Forecasting Covid-19 New Cases in Vietnam

[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 is a highly contagious disease which has apparently frozen the entire globe along with its economy. Its astonishing ability of human-to-human and surface-to-human transmission has turned the planet Earth into recurrent catastrophic waves. In this research article, the ANN approach was applied to analyze COVID-19 cases in Vietnam. This study is based on daily new cases of COVID-19 in Vietnam Faso 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 simple model indicate that the model is stable and acceptable. The study established that daily COVID-19 cases in Vietnam are likely to remain very low over the out-of-sample period. The government of Vietnam should, however, ensure the continued compliance to control and preventive COVID-19 measures such as social distancing, quarantine, isolation, face-mask wearing and so on, including vaccinations. This is expected to play a pivotal role, particularly in avoiding extremely dangerous daily COVID-19 case volumes in the country, even in the face of new variants.**

Keywords: ANN, COVID-19, Forecasting.

I. INTRODUCTION

The first infected case of COVID-19 was discovered in Hubei, a province in the city of Wuhan in China, on December 31 2019 (Guan *et al*., 2020) and its spread has become a global threat and the World Health Organization (WHO) declared COVID-19 a global pandemic on March 11, 2020 (WHO, 2020). The new and fast dynamics of the pandemic are challenging the health systems of different countries across the globe, including Burkina Faso. In the absence of effective treatments, mitigation policies, such as social isolation and lock-down of cities, have been adopted (Reis *et al*., 2020). Predicting daily COVID-19 cases is important for policy makers and public health authorities to have informed decisions on appropriate interventions and resource allocations. The study aims to forecast the number of confirmed COVID-19 cases in Vietnam.

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 Vietnam.

Data Issues

This study is based on daily new cases of COVID-19 in Vietnam 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	VT
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	0.116224
MSE	50.446307
MAE	3.171940

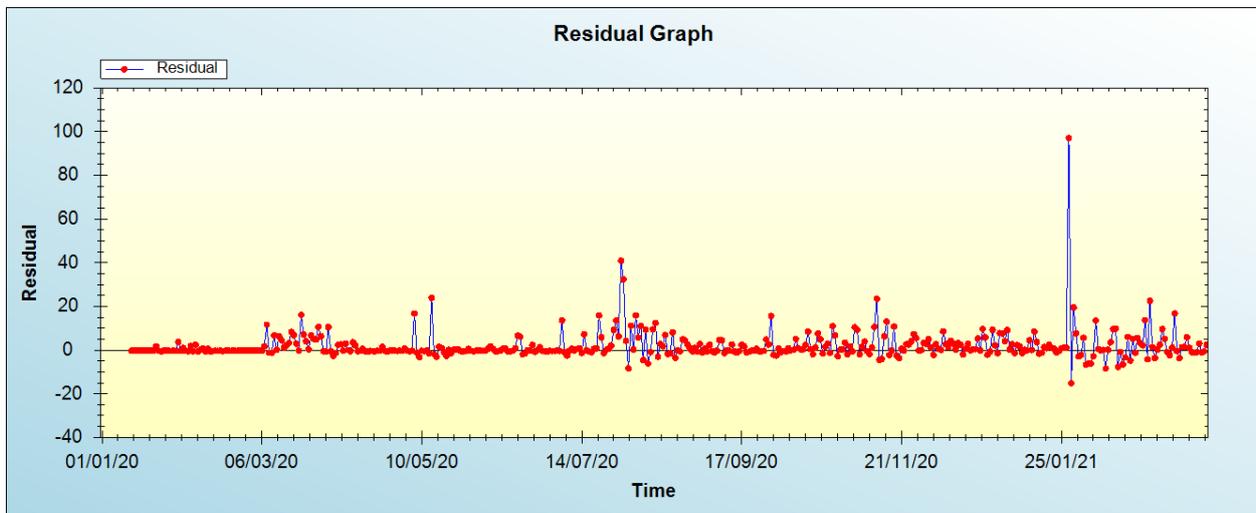*Residual Analysis for the Applied Model*

