Forecasting Covid-19 New Cases in Eritrea

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Abstract - **COVID-19 continues to have a devastating impact on the health and well-being of the world population. One of the critical steps in the fight against COVID-19 is to come up with accurate forecasting models. In this research endeavor, the ANN approach was applied to analyze confirmed COVID-19 cases in Eritrea. This study is based on daily new cases of COVID-19 in Eritrea 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 technique indicate that the model is quite stable and acceptable. It is projected that the COVID-19 pandemic may disappear around late June 2021.We recommend the continued compliance to control and preventive COVID-19 measures such as social distancing, quarantine, isolation, face-mask wearing and so on; including vaccinations.**

Keywords: ANN, COVID-19, Forecasting.

I. INTRODUCTION

The outbreak of COVID-19 started in China in December 2019 and has spread worldwide (Bayyurt & Bayyurt, 2020), largely because of a lack of prior immunity combined with relatively high infectiousness (Wolfel *et al*., 2020). The common symptoms of the disease are fever, fatigue and dry cough (Drosten *et al*., 2020). COVID-19 may cause fatality, especially among elderly, and people with chronic health problems (Direkoglu & Sah, 2020). The disease is highly contagious. A single infected person will transmit the virus (usually via human-to-human transmission) with a reproduction number of approximately 1.4 to 2.5 (WHO, 2020). People infected with COVID-19 are placed under quarantine, so that the virus does not spread (Uddin *et al*., 2020) and their own immune system is expected to fight off the virus (Chan *et al*., 2020). As of late, vaccinations are now being used to help the immune system in fighting the virus. Modeling and future forecast of daily number of confirmed cases and deaths can help the treatment system (Dehesh *et al*., 2020). This research seeks to model and forecast COVID-19 daily confirmed cases in Eritrea.

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 Eritrea.

Data Issues

This study is based on daily new cases of COVID-19 in Eritrea 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	E
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	0.093316
MSE	117.397561
MAE	5.268419

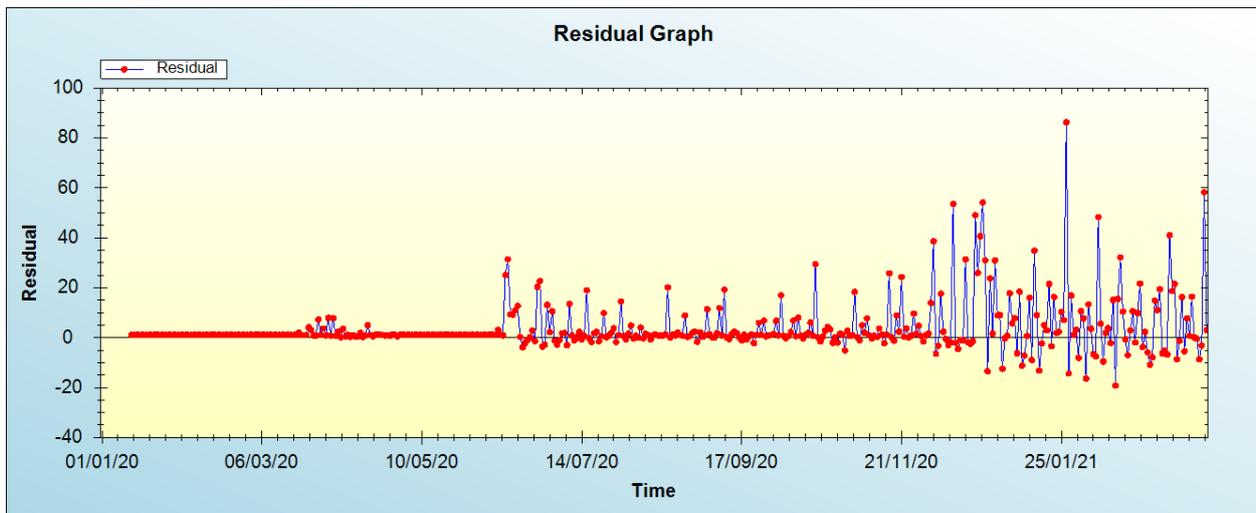*Residual Analysis for the Applied Model*

