

Forecasting Covid-19 New Cases in Afghanistan

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Abstract - In this work, the ANN approach was employed to analyze COVID-19 case volumes in Afghanistan. This study is based on daily new cases of COVID-19 in Afghanistan 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 model indicate that it is stable. The results of the study suggest that the COVID-19 pandemic is likely to subside significantly over the out-of-sample period. The government should ensure continued compliance to COVID-19 mitigation measures such as social distancing, quarantine, isolation, face-mask wearing and so on., including COVID-19 vaccine uptake.

Keywords: ANN, COVID-19, Forecasting.

I. INTRODUCTION

COVID-19 is a deadly viral disease quickly spreading throughout the world. Its major symptoms include fever, sore throat, coughing and difficulty in breathing. The first cases appeared in Wuhan, China, in late December 2019 and the gradually, cases started coming up in many other countries as well (Singhal *et al.*, 2020). The increasing number of new infections and death toll the virus has been a major threat and serious challenge for each and every country (Pathak *et al.*, 2020). Accurately forecasting the transmission dynamics of confirmed COVID-19 cases is vital to understand and help decision makers to slow down or arrest its spreading (Velasquez & Lara, 2020; Yousaf *et al.*, 2020; Ribeiro *et al.*, 2020). The main purpose of this study is model and forecast daily confirmed cases of COVID-19 in Afghanistan.

II. METHODOLOGY

The Artificial Neural Network (ANN) technique, 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. Because 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 Afghanistan.

Data Issues

This study is based on daily new cases of COVID-19 in Afghanistan 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	A
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	0.106751
MSE	7756.285349
MAE	44.372206

