Forecasting Covid-19 New Cases in Burkina Faso

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Abstract - **COVID-19 is a highly contagious disease which has almost frozen the entire globe along with its economy. It's astonishing ability of human-to-human and surface-to-human transmission has turned the planet Earth into recurrent catastrophic phases. In this research article, the ANN approach was applied to analyze COVID-19 cases in Burkina Faso. This study is based on daily new cases of COVID-19 in Burkina 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 results of the study basically imply that daily COVID-19 cases in Burkina Faso are likely to remain high over the out-of-sample period. The government of Burkina Faso should ensure the continued compliance to control and preventive COVID-19 measures in line with WHO standards.**

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. Since the reporting of the first case of COVID-19 in Burkina Faso on March 9, 2020, it has been a curiosity for how and how long the number of cases will increase. The study aims to forecast the number of confirmed COVID-19 cases in Burkina Faso. Through the application of Artificial Neural Networks, it is this information hiatus that we seek to fill in the case of Burkina Faso.

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 Burkina Faso.

Data Issues

This study is based on daily new cases of COVID-19 in Burkina Faso 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	BF

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	0.114113
MSE	398.791756
MAE	14.541415

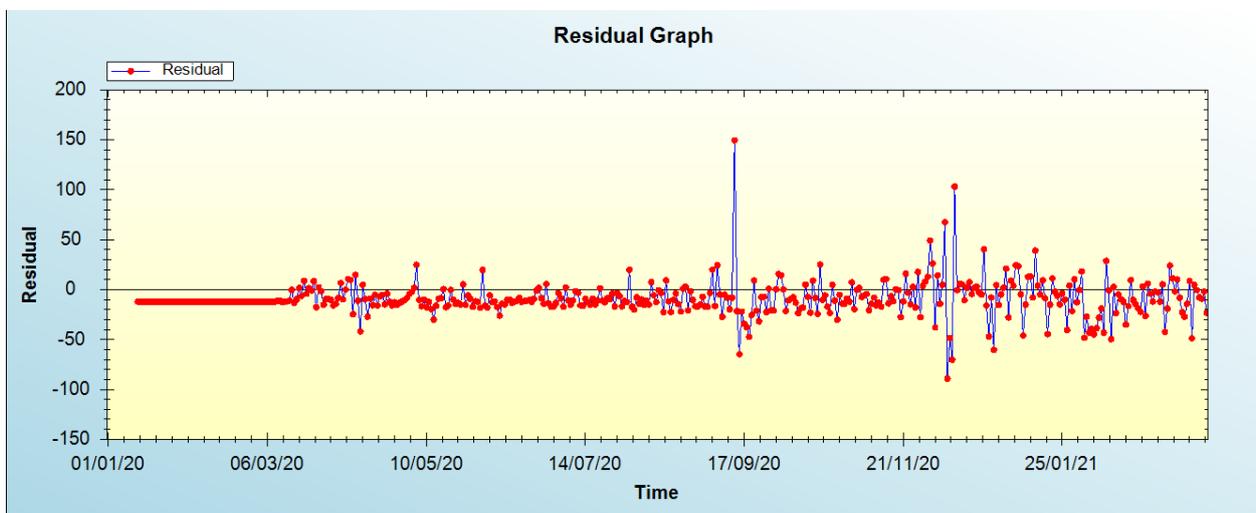*Residual Analysis for the Applied Model*

