

Forecasting Covid-19 New Cases in Suriname

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Abstract - In this research article, the ANN approach was applied to investigate COVID-19 cases in Suriname. This study is based on monthly new cases of COVID-19 in Suriname 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 Suriname. The results of the study generally suggest that daily COVID-19 cases in Suriname are likely to remain significantly high over the out-of-sample period. The government should continue to enforce sanitary rules postulated by the WHO and also embrace vaccine uptake in the country. We also encourage people in the country to always behave responsibly with regards to face-mask wearing, social distancing and so on., in order to stop avoidable infections in the country.

Keywords: ANN, COVID-19, Forecasting.

I. INTRODUCTION

The index case of COVID-19 occurred in late December 2019 in Wuhan in China (Zhu *et al.*, 2020). Since then, cases have been exported to other Chinese cities, as well as internationally, highlighting concern of a global outbreak (Wu *et al.*, 2020). COVID-19 symptoms include dry cough, fever, difficulty of breathing, and in some cases diarrhoea (Huang *et al.*, 2020). COVID-19 modeling in Suriname is scanty. There is need for a predictive model for the pandemic in Suriname in order to enhance planning and strategizing by public health policy makers. In an attempt to help relevant authorities in better managing the pandemic, the study seeks to model and forecast daily COVID-19 cases in Suriname.

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 Suriname.

Data Issues

This study is based on daily new cases of COVID-19 in Suriname 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	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	0.135367
MSE	109.272579
MAE	7.966231