Figure 1: Residual analysis
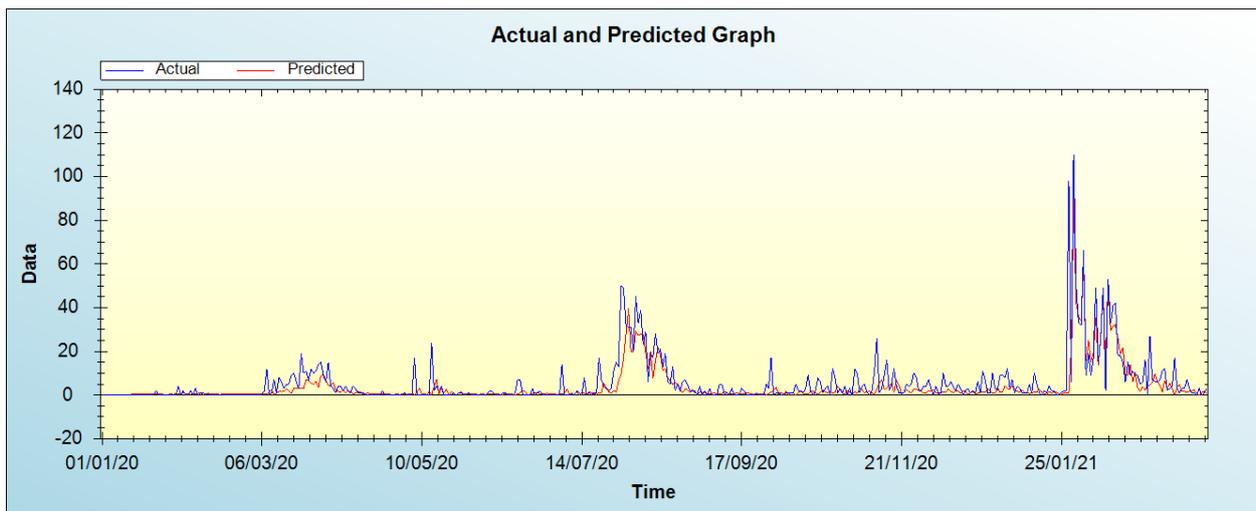
In-sample Forecast for VT

Figure 2: In-sample forecast for the VT series

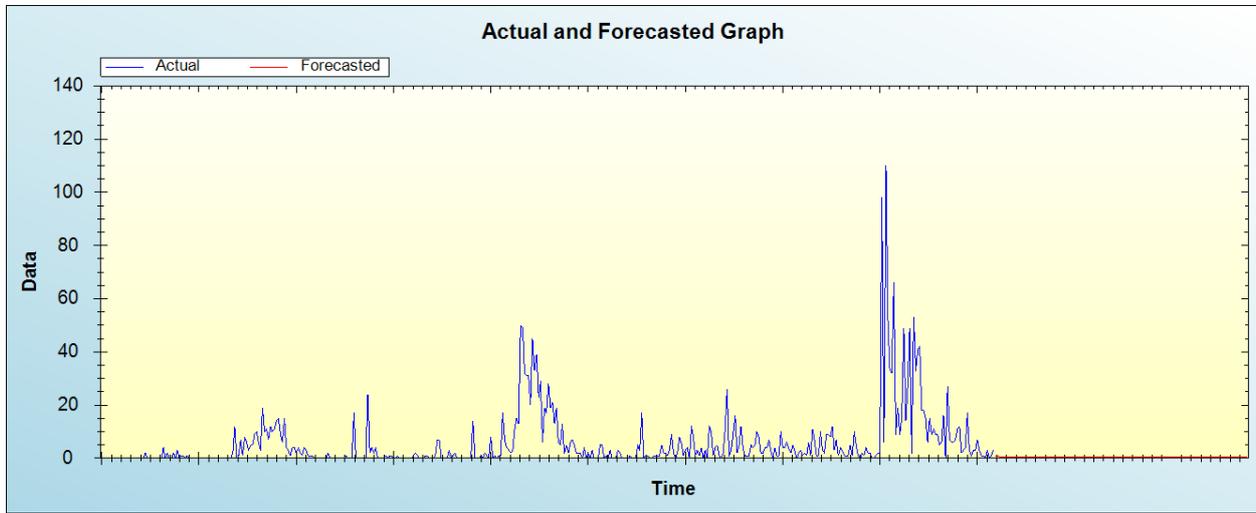*Out-of-Sample Forecast for VT: Actual and Forecasted Graph*

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

Out-of-Sample Forecast for VT: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Date	Forecasts
26/03/21	0.7482
27/03/21	0.6944
28/03/21	0.6880
29/03/21	0.4206
30/03/21	0.5619
31/03/21	0.6079
01/04/21	0.3088
02/04/21	0.5882
03/04/21	0.4695
04/04/21	0.3381
05/04/21	0.4710
06/04/21	0.4418
07/04/21	0.3979
08/04/21	0.4319
09/04/21	0.3905
10/04/21	0.3879
11/04/21	0.4087
12/04/21	0.3834
13/04/21	0.3907
14/04/21	0.3993
15/04/21	0.3857
16/04/21	0.3892
17/04/21	0.3911
18/04/21	0.3861
19/04/21	0.3895
20/04/21	0.3887
21/04/21	0.3864
22/04/21	0.3884
23/04/21	0.3874
24/04/21	0.3866
25/04/21	0.3877
26/04/21	0.3871
27/04/21	0.3870
28/04/21	0.3874
29/04/21	0.3870