Residual Analysis for the Applied Model

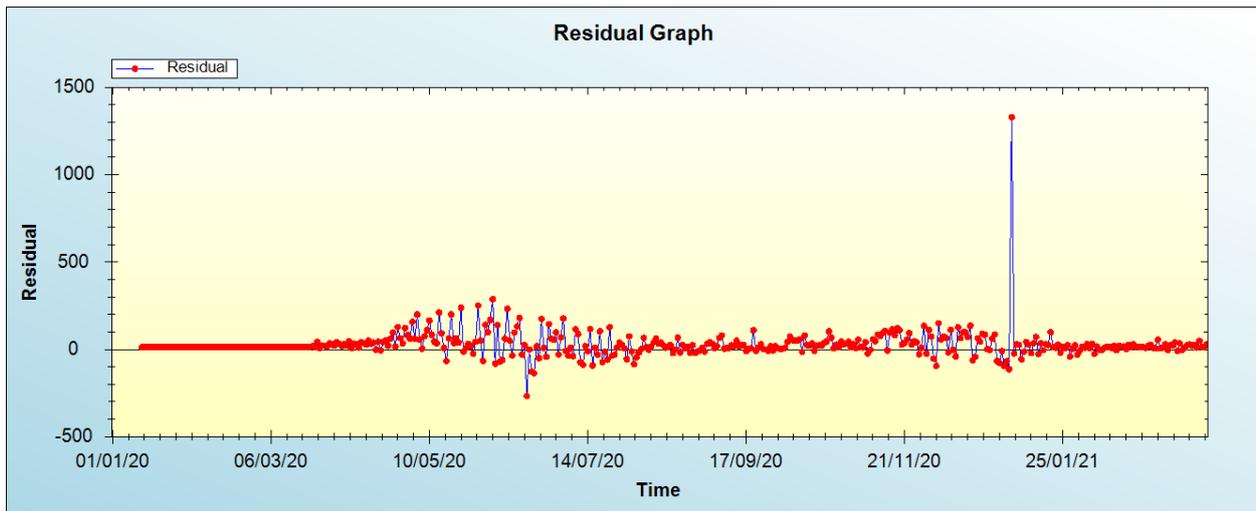


Figure 1: Residual analysis

In-sample Forecast for A

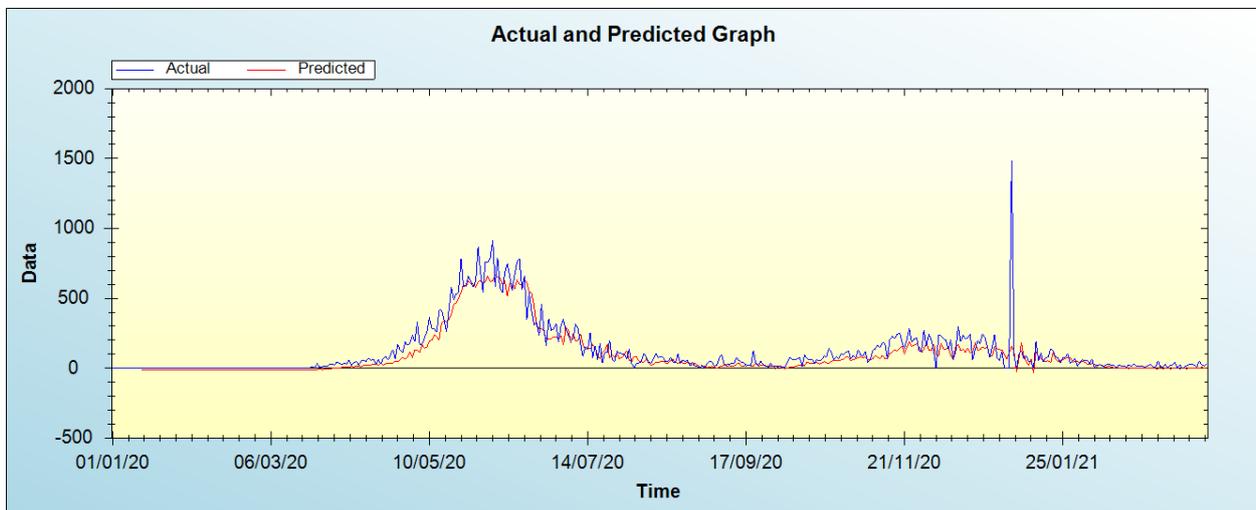


Figure 2: In-sample forecast for the A series

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

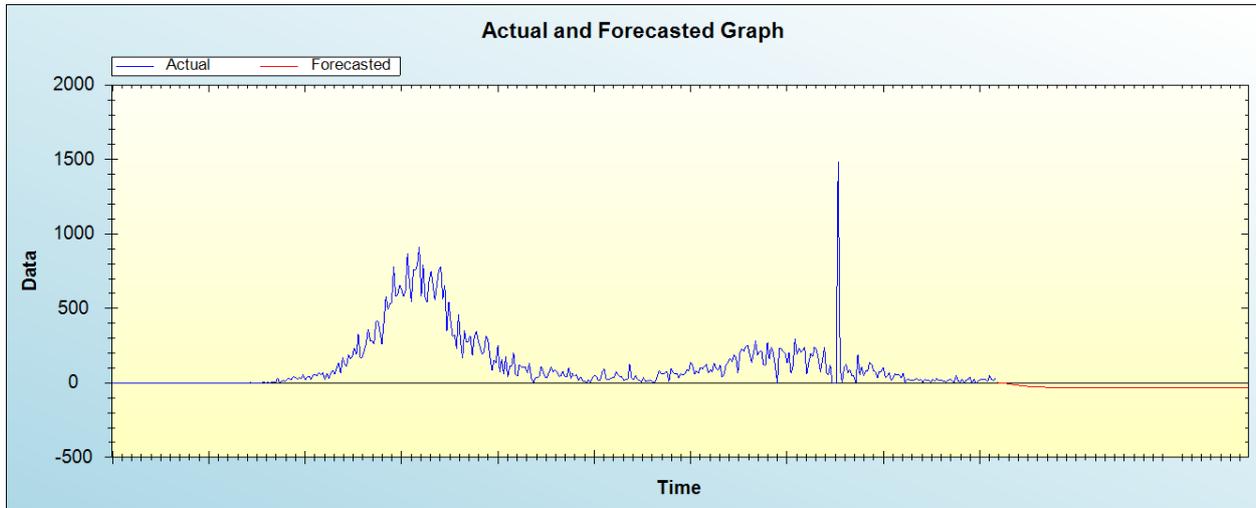


Figure 3: Out-of-sample forecast for A: actual and forecasted graph

Out-of-Sample Forecast for A: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Day/Month/Year	Forecasts
26/03/21	5.2115
27/03/21	-0.8316
28/03/21	-0.1179
29/03/21	-1.6769
30/03/21	-0.7887
31/03/21	-7.3909
01/04/21	-10.4650
02/04/21	-5.9976
03/04/21	-13.4960
04/04/21	-15.5464
05/04/21	-13.6846
06/04/21	-18.3790
07/04/21	-19.9604
08/04/21	-20.8861
09/04/21	-22.1082
10/04/21	-22.0861
11/04/21	-24.1912
12/04/21	-25.1783
13/04/21	-24.6957
14/04/21	-26.4712
15/04/21	-27.1137
16/04/21	-27.1017
17/04/21	-28.0977
18/04/21	-28.4594
19/04/21	-28.8911
20/04/21	-29.3288
21/04/21	-29.3803
22/04/21	-29.9386
23/04/21	-30.2317
24/04/21	-30.2257
25/04/21	-30.6418
26/04/21	-30.8209
27/04/21	-30.8998
28/04/21	-31.1400
29/04/21	-31.2305
30/04/21	-31.3729
01/05/21	-31.5032

02/05/21	-31.5343
03/05/21	-31.6767
04/05/21	-31.7590
05/05/21	-31.7819
06/05/21	-31.8830
07/05/21	-31.9316
08/05/21	-31.9674
09/05/21	-32.0288
10/05/21	-32.0542
11/05/21	-32.0963
12/05/21	-32.1327
13/05/21	-32.1460
14/05/21	-32.1826
15/05/21	-32.2052
16/05/21	-32.2165
17/05/21	-32.2420
18/05/21	-32.2554
19/05/21	-32.2677
20/05/21	-32.2839
21/05/21	-32.2915
22/05/21	-32.3034
23/05/21	-32.3134
24/05/21	-32.3183
25/05/21	-32.3278
26/05/21	-32.3341
27/05/21	-32.3382
28/05/21	-32.3448
29/05/21	-32.3486
30/05/21	-32.3524
31/05/21	-32.3568
01/06/21	-32.3591
02/06/21	-32.3624