Residual Analysis for the Applied Model

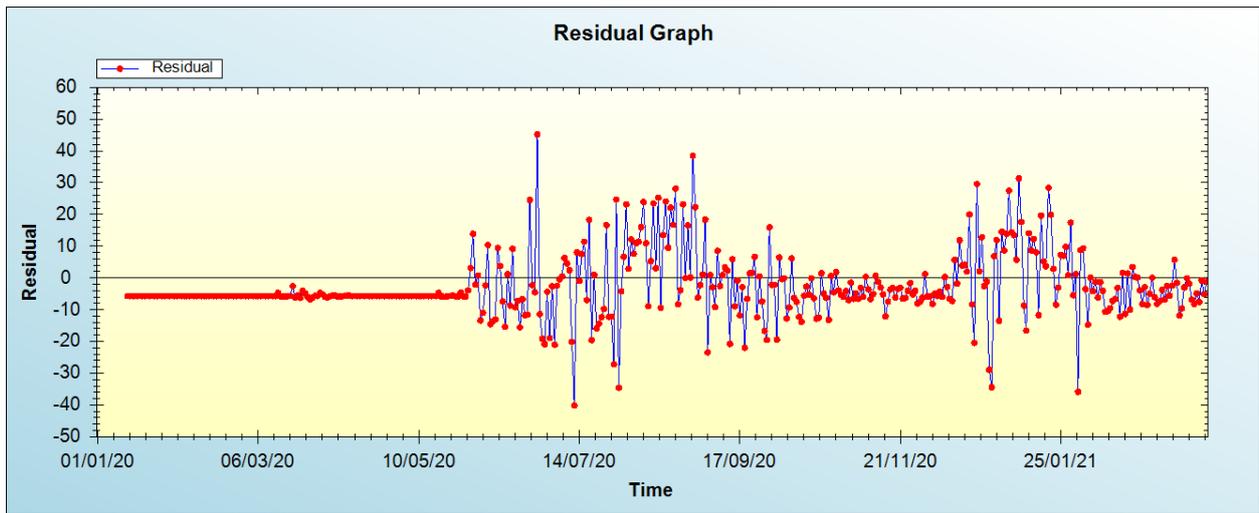


Figure 1: Residual analysis

In-sample Forecast for S

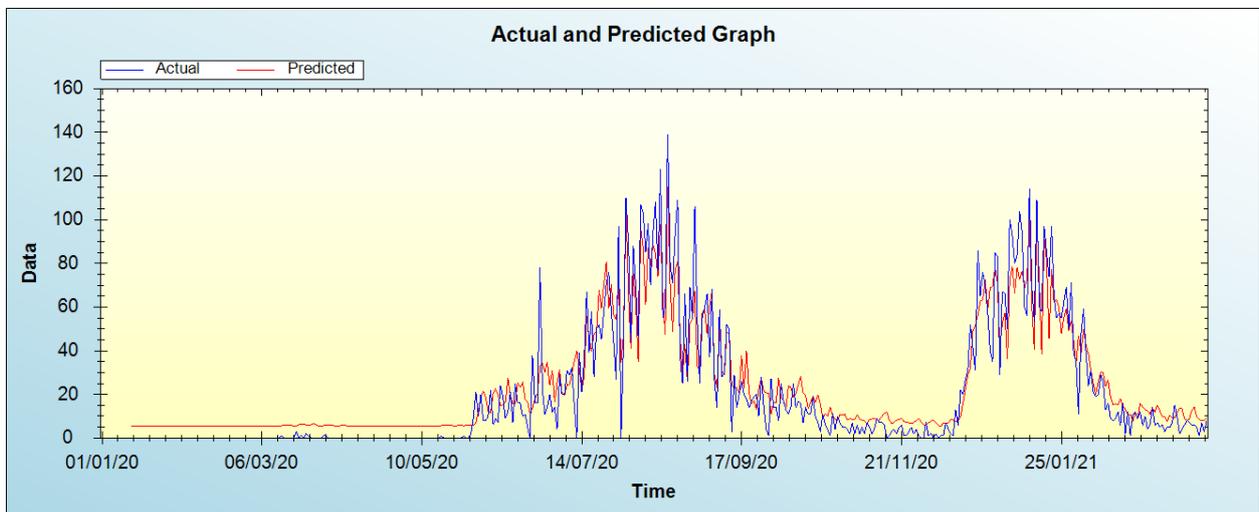


Figure 2: In-sample forecast for the S series

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

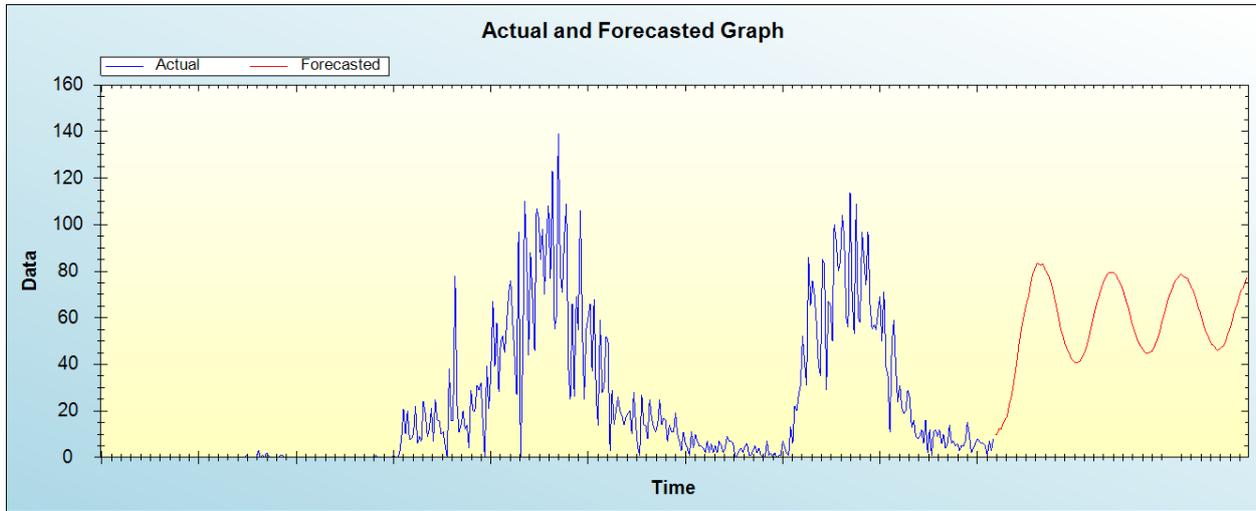


Figure 3: Out-of-sample forecast for S: actual and forecasted graph

Out-of-Sample Forecast for S: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Date	Forecasts
26/03/21	9.5100
27/03/21	10.1293
28/03/21	12.4612
29/03/21	12.1407
30/03/21	14.5903
31/03/21	16.1928
01/04/21	17.7171
02/04/21	22.5220
03/04/21	25.2184
04/04/21	30.1716
05/04/21	35.9421
06/04/21	41.6108
07/04/21	48.4968
08/04/21	54.4596
09/04/21	58.9378
10/04/21	63.0450
11/04/21	66.8143
12/04/21	69.7849
13/04/21	75.1831
14/04/21	78.8250
15/04/21	80.9601
16/04/21	83.4015
17/04/21	82.9674
18/04/21	82.7645
19/04/21	83.3140
20/04/21	81.0420
21/04/21	79.5350
22/04/21	78.0495
23/04/21	75.4860
24/04/21	72.2606
25/04/21	68.1901
26/04/21	64.3202
27/04/21	59.9012
28/04/21	55.4507
29/04/21	52.5784
30/04/21	49.5165
01/05/21	47.0201

02/05/21	45.2471
03/05/21	43.3642
04/05/21	41.6665
05/05/21	40.8124
06/05/21	40.7715
07/05/21	40.9849
08/05/21	41.6431
09/05/21	43.2265
10/05/21	45.1194
11/05/21	47.2456
12/05/21	50.5613
13/05/21	54.4724
14/05/21	58.0351
15/05/21	61.9918
16/05/21	65.7594
17/05/21	68.3574
18/05/21	71.1631
19/05/21	74.1430
20/05/21	76.1010
21/05/21	77.8515
22/05/21	79.3109
23/05/21	79.5807
24/05/21	79.4069
25/05/21	79.1683
26/05/21	78.1471
27/05/21	76.3236
28/05/21	74.7777
29/05/21	73.0587
30/05/21	70.1347
31/05/21	67.1062
01/06/21	64.4168
02/06/21	60.9661
03/06/21	57.3910
04/06/21	54.8023
05/06/21	52.3860
06/06/21	49.8804
07/06/21	48.2427
08/06/21	47.0701
09/06/21	45.6151
10/06/21	44.7795
11/06/21	44.9296
12/06/21	45.1134
13/06/21	45.6157
14/06/21	47.3007
15/06/21	49.4236
