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Forecasting Covid-19 New Cases in Barbados

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***Abstract* - The crisis of COVID-19 is growing and has devastating implications for many countries around the world. In this research article, the ANN technique was applied to analyze daily COVID-19 cases based on new cases of COVID-19 in Barbados 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 employed model suggest that the model is stable in forecasting COVID-19 cases in Barbados. The results of the study imply that that daily COVID-19 cases in Barbados are likely to remain relatively low over the out-of-sample period. The government should continue to implement strong control and preventive measures in order to save lives despite the projected relatively low COVID-19 case volumes.**

Keywords: ANN, COVID-19, Forecasting.

I. INTRODUCTION

The outbreak of COVID-19 was first detected in Wuhan, China, in late 2019 (Porcheddu *et al*., 2020). Later on, the virus has overtaken the burden of morbidity and mortality around the world with a quick and dexterous spread compared to China (Jahan & Rahman, 2020). The clinical symptoms of COVID-19 are identified as fever, cough, rhinorrhea, sneezing, sore throat, and fatigue, while other symptoms include sputum production, headache, haemoptysis, diarrhoea, dyspnea, and lymphopenia. In addition, there are abnormal features like acute respiratory distress syndrome and acute cardiac injury (Huang *et al*., 2020). The genomic sequence analysis of COVID-19 indicates that approximately 80% of transmission occurs primarily from person-to-person transmission through droplets of saliva or discharge from the nose when an infected person coughs or sneezes (Wan *et al*., 2020). In Barbados, the first cases were officially confirmed on March 17, 2020. The main objective of this research is to forecast daily confirmed COVID-19 cases in Barbados.

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 Barbados.

Data Issues

This study is based on daily new cases of COVID-19 in Barbados 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	BB
Observations	438 (After Adjusting Endpoints)
Neural Network Architecture:	

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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	0.09619
MSE	122.365694
MAE	6.509786

