

Forecasting Covid-19 New Cases in Niger

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Abstract - In this study, the ANN approach was applied to analyze COVID-19 new cases in Niger. The employed data covers the period 1 January 2020 – 25 March 2021 and the out-of-sample period ranges over the period 26 March – 31 July 2021. The residuals and forecast evaluation criteria (Error, MSE and MAE) of the applied model indicate that the model is quite stable. The results of the study indicate that the pandemic may disappear in Niger over the out-of-sample period. Amongst other suggested policy directions, there is need for the government of Niger to ensure adherence to safety guidelines while continuing to create awareness about the COVID-19 pandemic.

Keywords: ANN, COVID-19, Forecasting.

I. INTRODUCTION

Niger is a landlocked country located at the middle of a turbulent region characterized by political and religious violence in Northern Nigeria and armed groups in Northern Mali and civil conflict in Southern Libya. In 2015, the country had an estimated population size of approximately 19.9 million and the country's economy is largely driven by agriculture and livestock production (World Bank, 2017). The Sahel countries namely Niger, Mali and Burkina Fasso are conflict affected nations and they were expected to suffer a lot from the COVID-19 pandemic. However the number of positive cases and fatalities have remained low with Niger having recorded 1,152 confirmed cases by the 6th of August 2020 (Johns Hopkins University, 2020). The poor health infrastructure in the Sahel region is an issue of concern for local governments and international partners. Their population has limited access to health services coupled with limited medical supplies and shortage of medical staff (OECD/SWAC, 2020; IRC, 2020; World Bank, 2020; WHO, 2020; Marbot, 2020). The government of Niger responded to the COVID-19 pandemic by following WHO guidelines on prevention and control of the SARS-COV2 virus (Lyammouri & El mquirmi, 2020). The aim of this paper is to model and predict daily COVID-19 cases in Niger using the artificial neural network approach. The results of the study are expected to highlight the likely future trends of COVID-19 and trigger an appropriate health response to curb the transmission of the virus.

II. LITERATURE REVIEW

Abebe (2020) applied an exponential smoothing model to predict COVID-19 cases in Ethiopia and the study results indicated that Double Exponential Smoothing method was appropriate in forecasting the future number of COVID-19 cases in Ethiopia and COVID-19 cases in Ethiopia were growing exponentially. Based on the OLS model, Argawu (2020) studied the relationship between number of lab tests and new COVID-19 cases. The study revealed that Number of new laboratory tests and number of new cases from Addis Ababa city significantly predicted COVID-19 new cases. The predictors of mortality in severe COVID-19 cases were investigated by Maru et al (2020) in Ethiopia. The study utilized the logistic regression model and the findings indicated that having diabetes mellitus, fever and shortness of breath are significant predictors of death in severe COVID-19 patients. Bentout et al (2020) studied the evolution of COVID-19 in Algeria using the SEIR model. The model projected that the epidemic in Algeria could occur in a strong way.

III. 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 Niger.

Data Issues

This study is based on daily new cases of COVID-19 in Niger 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).

IV. FINDINGS OF THE STUDY

ANN Model Summary

Table 1: ANN model summary

Variable	N
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	0.153138
MSE	160.691707
MAE	7.166830

