Forecasting Covid-19 New Cases in Trinidad & Tobago

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Abstract - **The need for forecasting the future trend of COVID-19 is at its highest levels now. Forecasting the disease progression will lessen the burden of health workers in terms of managing the pandemic. Trinidad & Tobago, just like any other resource-limited country, is in need of accurate forecasts of the COVID-19 cases, in order to be "on top" of the virus. In this research paper, the ANN approach was applied to analyze COVID-19 cases in the country. This study is based on monthly new cases of COVID-19 in Trinidad and Tobago 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 our model indicate that the model is stable and acceptable for predicting daily new COVID-19 cases in Trinidad & Tobago. It is projected that daily COVID-19 cases in Trinidad and Tobago are likely to remain high over the out-of-sample period. Relevant authorities, especially the ministry responsible for public health; have a big role to play in terms of controlling the further spread of the virus. There is need for continued implementation of control and prevention strategies in the country, especially the vaccinations.**

Keywords: ANN, COVID-19, Forecasting.

I. INTRODUCTION

Modelling and forecasting COVID-19 dynamics is fundamental to being able to act timeously and take the best safety measures for the population (Petrica *et al*., 2020). Surprisingly, the government of Trinidad & Tobago has not yet presented any official analysis or predictions for the evolution of the pandemic and yet forecasting the pandemic will inform policy on the way forward in terms of control and prevention strategy formulation (Antonescu, 2020). There is need to come up with a forecasting model with predictions that will aid public health policy dynamics in the country (Stochitoiu*et al*., 2020).. It is this informational hiatus that we attempt to address in this regard. Hence, we attempt to model and forecast daily confirmed COVID-19 cases in Trinidad & Tobago.

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 Trinidad and Tobago.

Data Issues

This study is based on daily new cases of COVID-19 in Trinidad and Tobago 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	TT
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	0.110113
MSE	176.219543
MAE	9.567116

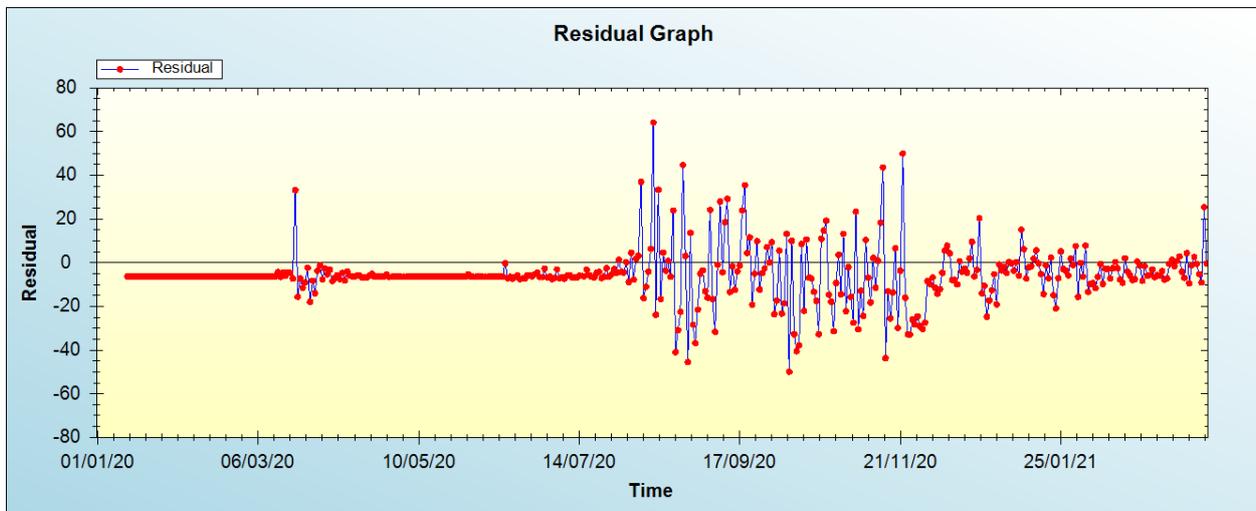*Residual Analysis for the Applied Model*