Residual Analysis for the Applied Model

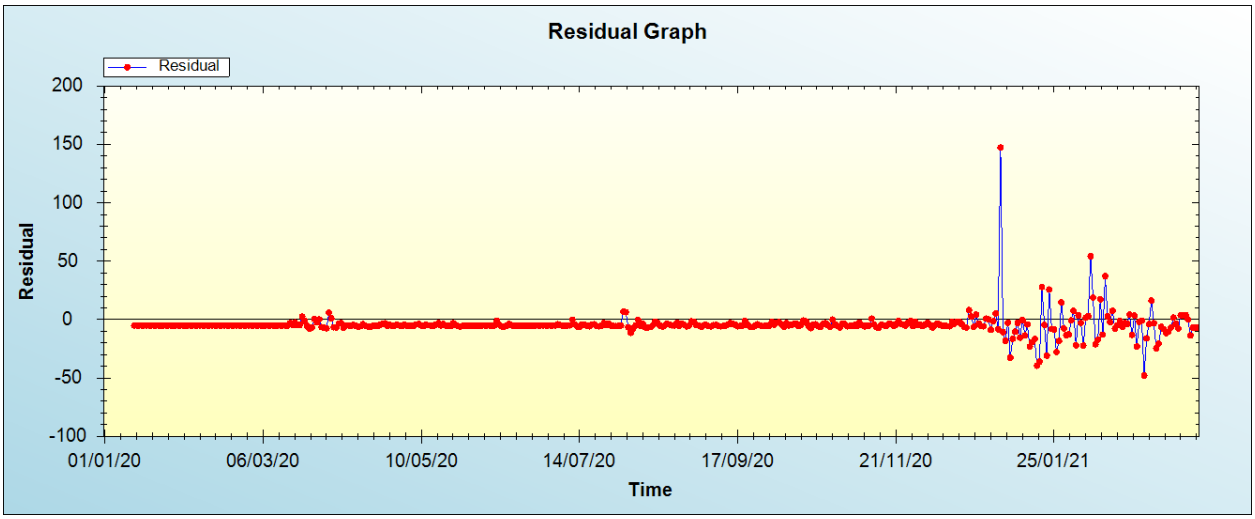

Figure 1: Residual analysis

In-sample Forecast for BB

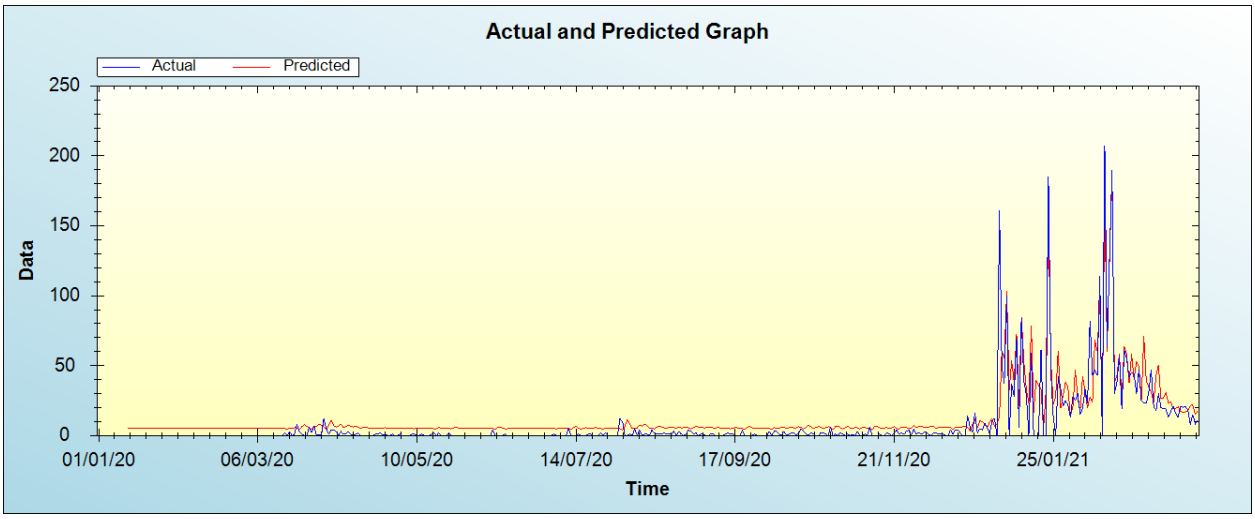

Figure 2: In-sample forecast for the BB series

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

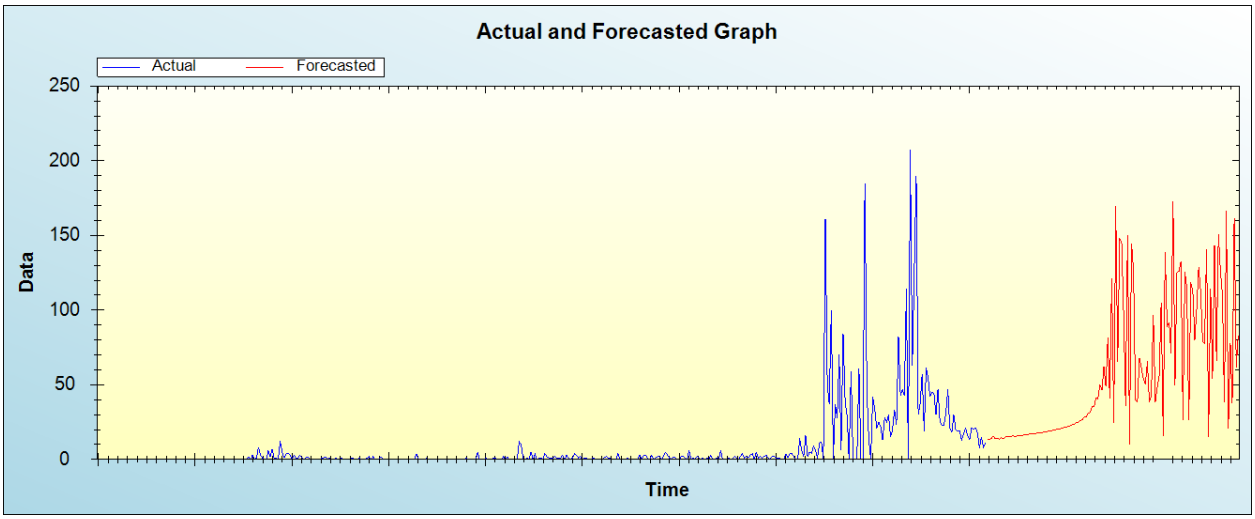

Figure 3: Out-of-sample forecast for BB: actual and forecasted graph

Out-of-Sample Forecast for BB: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Day/Month/Year	Forecasts
26/03/21	13.8856
27/03/21	13.0199
28/03/21	14.0426
29/03/21	15.8055
30/03/21	13.9819
31/03/21	14.0080
01/04/21	13.6044
02/04/21	14.8295
03/04/21	13.6959
04/04/21	15.1810
05/04/21	15.0364
06/04/21	15.2918
07/04/21	15.2300
08/04/21	15.9188
09/04/21	15.2819
10/04/21	15.8931
11/04/21	15.8181
12/04/21	16.2709
13/04/21	16.0845
14/04/21	16.7143
15/04/21	16.5352
16/04/21	16.9394
17/04/21	16.9111
18/04/21	17.3381
19/04/21	17.2115
20/04/21	17.7079
21/04/21	17.6711
22/04/21	18.0902
23/04/21	18.0823
24/04/21	18.5542
25/04/21	18.5239
26/04/21	19.0010
27/04/21	19.0258
28/04/21	19.5155
29/04/21	19.5444

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30/04/21	20.0987
01/05/21	20.1433
02/05/21	20.7353
03/05/21	20.8122
04/05/21	21.4809
05/05/21	21.5695
06/05/21	22.3455
07/05/21	22.4651
08/05/21	23.3761
09/05/21	23.5279
10/05/21	24.6453
11/05/21	24.8297
12/05/21	26.2418
13/05/21	26.4730
14/05/21	28.3337
15/05/21	28.6090
16/05/21	31.1871
17/05/21	31.4855
18/05/21	35.2474
19/05/21	35.4360
20/05/21	41.2235
21/05/21	40.6938
22/05/21	49.9704
23/05/21	46.4212
24/05/21	62.2809
25/05/21	48.8738
26/05/21	81.6666
27/05/21	40.7992
28/05/21	121.2302
29/05/21	24.6739
30/05/21	169.2519
31/05/21	65.3552
01/06/21	148.2102
02/06/21	144.4446
03/06/21	97.0217
04/06/21	35.9742
05/06/21	150.2114
06/06/21	10.4232
07/06/21	144.4869
08/06/21	126.5565
09/06/21	39.6962
10/06/21	38.4606
11/06/21	68.0560
12/06/21	61.2254
13/06/21	54.2559
14/06/21	50.1693
15/06/21	65.4978
16/06/21	38.5906
17/06/21	42.2757