03/06/21	-32.3652
04/06/21	-32.3668
05/06/21	-32.3693
06/06/21	-32.3711
07/06/21	-32.3724
08/06/21	-32.3742
09/06/21	-32.3753
10/06/21	-32.3764
11/06/21	-32.3776
12/06/21	-32.3783
13/06/21	-32.3792
14/06/21	-32.3800
15/06/21	-32.3805
16/06/21	-32.3812
17/06/21	-32.3817
18/06/21	-32.3821
19/06/21	-32.3825
20/06/21	-32.3829
21/06/21	-32.3832
22/06/21	-32.3835
23/06/21	-32.3837
24/06/21	-32.3840
25/06/21	-32.3842
26/06/21	-32.3844
27/06/21	-32.3845
28/06/21	-32.3847
29/06/21	-32.3848
30/06/21	-32.3849
01/07/21	-32.3850
02/07/21	-32.3851
03/07/21	-32.3852
04/07/21	-32.3853

05/07/21	-32.3853
06/07/21	-32.3854
07/07/21	-32.3854
08/07/21	-32.3855
09/07/21	-32.3855
10/07/21	-32.3856
11/07/21	-32.3856
12/07/21	-32.3856
13/07/21	-32.3857
14/07/21	-32.3857
15/07/21	-32.3857
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17/07/21	-32.3857
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23/07/21	-32.3858
24/07/21	-32.3858
25/07/21	-32.3858
26/07/21	-32.3858
27/07/21	-32.3858
28/07/21	-32.3858
29/07/21	-32.3858
30/07/21	-32.3859
31/07/21	-32.3859

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 in the out-of-sample period.

IV. CONCLUSION & RECOMMENDATIONS

Based on daily observations of COVID-19 cases in Afghanistan, this study used the ANN (12, 12, 1) model to come up with forecasts ranging over the specified period. The results of the study suggest that the COVID-19 pandemic is likely to subside significantly over the out-of-sample period. The government should ensure continued compliance to COVID-19 mitigation measures such as social distancing, quarantine, isolation, face-mask wearing and so on, including COVID-19 vaccine uptake.

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