Forecasting Covid-19 New Cases in Benin

[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 - **In this piece of work, the ANN approach was applied to analyze daily new COVID-19 cases in Benin. This study is based on monthly new cases of COVID-19 in Benin 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 new COVID-19 cases in Benin. The results of the study indicate that COVID-19 may disappear in the out-of-sample period. The government of Benin, however; is encouraged to continue implementing interventions with strict adherence to the recommended WHO guidelines on prevention and control of COVID-19.**

Keywords: ANN, COVID-19, Forecasting.

I. INTRODUCTION

COVID-19 virus is transmitted from person to person via droplets produced by sneezing, coughing and talking and through touching contaminated objects or surfaces. The virus has an incubation period of 2-14days. The clinical symptoms of the disease include headache, fever, cough, sore-throat, chest pains, muscle pains and shortness of breath. Multi-organ failure may occur in severe cases. Severe disease and death are more common in the elderly or patients with underlying chronic medical conditions. However, severe illness and death can still occur in the young and healthy individuals (WHO, 2020a & b). Empirical studies on COVID-19 are scanty in Benin. In this paper we applied the ANN (Multilayer Perceptron) to model and forecast the number of daily new COVID-19 cases in Benin. The findings of this study are envisioned to stimulate an evidence-based National Response to the COVID-19 epidemic in order to save lives.

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 Benin.

Data Issues

This study is based on daily new cases of COVID-19 in Benin 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	0.591433
MSE	77269.285826
MAE	272.133614

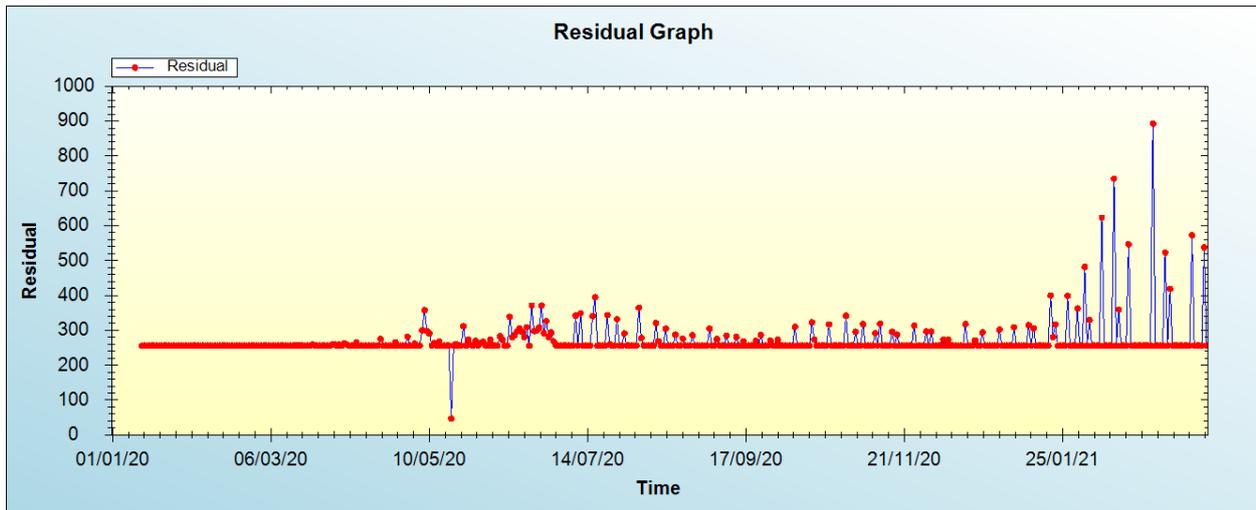*Residual Analysis for the Applied Model*

Figure 1: Residual analysis

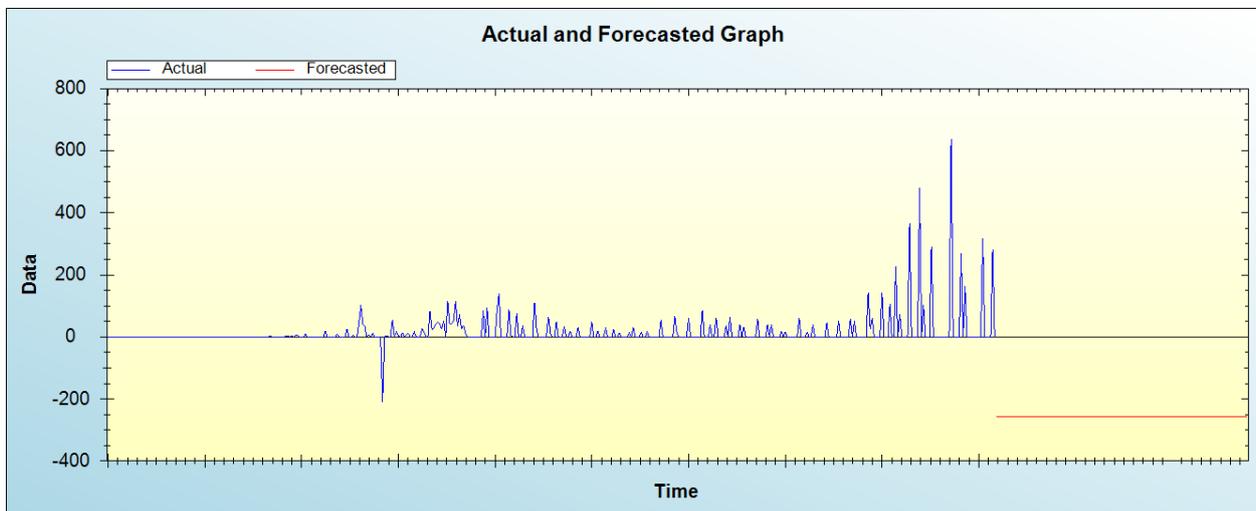*Out-of-Sample Forecast for B: Actual and Forecasted Graph*

Figure 2: Out-of-sample forecast for B: actual and forecasted graph

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 COVID-19 may disappear in the out-of-sample period.

IV. CONCLUSION & RECOMMENDATIONS

The use of artificial intelligence (AI) methods in Africa to predict infectious diseases is lagging behind. These techniques are critical in medicine for prognosis, diagnosis, screening and prediction of diseases. Machine learning algorithms such as artificial neural networks play a critical role in pattern recognition, classification, regression and prediction. In this study the ANN (12, 12, 1) was applied to predict daily COVID-19 cases in Benin. The results indicate that COVID-19 may disappear in the

country over the out-of-sample period. However, we still implore the authorities to continue enforcing adherence to WHO guidelines on prevention and control of COVID-19.

REFERENCES

[1] WHO (2020a). Modes of transmission of virus causing COVID-19: implications for IPC precaution recommendations World Health Organization—Department of Communication Available online: WHO Reference Number: WHO/2019-nCoV/Sci_Brief/Transmission modes/2020.2

[2] WHO (2020b). Statement—Older people are at highest risk from COVID-19, but all must act to prevent community spread World Health Organization—Department of Communication 2020. Available online: http://www.euro.who.int/en/healthtopics/health-emergencies/coronavirus-covid-19/statements/statement-older-people-are-at-highest-risk-from-covid-19but-all-must-act-to-prevent-communityspread

****