.8655
13/07/21	54.9440
14/07/21	55.0039
15/07/21	54.8139
16/07/21	55.1100
17/07/21	54.7381
18/07/21	55.1601
19/07/21	54.7133
20/07/21	55.1543
21/07/21	54.7558
22/07/21	55.0829
23/07/21	54.8430
24/07/21	54.9873
25/07/21	54.9427
26/07/21	54.8890
27/07/21	55.0304
28/07/21	54.8178
29/07/21	55.0842
30/07/21	54.7827
31/07/21	55.0977

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 Bahamas are likely to hover around 55 cases per day over the out-of-sample period.

IV. CONCLUSION AND POLICY RECOMMENDATIONS

COVID-19 has alarmingly spread all over the world, catching many people unaware and this comes up with new challenges to the 21st century research community. Forecasting the future pattern of the pandemic is one such challenge. This paper applied the neural network approach to analyze daily new COVID-19 cases in Bahamas. The proposed model is quite stable and acceptable for predicting COVID-19 cases in the country. The model shows that the country is likely to record about 55 new cases per day over the out-of-sample period. We encourage the country to continue enforcing COVID-19 control and preventive measures such as mass-media sensitization, social distancing, face-mask wearing, contact tracing, disinfection and decontamination of infected areas, washing and sanitization of hands and so on as advised by the WHO. These measures will definitely go a long way arresting a further increase or second wave of infections in Bahamas.

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