Residual Analysis for the Applied Model

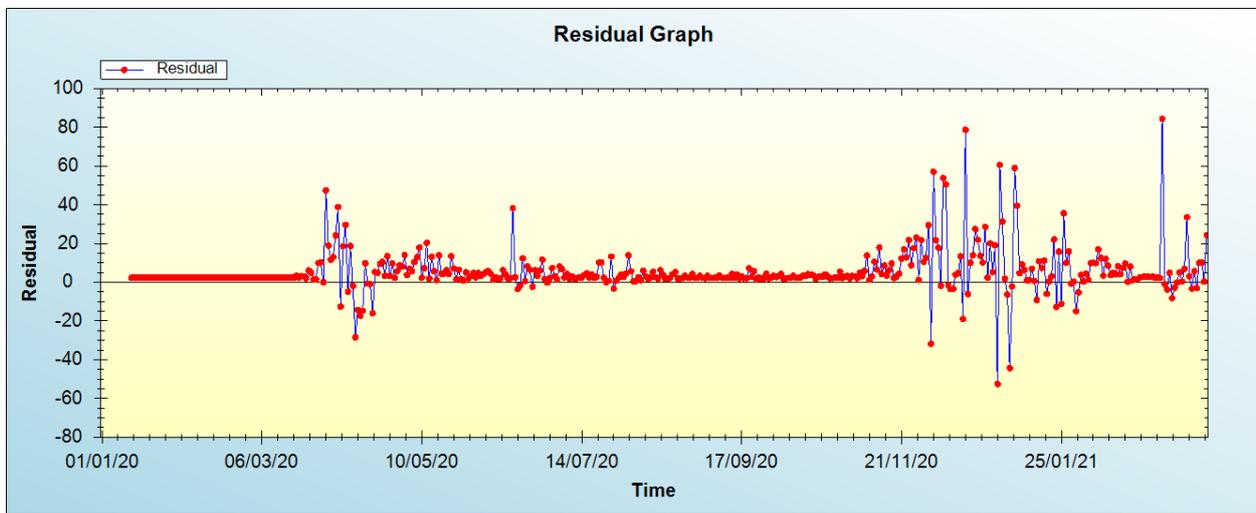


Figure 1: Residual analysis

In-sample Forecast for N

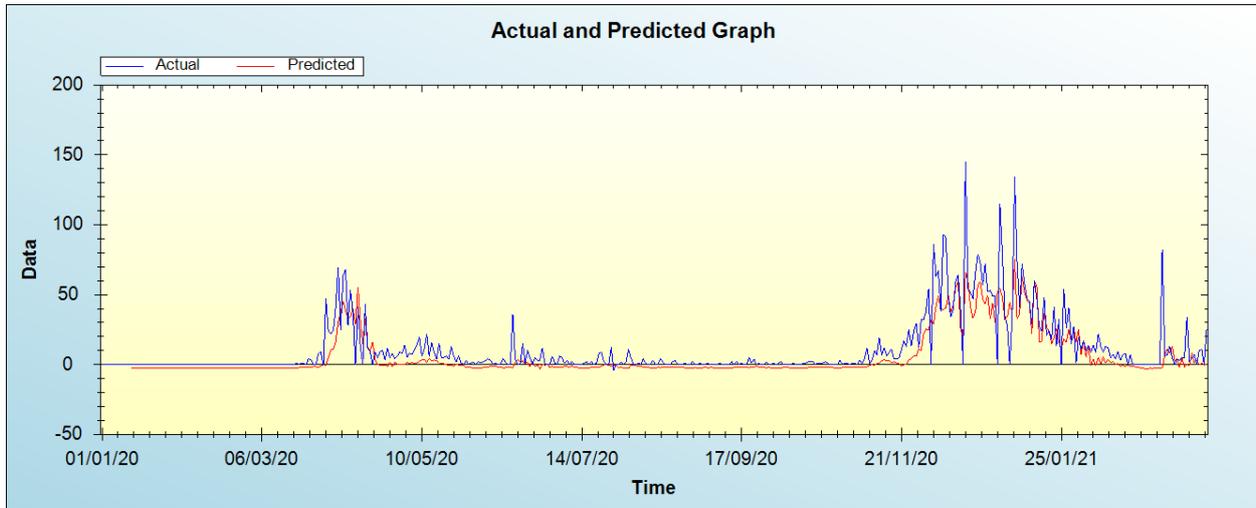


Figure 2: In-sample forecast for the N series

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

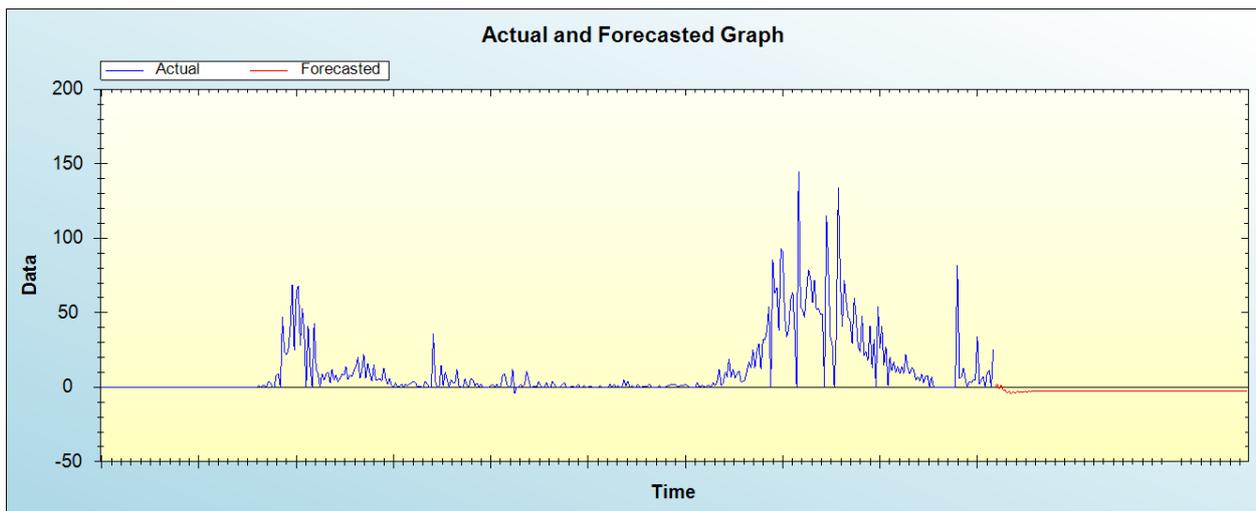


Figure 3: Out-of-sample forecast for N: actual and forecasted graph

Out-of-Sample Forecast for N: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Day/Month/Year	Forecasts
26/03/21	0.0186
27/03/21	2.3863
28/03/21	-1.2808
29/03/21	1.3449
30/03/21	-2.0810
31/03/21	-2.0442
01/04/21	-3.9397
02/04/21	-2.8574
03/04/21	-4.2779
04/04/21	-2.7265
05/04/21	-4.1511
06/04/21	-2.6494
07/04/21	-3.4254
08/04/21	-2.9563
09/04/21	-3.1955

10/04/21	-2.8236
11/04/21	-3.0161
12/04/21	-2.7568
13/04/21	-2.9684
14/04/21	-2.7612
15/04/21	-2.9308
16/04/21	-2.7985
17/04/21	-2.9202
18/04/21	-2.8393
19/04/21	-2.9036
20/04/21	-2.8653
21/04/21	-2.9105
22/04/21	-2.8790
23/04/21	-2.9112
24/04/21	-2.8858
25/04/21	-2.9092
26/04/21	-2.8906
27/04/21	-2.9050
28/04/21	-2.8929
29/04/21	-2.9019
30/04/21	-2.8941
01/05/21	-2.8995
02/05/21	-2.8941
03/05/21	-2.8982
04/05/21	-2.8944
05/05/21	-2.8974
06/05/21	-2.8948
07/05/21	-2.8969
08/05/21	-2.8952
09/05/21	-2.8966
10/05/21	-2.8955
11/05/21	-2.8965
12/05/21	-2.8957
13/05/21	-2.8964
14/05/21	-2.8959
15/05/21	-2.8963
16/05/21	-2.8960
17/05/21	-2.8963
18/05/21	-2.8960
