

# Forecasting Covid-19 New Cases in Bahrain

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**Abstract -** The current COVID-19 outbreak is a serious disaster worldwide, including Bahrain. In this empirical paper, the ANN approach was applied to analyze COVID-19 cases in Bahrain. This study is based on daily new cases of COVID-19 in Bahrain 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 indeed stable in forecasting COVID-19 cases in Bahrain. The results of the study suggest that daily COVID-19 cases in Bahrain are likely to remain significantly high over the out-of-sample period. The government of Bahrain should ensure serious compliance to control and preventive COVID-19 measures such as social distancing, quarantine, isolation, face-mask wearing and so on, in line with WHO guidelines.

**Keywords:** ANN, COVID-19, Forecasting.

## I. INTRODUCTION

COVID-19 originated in Wuhan, the capital city of China's Hubei province, around December 2019 and spread out all over the world within a few weeks (Chimmula & Zhang, 2020). COVID-19 is a respiratory infectious disease caused by a new strain of coronavirus that causes illness in humans. Scientists are still learning about the disease, and think that the virus began in animals. At some point, one or more humans acquired infection from an animal, and those infected humans began transmitting the infection to other humans. The disease spreads from person to person through infected air droplets that are projected during sneezing or coughing. It can also be transmitted when humans have contact with hands or surfaces that contain the virus and touch their eyes, nose or mouth, with the contaminated hands (Ayinde *et al.*, 2020). While most infections with COVID-19 are mild or even asymptomatic, approximately 20% of recognized infections are sufficiently severe to require hospitalization (Wang *et al.*, 2020). Among these hospitalized, 10-20% have an intensive care requirement, usually related to respiratory failure (Wang *et al.*, 2020), though multiorgan system failure (Zhang *et al.*, 2020), clotting abnormalities (Nahum *et al.*, 2020) and angioneogenesis (Ackermann *et al.*, 2020) with resultant bleeding are increasingly recognized as severe complications of COVID-19 (Fisman *et al.*, 2020). Forecasting COVID-19 is critical, especially in ensuring that healthcare systems are adequately prepared for the ongoing pandemic (Barrett *et al.*, 2020). The main motive behind this piece of work is to model and forecast COVID-19 cases in Bahrain using an Artificial Neural Network (ANN) model.

## 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 Bahrain.

### Data Issues

This study is based on daily new cases of COVID-19 in Bahrain 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	0.148681
MSE	5477.515125
MAE	56.160552

