

# Forecasting Covid-19 New Cases in Venezuela

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**Abstract -** In this study, the ANN approach was applied to analyze COVID-19 new cases in Venezuela. The employed data covers the period 1 January 2020 – 25 March 2021 and the out-of-sample period ranges over the period 26 March – 31 July 2021. The residuals and forecast evaluation criteria (Error, MSE and MAE) of the applied model indicate that the model is quite stable. We find that the pandemic is far from ending in Venezuela. We advise the relevant authorities in the country to continue strictly enforcing WHO recommended control and prevention measures, especially the vaccinations.

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

## I. INTRODUCTION

Having started in Wuhan, China, in late December 2019 (Hernandez-Matamoros *et al.*, 2020), COVID-19 is an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (Katris, 2020). The first case outside of China was reported in Thailand on January 13, 2020 (Hui *et al.*, 2020). Since then, this ongoing outbreak has spread to the rest of the world. The symptoms of COVID-19 infection include fever, cough, shortness of breath, and diarrhoea. In more severe cases, COVID-19 can cause pneumonia and even death (WHO, 2020). COVID-19 eruption has not only disrupted the global healthcare networks but also it has demised the world economy (Hazarika & Gupta, 2020). Forecasting is a very essential (Fong *et al.*, 2020) and yet challenging task (Rizk-Allah & Hassanien, 2020), especially for COVID-19. Accurate modelling and future forecast of daily number of confirmed COVID-19 cases can help the treatment system in providing services for the new patients (Katris, 2020). In this paper, we seek to model and forecast COVID-19 cases in Venezuela using Artificial Neural Networks (ANNs).

## 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 Venezuela.

### Data Issues

This study is based on daily new cases of COVID-19 in Venezuela 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	VZ
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	0.138334
MSE	9691.977605
MAE	76.948079