Figure 1: Residual analysis
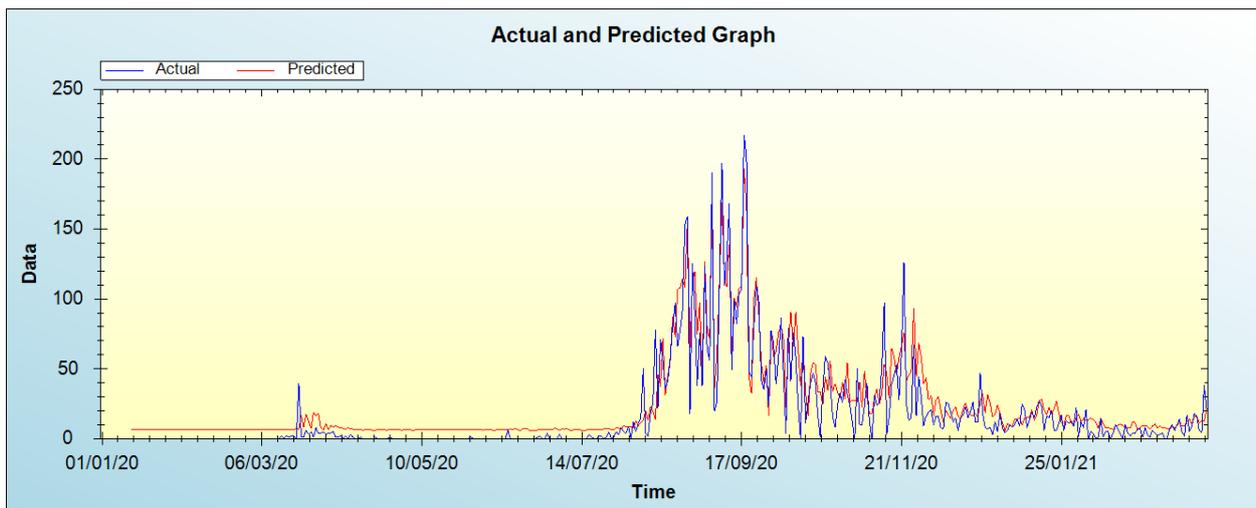
In-sample Forecast for TT

Figure 2: In-sample forecast for the TT series

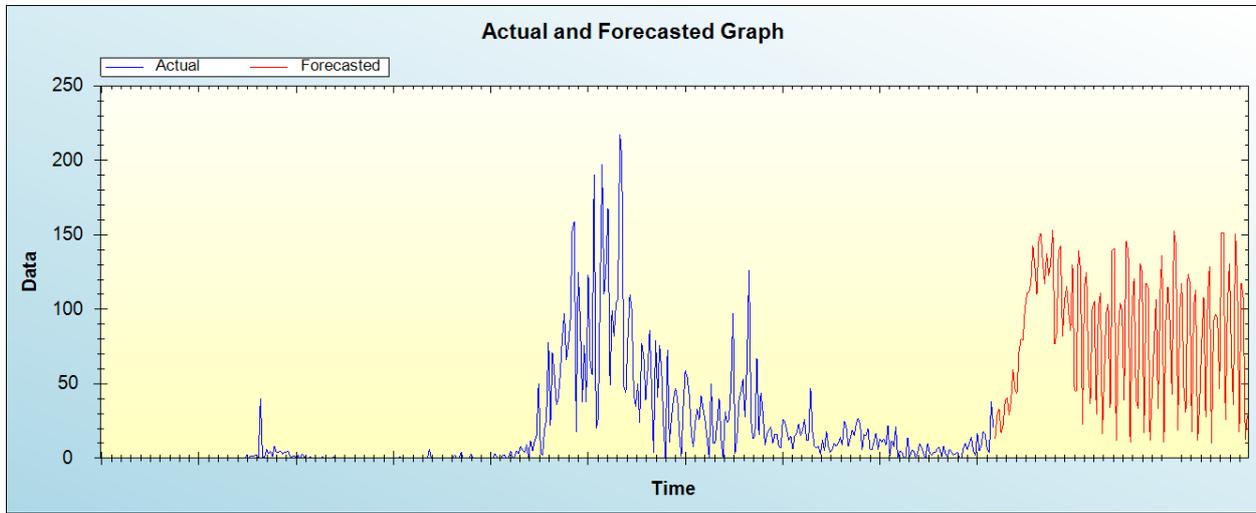*Out-of-Sample Forecast for TT: Actual and Forecasted Graph*