#### Residual Analysis for the Applied Model

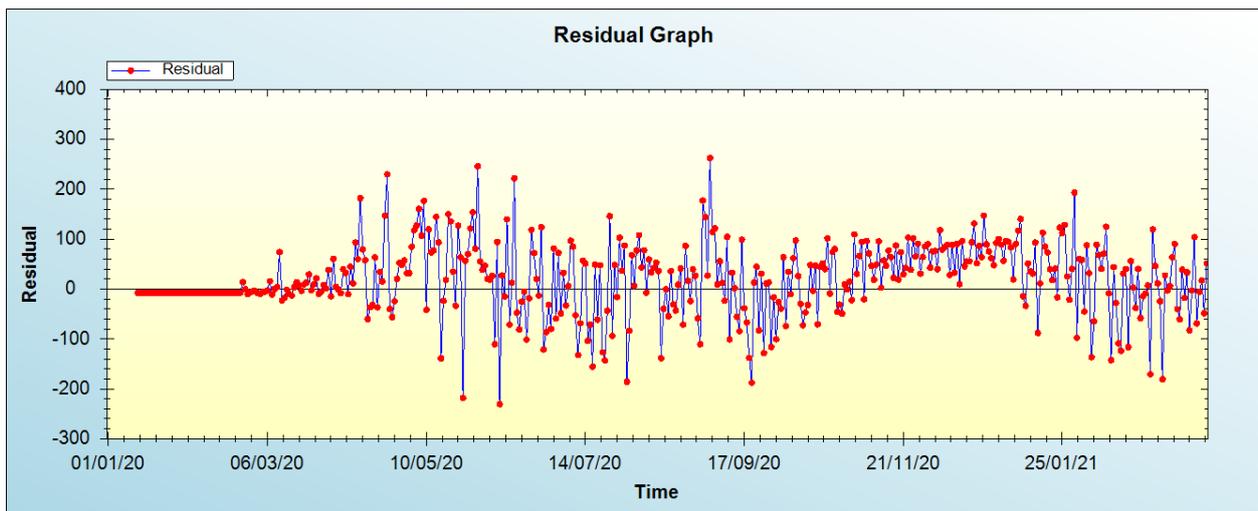


Figure 1: Residual analysis

#### In-sample Forecast for B

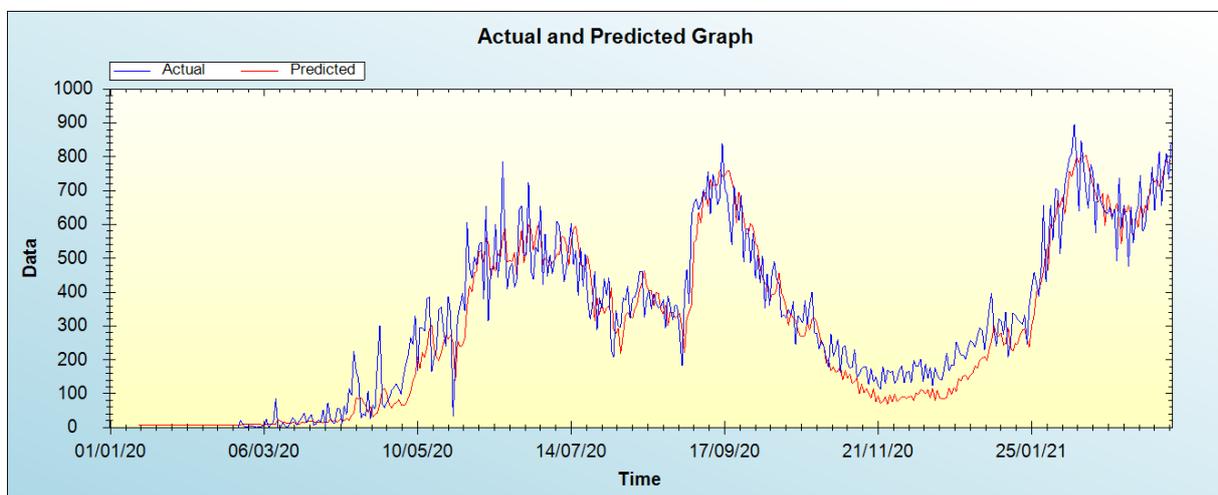


Figure 2: In-sample forecast for the B series

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

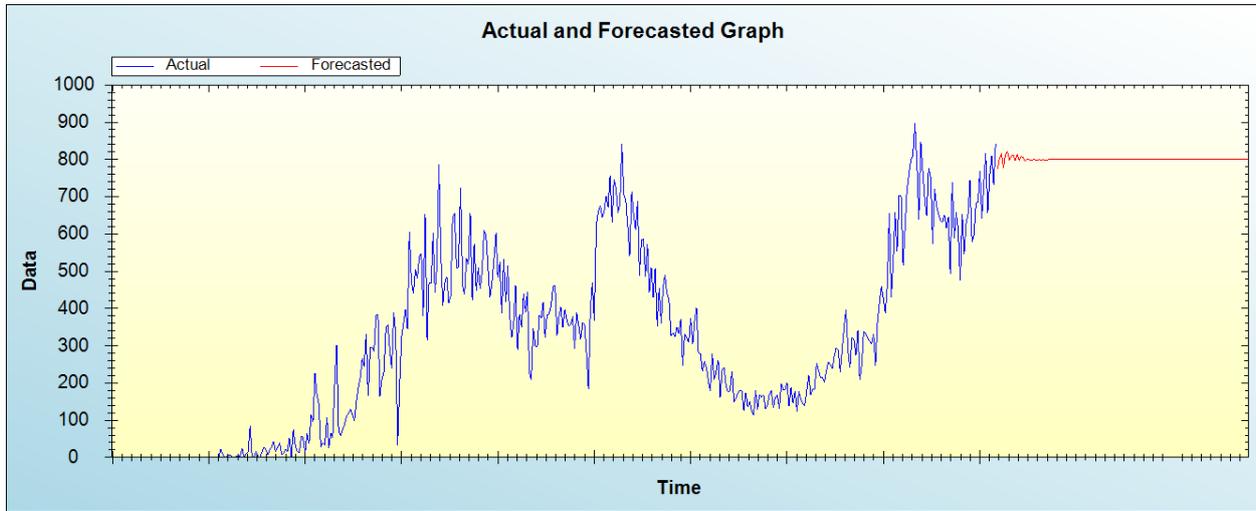


Figure 3: Out-of-sample forecast for B: actual and forecasted graph

Out-of-Sample Forecast for B: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Day/Month/Year	Forecasts
26/03/21	775.6899
27/03/21	803.8791
28/03/21	815.6279
29/03/21	777.8682
30/03/21	813.5063
31/03/21	821.5047
01/04/21	797.3124
02/04/21	809.8984
03/04/21	811.5687
04/04/21	796.1237
05/04/21	813.2082
06/04/21	797.0038
07/04/21	807.1568
08/04/21	805.7104
09/04/21	796.0938
10/04/21	802.1792
11/04/21	800.3665
12/04/21	797.9517
13/04/21	799.4661
14/04/21	800.0241
15/04/21	797.0677
16/04/21	800.3277
17/04/21	796.4478
18/04/21	799.5651
19/04/21	799.3825
20/04/21	798.2653
21/04/21	800.1547
22/04/21	799.4552
23/04/21	799.8513
24/04/21	800.0075
25/04/21	800.6075
26/04/21	800.3239
27/04/21	801.2045
28/04/21	800.4635
29/04/21	801.1828
30/04/21	801.0641
01/05/21	800.8592