19/05/21	-2.8962
20/05/21	-2.8961
21/05/21	-2.8962
22/05/21	-2.8961
23/05/21	-2.8962
24/05/21	-2.8961
25/05/21	-2.8962
26/05/21	-2.8961
27/05/21	-2.8961
28/05/21	-2.8961
29/05/21	-2.8961
30/05/21	-2.8961
31/05/21	-2.8961
01/06/21	-2.8961
02/06/21	-2.8961
03/06/21	-2.8961
04/06/21	-2.8961
05/06/21	-2.8961
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12/06/21	-2.8961

13/06/21	-2.8961
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24/07/21	-2.8961
25/07/21	-2.8961
26/07/21	-2.8961
27/07/21	-2.8961
28/07/21	-2.8961
29/07/21	-2.8961
30/07/21	-2.8961
31/07/21	-2.8961

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 the pandemic may disappear in Niger over the out-of-sample period.

V. CONCLUSION AND POLICY RECOMMENDATIONS

Niger is a developing country which is found in the Sahel region. The country is suffering from civil conflict and drought related problems. The emergence of the COVID-19 outbreak increased the vulnerability of its citizens and the situation is being aggravated by poor health infrastructure and shortage of skilled health workers. In this study we predicted the daily COVID-19 cases in Niger. The results indicate that the pandemic may disappear in Niger over the out-of-sample period. Hence we advise the government to focus on the continuous implementation of COVID-19 public health mitigation measures.

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