

Forecasting Covid-19 New Cases in Norway

¹Dr. Smartson. P. NYONI, ²Mr. Thabani NYONI, ³Mr. Tatenda. A. CHIHOHO

¹ZICHIRE Project, University of Zimbabwe, Harare, Zimbabwe

²SAGIT Innovation Center, Harare, Zimbabwe

³Independent Health Economist, Harare, Zimbabwe

Abstract - The tail end of 2019 will never be forgotten due to the coming-in of the novel coronavirus in China; which has continuously threatened our lives and livelihoods. Just like any other country affected, Norway is struggling to halt the spread of the COVID-19 pandemic. In this paper, the ANN approach was applied to analyze COVID-19 case volumes in the country. This study is based on daily new cases of COVID-19 in Norway 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 stable in forecasting COVID-19 cases in the country. The study showed that daily COVID-19 cases in Norway are likely to remain significantly high over the out-of-sample period. Control and preventive measures need to be strictly followed and observed all the time, especially the vaccine roll-out programme; alongside wearing of masks, regular washing of hands as well as social distancing among other things.

Keywords: ANN, COVID-19, Forecasting.

I. INTRODUCTION

The novel coronavirus disease 2019 (COVID-19) is a new beta coronavirus caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (Sohrabi *et al.*, 2020). The first infected case was discovered in Hubei, a province in the city of Wuhan in China, on December 31 2019 (Guan *et al.*, 2020). While critical cases of COVID-19 might end up dying, infected people usually experience mild to severe respiratory illness (Sohrabi *et al.*, 2020). Compared to other coronavirus families, COVID-19 is quite dangerous because of its asymptomatic and high human-to-human transmission (Shereen *et al.*, 2020). Developing a predictive model for the COVID-19 pandemic in Norway is important for policy formulation purposes, especially given the way the pandemic is ravaging the lives of people. The main aim of this paper is to model and forecast daily new COVID-19 cases for all age groups in Norway in order to inform policy.

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 in Norway.

Data Issues

This study is based on daily new cases of COVID-19 in Norway 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	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	0.104442
MSE	9502.169478
MAE	66.033263