02/05/21	801.2803
03/05/21	800.9620
04/05/21	801.1153
05/05/21	800.9138
06/05/21	800.9775
07/05/21	800.7921
08/05/21	800.8861
09/05/21	800.6566
10/05/21	800.7309
11/05/21	800.6346
12/05/21	800.5302
13/05/21	800.5891
14/05/21	800.4653
15/05/21	800.5230
16/05/21	800.4486
17/05/21	800.4857
18/05/21	800.4488
19/05/21	800.4852
20/05/21	800.4614
21/05/21	800.4981
22/05/21	800.5081
23/05/21	800.5082
24/05/21	800.5494
25/05/21	800.5363
26/05/21	800.5757
27/05/21	800.5685
28/05/21	800.5944
29/05/21	800.5940
30/05/21	800.6081
31/05/21	800.6075
01/06/21	800.6138
02/06/21	800.6163
03/06/21	800.6115
04/06/21	800.6177
05/06/21	800.6075
06/06/21	800.6119
07/06/21	800.6023
08/06/21	800.6028
09/06/21	800.5964
10/06/21	800.5942
11/06/21	800.5901
12/06/21	800.5869
13/06/21	800.5852
14/06/21	800.5813
15/06/21	800.5818
16/06/21	800.5783
17/06/21	800.5797
18/06/21	800.5777
19/06/21	800.5788
20/06/21	800.5785
21/06/21	800.5794
22/06/21	800.5801
23/06/21	800.5808
24/06/21	800.5821
25/06/21	800.5824
26/06/21	800.5840
27/06/21	800.5842
28/06/21	800.5855
29/06/21	800.5857
30/06/21	800.5865
01/07/21	800.5867
02/07/21	800.5870
03/07/21	800.5873
04/07/21	800.5872

05/07/21	800.5874
06/07/21	800.5871
07/07/21	800.5871
08/07/21	800.5868
09/07/21	800.5867
10/07/21	800.5864
11/07/21	800.5862
12/07/21	800.5860
13/07/21	800.5858
14/07/21	800.5856
15/07/21	800.5854
16/07/21	800.5853
17/07/21	800.5852
18/07/21	800.5852
19/07/21	800.5851
20/07/21	800.5851
21/07/21	800.5851
22/07/21	800.5851
23/07/21	800.5852
24/07/21	800.5852
25/07/21	800.5853
26/07/21	800.5853
27/07/21	800.5854
28/07/21	800.5854
29/07/21	800.5855
30/07/21	800.5855
31/07/21	800.5856

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 Bahrain are likely to remain significantly high over the out-of-sample period.

#### IV. CONCLUSION AND POLICY RECOMMENDATIONS

COVID-19 is still spreading rapidly in many countries across the globe. Based on 450 daily observations of COVID-19 cases in Bahrain, this study used the ANN (12, 12, 1) model to come up with predictions ranging over the period March 26, 2021 to July 31, 2021. The results of the study show that the COVID-19 pandemic will not end anytime soon in Bahrain. The country ought to ensure serious compliance to control and preventive COVID-19 measures such as social distancing, quarantine, isolation, face-mask wearing and so on., in line with WHO guidelines.

#### REFERENCES

- [1] Ackermann, M., *et al.* (2020). Pulmonary Vascular Endothelialitis, Thrombosis and Angiogenesis in COVID-19, *New England Journal of Medicine*, pp: 1 – 11.
- [2] Ayinde, K., *et al.* (2020). Modeling Nigerian COVID-19 Cases: A Comparative Analysis of Models and Estimators, *Chaos, Solitons and Fractals*, 138 (2020): 1 – 17.
- [3] Barret, K., *et al.* (2020). Estimation of COVID-19-induced Depletion of Hospital Resources in Ontario, Canada, *CMAJ*, pp: 1 – 7.
- [4] Chimmula, V. K. R., & Zhang, L. (2020). Time Series Forecasting of COVID-19 Transmission in Canada Using LSTM Networks, *Chaos, Solitons and Fractals*, 135 (2020): 1 – 6.
- [5] Fisman, D. N., *et al.* (2020). Derivation and Validation of Clinical Prediction Rule for COVID-19 Mortality in Ontario, Canada, *medRxiv*, pp: 1 – 50.
- [6] Nahum, J., *et al.* (2020). Venous Thrombosis Among Critically ill Patients With Coronavirus Disease 2019 (COVID-19), *JAMA*, 3 (5): 1 – 7.
- [7] Wang, D., *et al.* (2020). Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-infected Pneumonia in Wuhan, China, *JAMA*, pp: 1 – 9.
- [8] Zhang, C., *et al.* (2020). Cytokine Release Syndrome in Severe COVID-19: Interleukin-6 Receptor Antagonist Tocilizumab may be the Key to Reduce Mortality, *International Journal of Antimicrobial Agents*, 55 (5): 1 – 16.

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