18/06/21	96.8253
19/06/21	38.2573
20/06/21	48.3739
21/06/21	55.6977
22/06/21	104.7512
23/06/21	15.7661
24/06/21	138.9298
25/06/21	89.0381
26/06/21	91.6006
27/06/21	70.9781
28/06/21	172.9353
29/06/21	49.4616
30/06/21	125.0517
01/07/21	125.9945
02/07/21	132.5045

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03/07/21	26.7028
04/07/21	125.1916
05/07/21	115.2398
06/07/21	26.4844
07/07/21	118.3945
08/07/21	113.0633
09/07/21	79.9104
10/07/21	101.8266
11/07/21	129.0030
12/07/21	112.1360
13/07/21	79.2510
14/07/21	77.8325
15/07/21	140.7808
16/07/21	15.2181
17/07/21	114.1407
18/07/21	54.1678
19/07/21	143.5681
20/07/21	66.2785
21/07/21	150.5683
22/07/21	126.1002
23/07/21	110.0127
24/07/21	38.7553
25/07/21	166.1462
26/07/21	20.6221
27/07/21	77.7265
28/07/21	37.9062
29/07/21	161.2817
30/07/21	62.0018
31/07/21	83.0298

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 Barbados are likely to remain relatively low over the out-of-sample period.

IV. CONCLUSION AND POLICY RECOMMENDATIONS

There is no doubt; the COVID-19 pandemic is an essential international test for the medical and scientific community, as it reveals weaknesses in the management of emerging viral diseases and reminds us that contagious diseases should never be underestimated (WHO, 2020). Barbados, just like any other country in any part of the world, has not been spared by this pandemic and hence the need for forecasting and control. Based on 450 daily observations of COVID-19 cases in Barbados, this study used the ANN model to come up with daily forecasts ranging over the period March 26, 2021 to July 31, 2021. The results of the study hint that the whole out-of-sample period could be the beginning of the end of the pandemic in Barbados. Despite the predicted further decrease in COVID-19 cases in Barbados, the government of the country should continue to implement strong control and preventive measures in order to save as many lives as possible.

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