Residual Analysis for the Applied Model

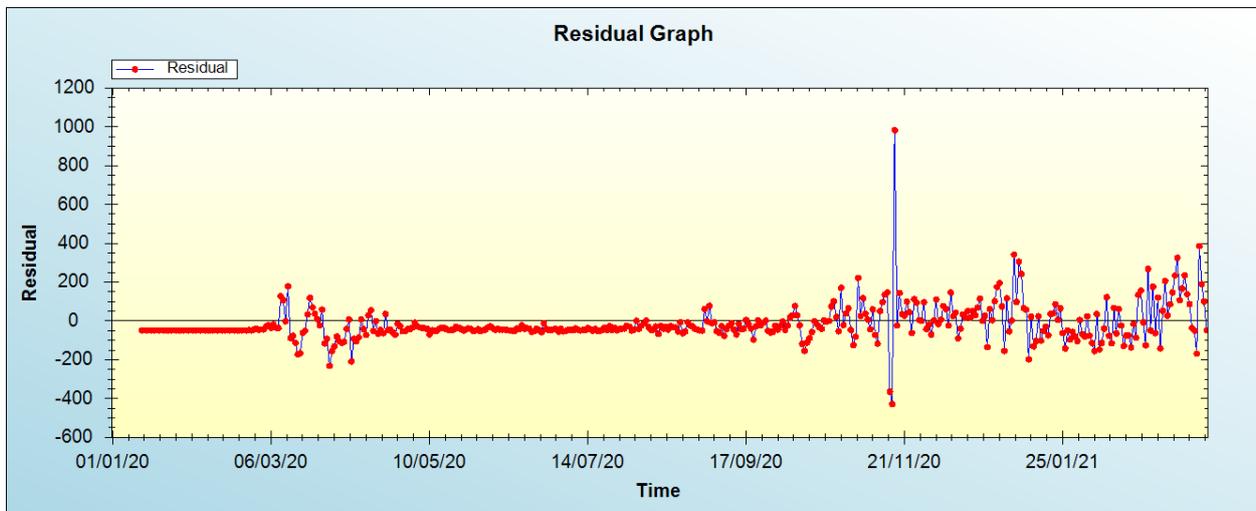


Figure 1: Residual analysis

In-sample Forecast for N

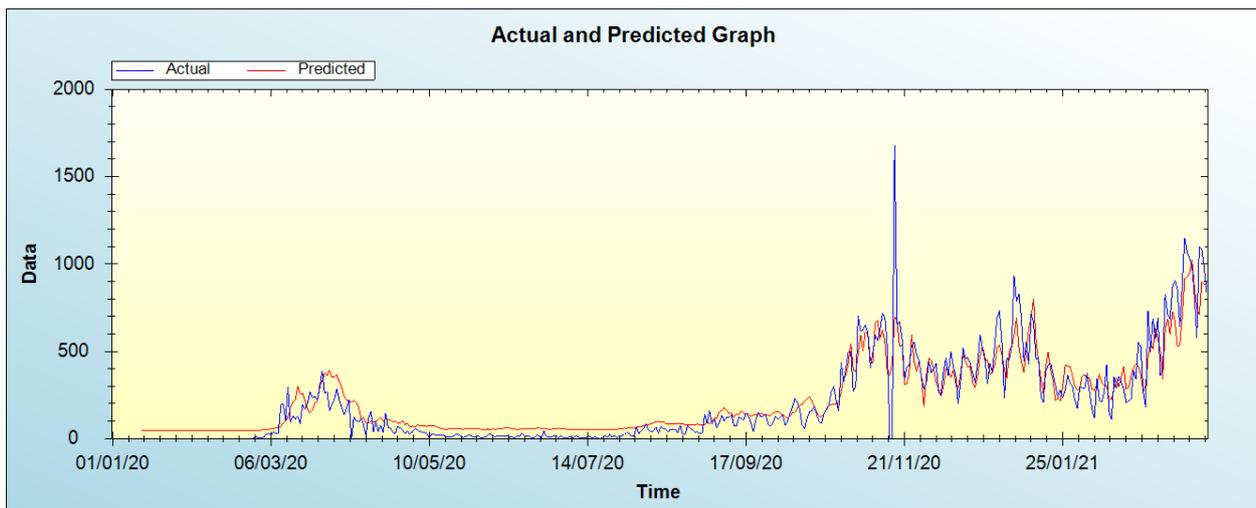


Figure 2: In-sample forecast for the N series

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

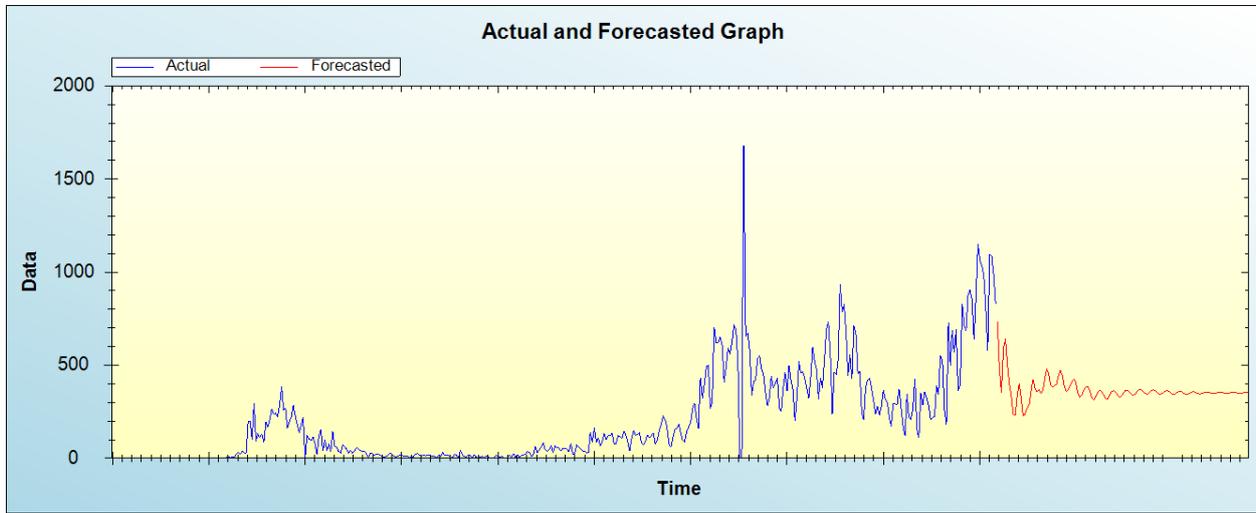


Figure 3: Out-of-sample forecast for N: actual and forecasted graph

Out-of-Sample Forecast for N: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Day/Month/Year	Forecasts
26/03/21	731.0305
27/03/21	481.7442
28/03/21	356.1213
29/03/21	590.3872
30/03/21	640.0965
31/03/21	501.6703
01/04/21	400.1242
02/04/21	333.7228
03/04/21	234.3389
04/04/21	230.9789
05/04/21	332.2184
06/04/21	401.1582
07/04/21	324.9437
08/04/21	229.1668
09/04/21	235.3981
10/04/21	271.8010
11/04/21	282.2535
12/04/21	350.4759
13/04/21	424.1189
14/04/21	380.3587
15/04/21	358.6375
16/04/21	369.4806
17/04/21	347.9434
18/04/21	363.3556
19/04/21	423.7242
20/04/21	480.7697
21/04/21	458.3181
22/04/21	394.8659
23/04/21	383.2779
24/04/21	390.8394
25/04/21	396.3286
26/04/21	440.6489
27/04/21	471.2804
28/04/21	443.1291
29/04/21	386.7668