16/06/21	51.4829
17/06/21	54.5155
18/06/21	58.2250
19/06/21	61.1848
20/06/21	64.1890
21/06/21	67.6449
22/06/21	69.9822
23/06/21	72.0741
24/06/21	74.8639
25/06/21	76.3912
26/06/21	77.0746
27/06/21	78.3782
28/06/21	78.6373
29/06/21	77.7099
30/06/21	77.3266
01/07/21	76.6483
02/07/21	74.5840
03/07/21	72.6847
04/07/21	71.3021

05/07/21	68.5678
06/07/21	65.1858
07/07/21	62.9049
08/07/21	60.2685
09/07/21	56.6828
10/07/21	54.3152
11/07/21	52.7184
12/07/21	50.3558
13/07/21	48.6062
14/07/21	48.0558
15/07/21	47.0536
16/07/21	46.0763
17/07/21	46.6441
18/07/21	47.5176
19/07/21	47.9051
20/07/21	49.6188
21/07/21	52.5198
22/07/21	54.6570
23/07/21	57.1969
24/07/21	61.2118
25/07/21	64.0407
26/07/21	66.0200
27/07/21	69.5103
28/07/21	71.9628
29/07/21	72.9669
30/07/21	75.5594
31/07/21	77.2984

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 Suriname are likely to remain significantly high over the out-of-sample period.

IV. CONCLUSION & RECOMMENDATIONS

Declared as a pandemic by WHO, early this year, COVID-19 is currently the most troublesome disease in the world, affecting everyone. Suriname also, just like other countries around the world, was not able to escape from the scourge. Today, the virus is now a serious threat in the country. It has become critical for us to model and forecast the trends of the pandemic in the country in order to inform policy. The study relied on an ANN model and established that daily COVID-19 cases in Suriname are likely to remain significantly high over the out-of-sample period. The government should continue to enforce sanitary rules postulated by the WHO and also embrace vaccine uptake in the country. We also encourage people in the country to always behave responsibly with regards to face-mask wearing, social distancing and so on., in order to stop avoidable infections in the country.

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