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

Out-of-Sample Forecast for TT: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Date	Forecasts
26/03/21	13.3436
27/03/21	29.0430
28/03/21	33.2359
29/03/21	17.0005
30/03/21	21.9979
31/03/21	38.9886
01/04/21	40.3422
02/04/21	29.0506
03/04/21	39.0079
04/04/21	59.3348
05/04/21	46.7782
06/04/21	43.2610
07/04/21	71.9149
08/04/21	80.3026
09/04/21	79.3475
10/04/21	99.9678
11/04/21	110.8592
12/04/21	111.2638
13/04/21	117.3105
14/04/21	142.3543
15/04/21	128.2020
16/04/21	110.1351
17/04/21	147.2387
18/04/21	150.9067
19/04/21	131.3775
20/04/21	117.2096
21/04/21	137.3108
22/04/21	122.8733
23/04/21	131.5830
24/04/21	153.4891
25/04/21	76.7720
26/04/21	84.0120
27/04/21	138.4887
28/04/21	142.5103
29/04/21	82.0740

30/04/21	105.9235
01/05/21	115.3113
02/05/21	97.9837
03/05/21	85.4253
04/05/21	129.8169
05/05/21	45.2085
06/05/21	45.1921
07/05/21	139.2760
08/05/21	127.6357
09/05/21	23.0927
10/05/21	115.1599
11/05/21	125.0021
12/05/21	61.6230
13/05/21	36.5009
14/05/21	99.8602
15/05/21	105.3446
16/05/21	29.9189
17/05/21	100.8589
18/05/21	110.9188
19/05/21	16.4806
20/05/21	57.2317
21/05/21	97.5863
22/05/21	103.5470
23/05/21	33.8442
24/05/21	139.6780
25/05/21	140.9775
26/05/21	11.8174
27/05/21	81.9152
28/05/21	104.2073
29/05/21	99.1834
30/05/21	39.2054
31/05/21	145.8458
01/06/21	138.3087
02/06/21	10.9155
03/06/21	100.8231
04/06/21	120.4981
05/06/21	39.7711
06/06/21	33.5973
07/06/21	130.6755
08/06/21	124.0674
09/06/21	16.9605
10/06/21	117.5345
11/06/21	114.7298
12/06/21	11.8163
13/06/21	42.8503
14/06/21	74.4365
15/06/21	106.8604
16/06/21	33.2310
17/06/21	108.2216
18/06/21	136.4399
19/06/21	10.8392
20/06/21	91.7970
21/06/21	114.7421
22/06/21	90.7845
23/06/21	43.1952
24/06/21	152.2767
25/06/21	143.0849
26/06/21	19.0641
27/06/21	98.6217
28/06/21	117.3227
29/06/21	47.8912
30/06/21	30.5860
01/07/21	123.8068
02/07/21	117.9494

03/07/21	17.8776
04/07/21	102.0264
05/07/21	112.6826
06/07/21	11.8882
07/07/21	37.3808
08/07/21	78.4139
09/07/21	107.7840
10/07/21	27.4135
11/07/21	107.1252
12/07/21	128.3529
13/07/21	10.4743
14/07/21	91.3934
15/07/21	96.8448
16/07/21	93.6193
17/07/21	46.3004
18/07/21	151.3080
19/07/21	151.1849
20/07/21	25.7845
21/07/21	100.1494
22/07/21	130.6975
23/07/21	69.2113
24/07/21	36.1688
25/07/21	150.8657
26/07/21	117.1644
27/07/21	17.8141
28/07/21	117.6526
29/07/21	107.8960
30/07/21	12.5013
31/07/21	28.9440

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 Trinidad and Tobago are likely to remain high over the out-of-sample period.

IV. CONCLUSION & RECOMMENDATIONS

COVID-19, which has evolved as a worldwide public health emergency; has killed many people in the entire world and Trinidad & Tobago is not an exception. In this study, we attempted to model and forecast daily COVID-19 case volumes for the country with the purpose of informing policy. The study applied a generalized ANN model. It is projected that daily COVID-19 cases in Trinidad and Tobago are likely to remain high over the out-of-sample period. Relevant authorities, especially the ministry responsible for public health; have a big role to play in terms of controlling the further spread of the virus. There is need for continued implementation of control and prevention strategies in the country, especially the vaccinations. The public is also urged to exercise caution all the time and strictly adhere to sanitary rules established by WHO, in order to save lives.

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