

Forecasting Covid-19 New Cases in Slovakia

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 Wuhan, China; which has continued to threaten our lives and livelihoods. Just like any other country affected, Slovakia 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 Slovakia. This study is based on daily new cases of COVID-19 in Slovakia 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 Slovakia. The study showed that daily COVID-19 cases in Slovakia 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 Slovakia 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 Slovakia 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 Slovakia.

Data Issues

This study is based on daily new cases of COVID-19 in Slovakia 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	S
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	0.071698
MSE	63272.347446
MAE	172.035676

Residual Analysis for the Applied Model

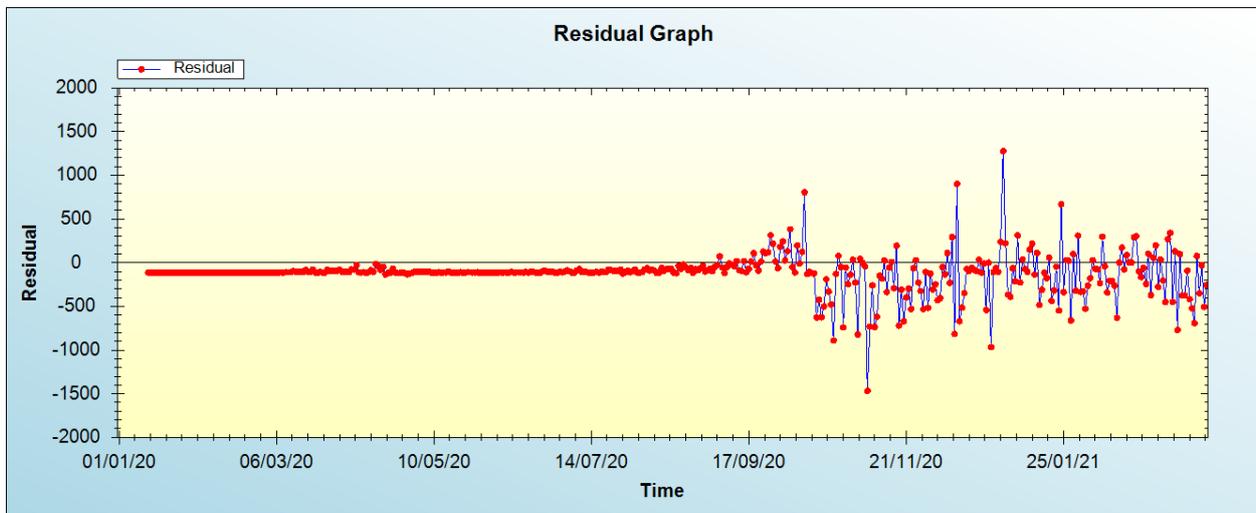


Figure 1: Residual analysis

In-sample Forecast for S