30/04/21	358.5438
01/05/21	370.9834
02/05/21	391.5481
03/05/21	412.5926
04/05/21	427.9055
05/05/21	400.2801
06/05/21	348.4184
07/05/21	329.0645
08/05/21	344.2559
09/05/21	370.0220
10/05/21	384.5584
11/05/21	383.8998
12/05/21	360.5778
13/05/21	324.4729
14/05/21	312.3145
15/05/21	331.5618
16/05/21	356.4751
17/05/21	365.9182
18/05/21	360.2024
19/05/21	339.9941
20/05/21	318.9312
21/05/21	317.3965
22/05/21	337.5589
23/05/21	357.7812
24/05/21	362.7774
25/05/21	355.1667
26/05/21	340.5611
27/05/21	329.0974
28/05/21	332.4940
29/05/21	349.6515
30/05/21	364.8436
31/05/21	366.9030
01/06/21	357.8561
02/06/21	345.7617
03/06/21	338.9048
04/06/21	343.7896
05/06/21	357.9811
06/06/21	368.9670
07/06/21	367.9613
08/06/21	357.9157
09/06/21	347.4933
10/06/21	343.7716
11/06/21	349.5121
12/06/21	360.7657
13/06/21	367.9261
14/06/21	364.7360
15/06/21	354.6998
16/06/21	346.2710
17/06/21	345.0059
18/06/21	351.1557
19/06/21	359.9409
20/06/21	364.0026
21/06/21	359.6153
22/06/21	350.5984
23/06/21	344.4204
24/06/21	345.1537
25/06/21	351.3699
26/06/21	358.0724
27/06/21	359.8935
28/06/21	355.1245
29/06/21	347.7107
30/06/21	343.7731
01/07/21	345.9358
02/07/21	351.8519

03/07/21	356.7933
04/07/21	357.0599
05/07/21	352.4437
06/07/21	346.7425
07/07/21	344.6868
08/07/21	347.6648
09/07/21	352.9263
10/07/21	356.3499
11/07/21	355.5531
12/07/21	351.3246
13/07/21	347.1394
14/07/21	346.4526
15/07/21	349.6991
16/07/21	354.0789
17/07/21	356.1952
18/07/21	354.6864
19/07/21	350.9329
20/07/21	347.9786
21/07/21	348.2043
22/07/21	351.3471
23/07/21	354.7690
24/07/21	355.8114
25/07/21	353.8835
26/07/21	350.6594
27/07/21	348.6967
28/07/21	349.5008
29/07/21	352.3382
30/07/21	354.8520
31/07/21	355.0788

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 Norway are likely to remain very high over the out-of-sample period.

IV. CONCLUSION & RECOMMENDATIONS

The COVID-19 pandemic shocked everyone across the world. The scourge is now regarded as a global public health emergency. Health systems, even of higher income economies have been and continue to be overwhelmed. Norway has not been spared. This study investigated the trends of COVID-19 and also predicted its future evolution in order to help policy makers control it before the health systems are overwhelmed. The study showed that daily COVID-19 cases in Norway are likely to remain significantly high over the out-of-sample period. Control and preventive measures need to be strictly followed and observed all the time, especially the vaccine roll-out programme; alongside wearing of masks, regular washing of hands as well as social distancing among other things.

REFERENCES

- [1] Shereen, M. A., et al. (2020). COVID-19 Infection: Origin, Transmission, and Characteristics of Human Coronaviruses, *Journal of Advanced Research*, pp: 1 – 12.
- [2] Sohrabi, C., et al. (2020). WHO Declares Global Emergency: A Review of the 2019 Novel Coronavirus (COVID-19), *International Journal of Surgery*, pp: 1 – 6.
- [3] Guan, W., et al. (2020). Clinical Characteristics of Coronavirus Disease 2019 in China, *New England Journal of Medicine*, 382 (18): 1708 – 1720.



Citation of this Article:

Dr. Smartson. P. NYONI, Mr. Thabani NYONI, Mr. Tatenda. A. CHIHOHO, "Forecasting Covid-19 Mortality in Rica"
Published in *International Research Journal of Innovations in Engineering and Technology - IRJIET*, Volume 5, Issue 6, pp
473-478, June 2021. Article DOI <https://doi.org/10.47001/IRJIET/2021.506082>