30/04/21	0.3870
01/05/21	0.3872
02/05/21	0.3869
03/05/21	0.3870
04/05/21	0.3871
05/05/21	0.3870
06/05/21	0.3870
07/05/21	0.3870
08/05/21	0.3870
09/05/21	0.3870
10/05/21	0.3870
11/05/21	0.3870
12/05/21	0.3870
13/05/21	0.3870
14/05/21	0.3870
15/05/21	0.3870
16/05/21	0.3870
17/05/21	0.3870
18/05/21	0.3870
19/05/21	0.3870
20/05/21	0.3870
21/05/21	0.3870
22/05/21	0.3870
23/05/21	0.3870
24/05/21	0.3870
25/05/21	0.3870
26/05/21	0.3870
27/05/21	0.3870
28/05/21	0.3870
29/05/21	0.3870
30/05/21	0.3870
31/05/21	0.3870
01/06/21	0.3870
02/06/21	0.3870
03/06/21	0.3870
04/06/21	0.3870
05/06/21	0.3870
06/06/21	0.3870
07/06/21	0.3870
08/06/21	0.3870
09/06/21	0.3870
10/06/21	0.3870
11/06/21	0.3870
12/06/21	0.3870
13/06/21	0.3870
14/06/21	0.3870
15/06/21	0.3870
16/06/21	0.3870
17/06/21	0.3870
18/06/21	0.3870
19/06/21	0.3870
20/06/21	0.3870
21/06/21	0.3870
22/06/21	0.3870
23/06/21	0.3870
24/06/21	0.3870
25/06/21	0.3870
26/06/21	0.3870
27/06/21	0.3870
28/06/21	0.3870
29/06/21	0.3870
30/06/21	0.3870
01/07/21	0.3870
02/07/21	0.3870

03/07/21	0.3870
04/07/21	0.3870
05/07/21	0.3870
06/07/21	0.3870
07/07/21	0.3870
08/07/21	0.3870
09/07/21	0.3870
10/07/21	0.3870
11/07/21	0.3870
12/07/21	0.3870
13/07/21	0.3870
14/07/21	0.3870
15/07/21	0.3870
16/07/21	0.3870
17/07/21	0.3870
18/07/21	0.3870
19/07/21	0.3870
20/07/21	0.3870
21/07/21	0.3870
22/07/21	0.3870
23/07/21	0.3870
24/07/21	0.3870
25/07/21	0.3870
26/07/21	0.3870
27/07/21	0.3870
28/07/21	0.3870
29/07/21	0.3870
30/07/21	0.3870
31/07/21	0.3870

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 Vietnam are likely to remain very low over the out-of-sample period.

IV. CONCLUSION AND POLICY RECOMMENDATIONS

While COVID-19 is rapidly propagating around the globe, the need for providing real-time forecasts of the epidemics pushes fits of dynamical and statistical models to available data beyond their capabilities (Alberti & Faranda, 2020). This study used the ANN (12, 12, 1) model to come up with forecasts ranging over the period March 26, 2021 to July 31, 2021. The study established that daily COVID-19 cases in Vietnam are likely to remain very low over the out-of-sample period. The government of Vietnam should, however, ensure the continued compliance to control and preventive COVID-19 measures such as social distancing, quarantine, isolation, face-mask wearing and so on, including vaccinations. This is expected to play a pivotal role, particularly in avoiding extremely dangerous daily COVID-19 case volumes in the country, even in the face of new variants.

REFERENCES

[1] Alberti, T., & Faranda, D. (2020). On the Uncertainty of Real-time Predictions of Epidemic Growths: A COVID-19 Case Study for China and Italy, *Commun Nonlinear Sci Numer Simulat*, 90 (2020): 1 – 13.

[2] Guan, W., *et al*. (2020). Clinical Characteristics of Coronavirus Disease 2019 in China, *New England Journal of Medicine*, 382 (18): 1708 – 1720.

[3] Reis, R. F., *et al*. (2020). Characterization of the COVID-19 Pandemic and the Impact of Uncertainties, Mitigation Strategies and Under-reporting of Cases in South Korea, Italy and Brazil, *Chaos, Solitons and Fractals*, 136 (2020): 1 – 9.

[4] WHO (2020). Director-general's Opening Remarks, *WHO*, Geneva.

****