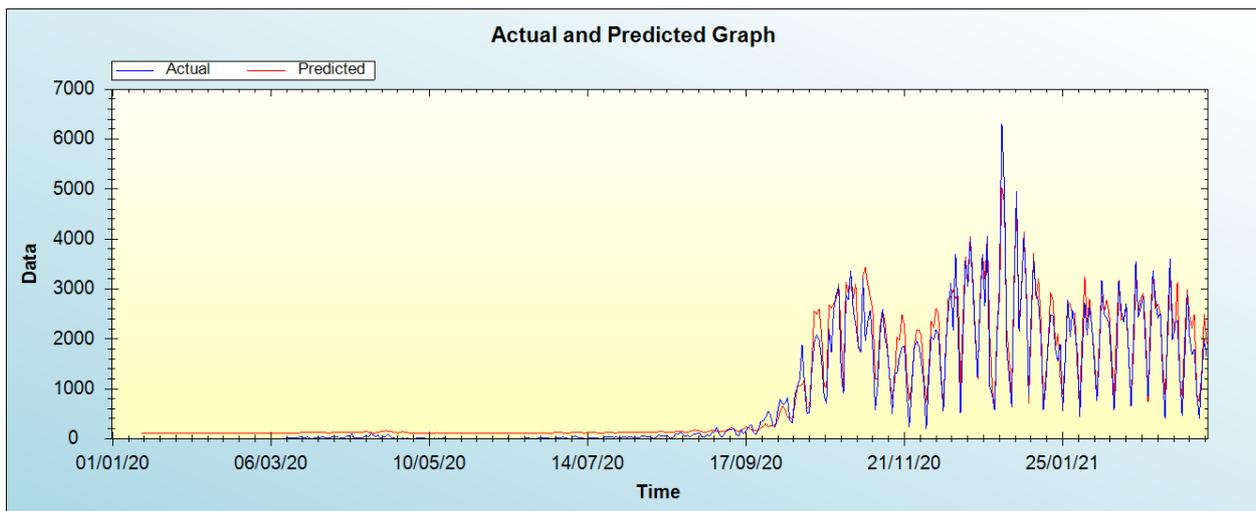


Figure 2: In-sample forecast for the S series

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

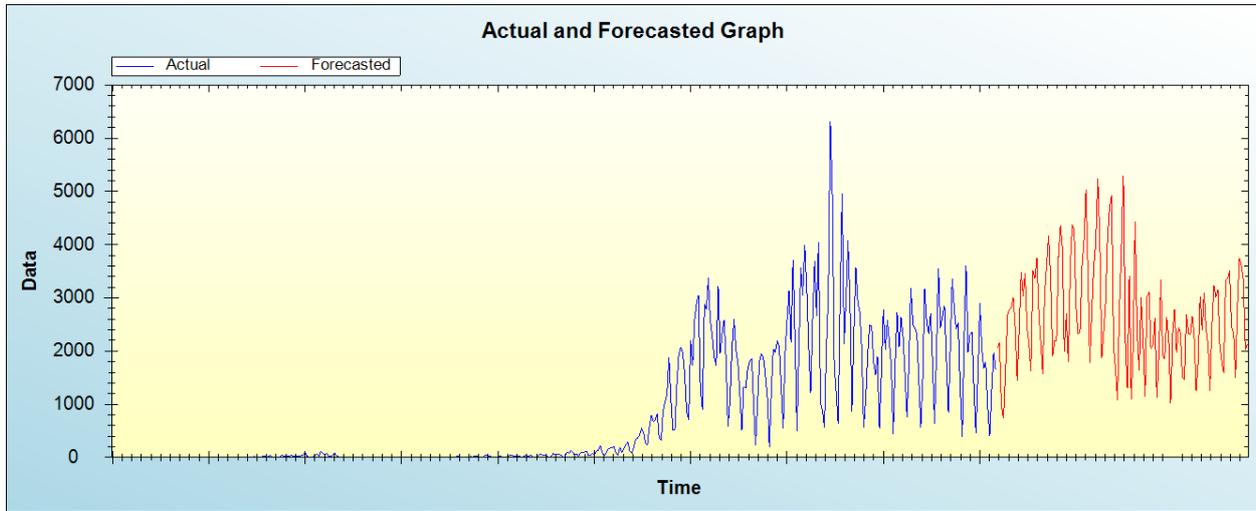


Figure 3: Out-of-sample forecast for S: actual and forecasted graph

Out-of-Sample Forecast for S: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Date	Forecasts
26/03/21	2056.1686
27/03/21	2162.0372
28/03/21	963.3036
29/03/21	744.9210
30/03/21	1558.0151
31/03/21	2681.7951
01/04/21	2769.0067
02/04/21	2831.1887
03/04/21	3010.4349
04/04/21	2459.4745
05/04/21	1443.4195
06/04/21	2387.9581
07/04/21	3480.3403
08/04/21	3040.2019
09/04/21	3459.4352
10/04/21	2444.1437
11/04/21	2153.8416
12/04/21	1629.9895
13/04/21	3510.7195
14/04/21	3364.0284
15/04/21	3749.5078
16/04/21	2734.5019
17/04/21	2160.3786
18/04/21	1564.9650
19/04/21	3054.8441
20/04/21	3608.6679
21/04/21	4166.2349
22/04/21	3373.3637
23/04/21	1904.3901
24/04/21	2189.2947
25/04/21	2194.4687
26/04/21	3774.6438
27/04/21	4355.9096
28/04/21	3946.1794
29/04/21	1998.5172
30/04/21	2697.8534
01/05/21	1799.9280