Figure 1: Residual analysis
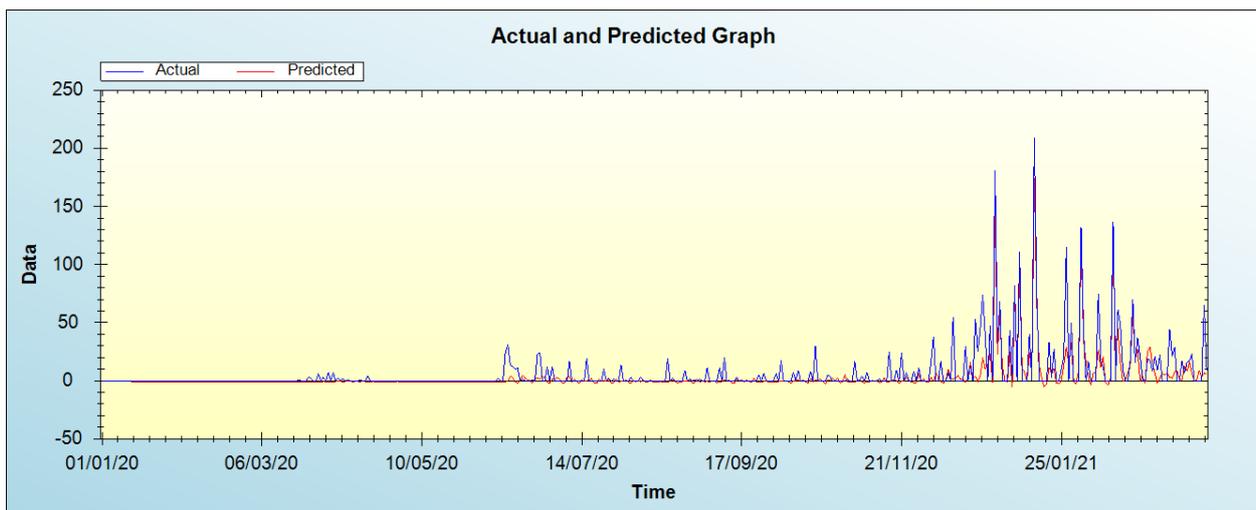
In-sample Forecast for E

Figure 2: In-sample forecast for the E series

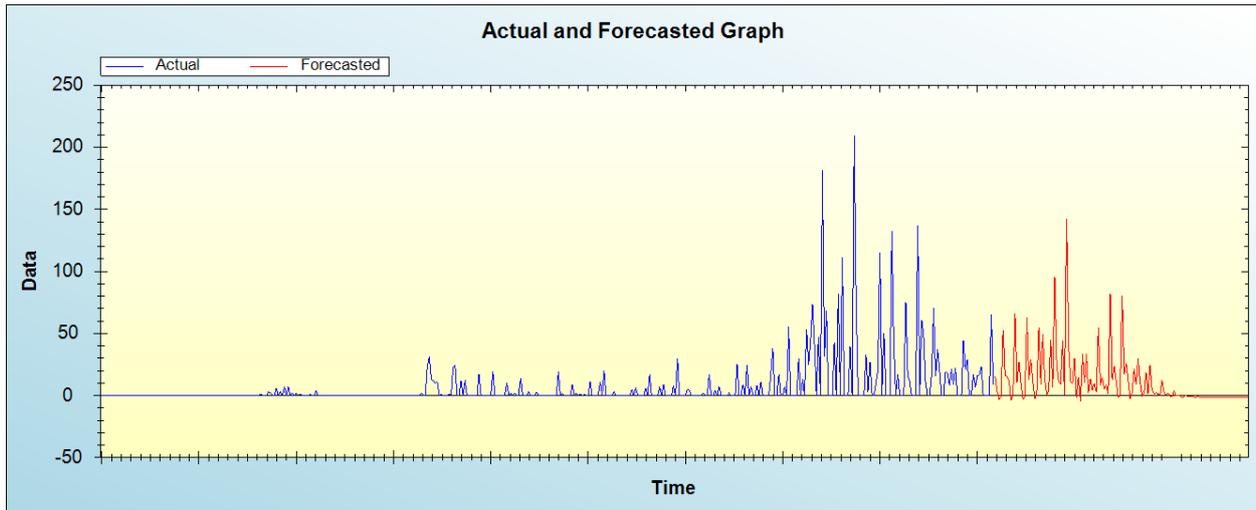*Out-of-Sample Forecast for E: Actual and Forecasted Graph*