Figure 1: Residual analysis
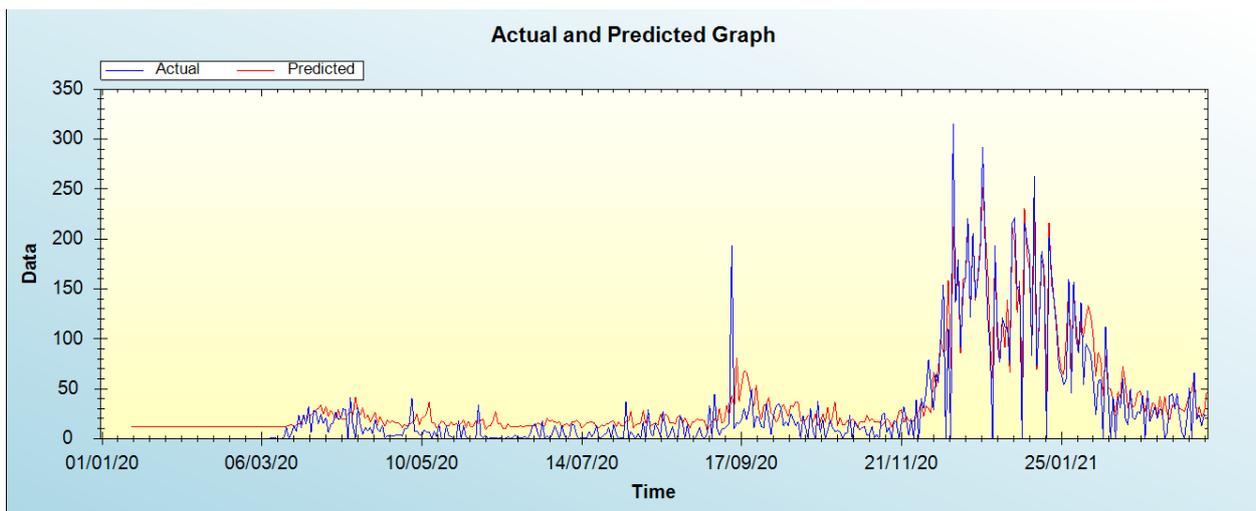
In-sample Forecast for BF

Figure 2: In-sample forecast for the BF series

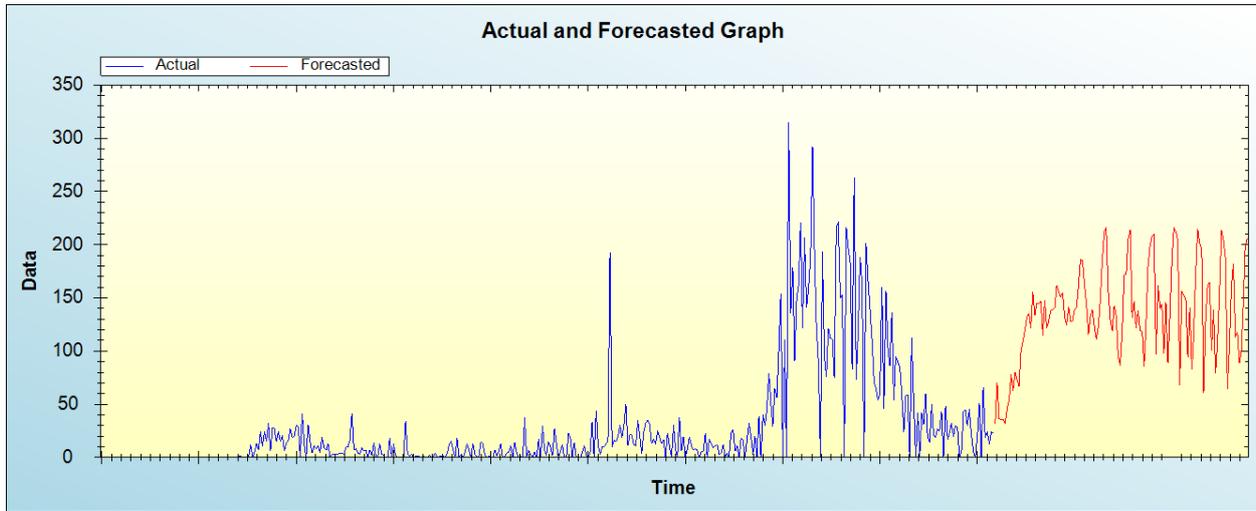*Out-of-Sample Forecast for BF: Actual and Forecasted Graph*