02/05/21	3616.2788
03/05/21	4367.1152
04/05/21	4291.9489
05/05/21	2845.9884
06/05/21	2317.8200
07/05/21	2351.7684
08/05/21	3608.6469
09/05/21	4092.3277
10/05/21	5028.4143
11/05/21	3499.8347
12/05/21	1789.3293
13/05/21	2743.4728
14/05/21	3586.1299
15/05/21	4048.6778
16/05/21	5238.2043
17/05/21	4060.8892
18/05/21	1859.0496
19/05/21	2352.0928
20/05/21	2878.0148
21/05/21	4112.8415
22/05/21	4659.5376
23/05/21	4930.3896
24/05/21	2073.5725
25/05/21	1663.4838
26/05/21	1073.4713
27/05/21	2797.3230
28/05/21	3798.0761
29/05/21	5295.8158
30/05/21	2181.0605
31/05/21	1296.4423
01/06/21	3406.9672
02/06/21	1101.1089
03/06/21	2118.7050
04/06/21	4436.2803
05/06/21	2370.3064
06/06/21	1644.3523
07/06/21	2999.5159
08/06/21	2163.0567
09/06/21	1153.5064
10/06/21	3032.9453
11/06/21	3106.1735
12/06/21	2040.8813
13/06/21	2107.1855
14/06/21	2609.4462
15/06/21	1128.9490
16/06/21	2012.1587
17/06/21	3329.2199
18/06/21	1913.3657
19/06/21	1854.2129
20/06/21	2630.3366
21/06/21	2231.2601
22/06/21	1018.2395
23/06/21	2343.7349
24/06/21	2785.3611
25/06/21	1965.7283
26/06/21	2434.2248
27/06/21	2348.8517
28/06/21	1501.0260
29/06/21	1464.2495
30/06/21	2677.5681
01/07/21	2330.1271
02/07/21	2307.2867
03/07/21	2663.2999
04/07/21	2252.8851

05/07/21	1254.4134
06/07/21	1782.4209
07/07/21	3028.5402
08/07/21	2405.0946
09/07/21	3091.0743
10/07/21	2416.1219
11/07/21	2111.3041
12/07/21	1255.9244
13/07/21	2438.2638
14/07/21	3235.4168
15/07/21	3014.0610
16/07/21	3156.7449
17/07/21	2088.2369
18/07/21	1800.9941
19/07/21	1582.0510
20/07/21	3331.7353
21/07/21	3363.2589
22/07/21	3507.5293
23/07/21	2441.0524
24/07/21	2335.5512
25/07/21	1504.1523
26/07/21	2867.6419
27/07/21	3742.4646
28/07/21	3614.1318
29/07/21	3335.5380
30/07/21	2024.6186
31/07/21	2124.0409

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

IV. CONCLUSION & RECOMMENDATIONS

The COVID-19 pandemic shocked the globe. Now the scourge is regarded as a global public health emergency. Health systems, even of higher income economies have been and continue to be overwhelmed. Slovakia has not been spared. This study investigated the trends of COVID-19 and also forecasted 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 Slovakia 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 New Cases in Slovakia” Published in *International Research Journal of Innovations in Engineering and Technology - IRJIET*, Volume 5, Issue 6, pp 567-571, June 2021. Article DOI <https://doi.org/10.47001/IRJIET/2021.506099>