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

Out-of-Sample Forecast for E: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Day/Month/Year	Forecasts
26/03/21	15.6427
27/03/21	2.8828
28/03/21	-2.9511
29/03/21	-0.6313
30/03/21	52.6982
31/03/21	16.0555
01/04/21	15.4760
02/04/21	11.2634
03/04/21	-3.9906
04/04/21	0.9551
05/04/21	65.7475
06/04/21	10.1573
07/04/21	27.1827
08/04/21	8.8305
09/04/21	-3.3377
10/04/21	-0.1925
11/04/21	62.8494
12/04/21	12.6756
13/04/21	28.8329
14/04/21	11.3306
15/04/21	-2.7375
16/04/21	3.1152
17/04/21	54.5831
18/04/21	9.0004
19/04/21	49.2347
20/04/21	13.3530
21/04/21	1.0204
22/04/21	3.6371
23/04/21	44.9863
24/04/21	6.2270
25/04/21	95.7195
26/04/21	24.7057
27/04/21	11.4816
28/04/21	9.0815
29/04/21	44.2490
30/04/21	1.0083
01/05/21	142.0091
02/05/21	38.9618
03/05/21	11.2930

04/05/21	9.5807
05/05/21	30.1577
06/05/21	-1.3671
07/05/21	14.8931
08/05/21	-4.2341
09/05/21	33.0341
10/05/21	10.2392
11/05/21	33.1304
12/05/21	2.3516
13/05/21	13.5284
14/05/21	4.4111
15/05/21	9.6250
16/05/21	3.2346
17/05/21	54.8225
18/05/21	8.5900
19/05/21	14.8165
20/05/21	4.9582
21/05/21	8.2763
22/05/21	1.3574
23/05/21	81.9378
24/05/21	12.6392
25/05/21	23.7048
26/05/21	10.7208
27/05/21	-1.7096
28/05/21	0.6693
29/05/21	80.2560
30/05/21	17.0892
31/05/21	26.3865
01/06/21	11.8138
02/06/21	-2.4967
03/06/21	2.2328
04/06/21	21.7619
05/06/21	8.9536
06/06/21	29.3223
07/06/21	11.2218
08/06/21	-1.1289
09/06/21	2.5701
10/06/21	18.7786
11/06/21	1.4540
12/06/21	24.3440
13/06/21	4.9658
14/06/21	1.2137
15/06/21	2.6193
16/06/21	1.1666
17/06/21	0.0905
18/06/21	12.0944
19/06/21	3.0474
20/06/21	0.2018
21/06/21	2.1203
22/06/21	-0.2413
23/06/21	-1.1452
24/06/21	3.8513
25/06/21	0.0062
26/06/21	-0.2025
27/06/21	0.1565
28/06/21	-1.5846
29/06/21	-1.2839
30/06/21	0.4375
01/07/21	-0.7374
02/07/21	-0.9524
03/07/21	-0.5251
04/07/21	-1.4027
05/07/21	-1.3478
06/07/21	-0.7255

07/07/21	-1.2406
08/07/21	-1.1061
09/07/21	-1.0379
10/07/21	-1.4126
11/07/21	-1.3461
12/07/21	-1.1367
13/07/21	-1.3094
14/07/21	-1.2757
15/07/21	-1.1989
16/07/21	-1.3697
17/07/21	-1.3387
18/07/21	-1.2774
19/07/21	-1.3546
20/07/21	-1.3080
21/07/21	-1.2964
22/07/21	-1.3577
23/07/21	-1.3436
24/07/21	-1.3221
25/07/21	-1.3519
26/07/21	-1.3366
27/07/21	-1.3253
28/07/21	-1.3524
29/07/21	-1.3433
30/07/21	-1.3398
31/07/21	-1.3521

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 COVID-19 pandemic may disappear around late June 2021.

IV. CONCLUSION & RECOMMENDATIONS

Forecasting COVID-19 has become a key research interest, especially for health economists and epidemiologists. There is no doubt, these forecasts are important for the effective allocation of healthcare resources, stockpiling and help in strategic planning for clinicians and relevant government authorities. This study used the ANN (12, 12, 1) model to come up with COVID-19 forecasts for Eritrea. It is projected that the COVID-19 pandemic may disappear around late June 2021. We recommend the continued compliance to control and preventive COVID-19 measures such as social distancing, quarantine, isolation, face-mask wearing and so on; including vaccinations.

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