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

Out-of-Sample Forecast for BF: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Day/Month/Year	Forecasts
26/03/21	31.9734
27/03/21	70.2335
28/03/21	36.4460
29/03/21	35.0928
30/03/21	35.5213
31/03/21	31.8000
01/04/21	45.9756
02/04/21	53.7298
03/04/21	77.7475
04/04/21	62.4483
05/04/21	80.3797
06/04/21	73.5151
07/04/21	67.1364
08/04/21	100.8132
09/04/21	109.1065
10/04/21	119.8793
11/04/21	131.6575
12/04/21	135.3986
13/04/21	121.7588
14/04/21	155.6143
15/04/21	133.3090
16/04/21	145.0828
17/04/21	144.3255
18/04/21	146.8752
19/04/21	115.0582
20/04/21	147.7875
21/04/21	121.4281
22/04/21	128.3442
23/04/21	138.2134
24/04/21	138.4800
25/04/21	140.3208
26/04/21	161.8383
27/04/21	156.3316
28/04/21	150.6678
29/04/21	154.4118
30/04/21	132.4629
01/05/21	124.3861

02/05/21	141.6324
03/05/21	127.4820
04/05/21	128.1789
05/05/21	138.5886
06/05/21	141.1815
07/05/21	160.5122
08/05/21	186.0961
09/05/21	184.8129
10/05/21	162.0027
11/05/21	143.8338
12/05/21	115.6236
13/05/21	132.3292
14/05/21	138.8162
15/05/21	123.3002
16/05/21	111.2871
17/05/21	122.9109
18/05/21	149.7497
19/05/21	186.1437
20/05/21	212.1429
21/05/21	216.0996
22/05/21	156.2413
23/05/21	129.7057
24/05/21	119.2090
25/05/21	142.7829
26/05/21	132.6516
27/05/21	94.3997
28/05/21	86.7347
29/05/21	115.7194
30/05/21	171.6003
31/05/21	171.6633
01/06/21	205.6568
02/06/21	213.7329
03/06/21	131.4200
04/06/21	147.1587
05/06/21	122.1202
06/06/21	137.7288
07/06/21	119.5012
08/06/21	118.6072
09/06/21	85.5637
10/06/21	125.4524
11/06/21	179.4557
12/06/21	198.8790
13/06/21	207.5386
14/06/21	210.0808
15/06/21	97.0948
16/06/21	161.5454
17/06/21	140.5042
18/06/21	144.4181
19/06/21	97.9238
20/06/21	145.8468
21/06/21	88.4831
22/06/21	133.5928
23/06/21	187.6815
24/06/21	215.8746
25/06/21	212.1798
26/06/21	203.5277
27/06/21	67.9918
28/06/21	156.2322
29/06/21	152.8559
30/06/21	149.0589
01/07/21	94.5257
02/07/21	140.6824
03/07/21	82.7481
04/07/21	114.7606

05/07/21	170.3491
06/07/21	214.8201
07/07/21	201.3983
08/07/21	196.3800
09/07/21	60.9805
10/07/21	130.1614
11/07/21	162.0839
12/07/21	164.5927
13/07/21	100.2226
14/07/21	138.5728
15/07/21	79.2408
16/07/21	109.5414
17/07/21	154.8839
18/07/21	213.7009
19/07/21	203.9242
20/07/21	187.3380
21/07/21	64.5903
22/07/21	102.6626
23/07/21	160.8100
24/07/21	182.1441
25/07/21	113.2621
26/07/21	118.0702
27/07/21	88.5535
28/07/21	99.2204
29/07/21	142.6180
30/07/21	199.4438
31/07/21	205.6524

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 Burkina Faso are likely to remain high 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). Based on 450 daily observations of COVID-19 cases in Burkina Faso, 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 the pandemic will not end anytime soon in Burkina Faso, and that daily cases will remain significantly high. The government of Burkina Faso should ensure the continued compliance to control and preventive COVID-19 measures such as social distancing, quarantine, isolation, face-mask wearing and so on. This is expected to play a pivotal role, particularly in avoiding extremely dangerous daily COVID-19 case volumes in the country.

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