*Residual Analysis for the Applied Model*

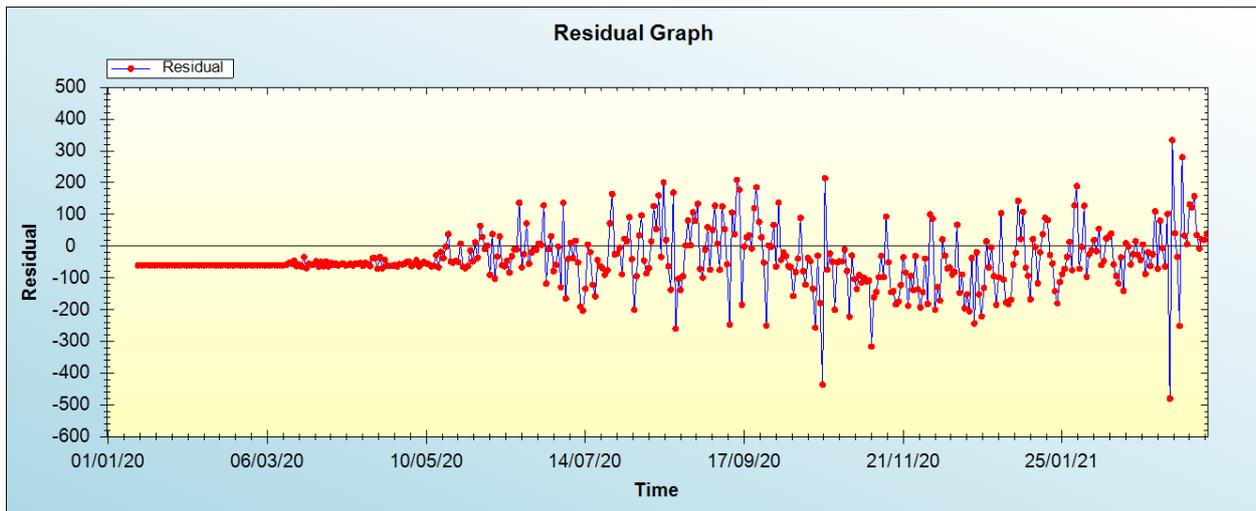


Figure 1: Residual analysis

*In-sample Forecast for VZ*

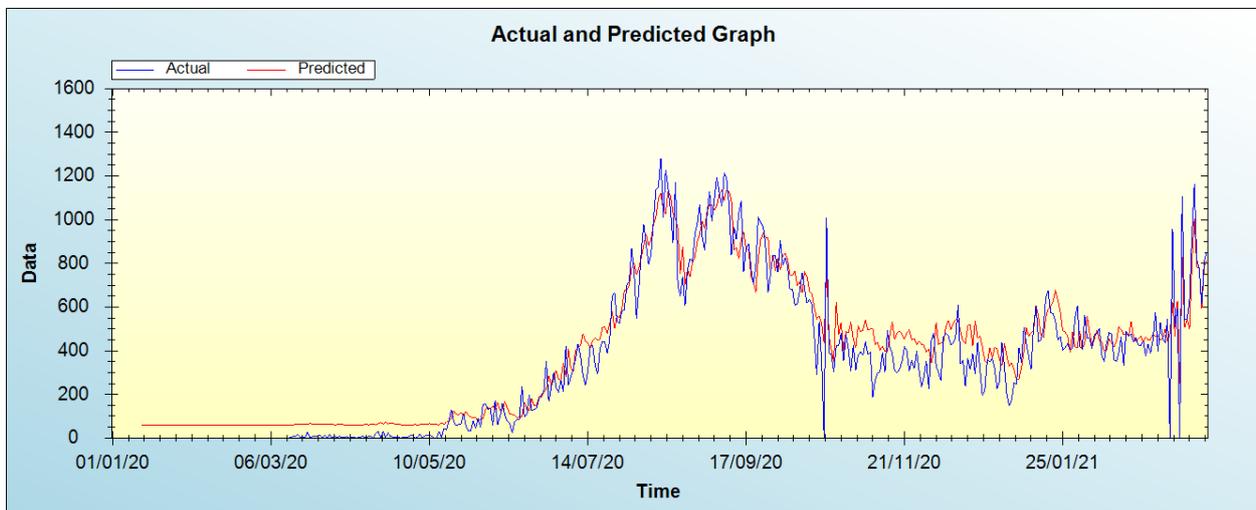


Figure 2: In-sample forecast for the VZ series

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

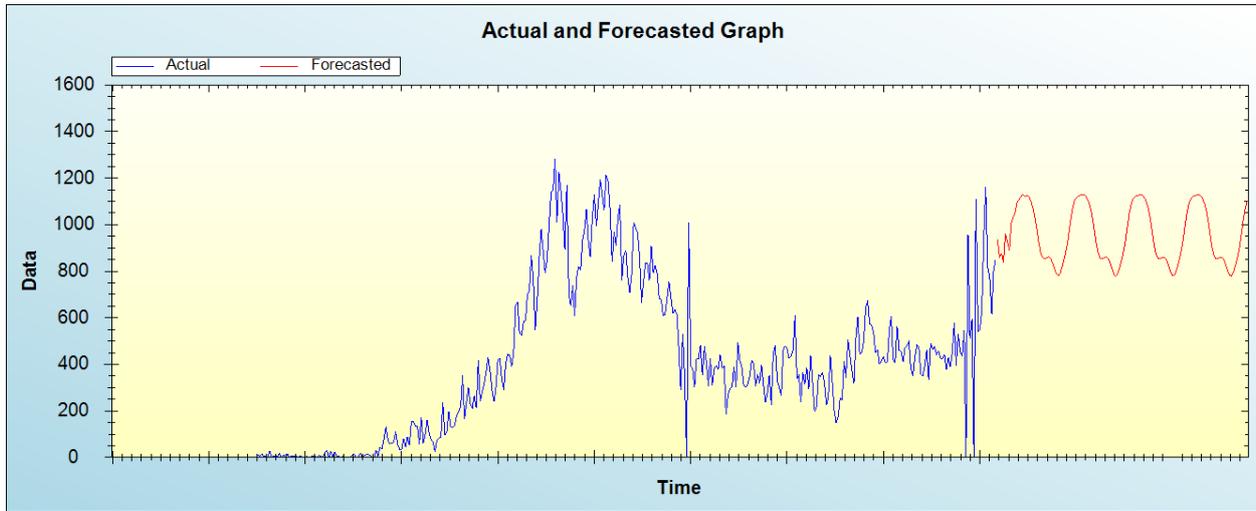


Figure 3: Out-of-sample forecast for VZ: actual and forecasted graph

Out-of-Sample Forecast for VZ: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Date	Forecasts
26/03/21	935.4673
27/03/21	858.1646
28/03/21	877.1405
29/03/21	838.8662
30/03/21	959.5801
31/03/21	925.7620
01/04/21	890.6340
02/04/21	1008.1912
03/04/21	1033.0185
04/04/21	1054.1605
05/04/21	1094.5680
06/04/21	1108.5277
07/04/21	1121.6882
08/04/21	1130.0686
09/04/21	1121.6568
10/04/21	1123.6366
11/04/21	1120.8721
12/04/21	1101.0090
13/04/21	1073.0058
14/04/21	1034.6367
15/04/21	979.7358
16/04/21	922.0154
17/04/21	879.4750
18/04/21	857.6583
19/04/21	853.1522
20/04/21	857.0159
21/04/21	861.2210
22/04/21	855.0518
23/04/21	835.4861
24/04/21	810.8150
25/04/21	788.9170
26/04/21	781.1094
27/04/21	794.3754
28/04/21	821.4620
29/04/21	853.8366
30/04/21	892.8444
01/05/21	944.6770

02/05/21	1007.8313
03/05/21	1063.5766
04/05/21	1097.3681
05/05/21	1114.9367
06/05/21	1122.4380
07/05/21	1125.8398
08/05/21	1128.6409
09/05/21	1128.2060
10/05/21	1121.1048
11/05/21	1105.9459
12/05/21	1082.2923
13/05/21	1045.4025
14/05/21	992.2890
15/05/21	931.0600
16/05/21	882.8210
17/05/21	858.7375
18/05/21	852.0975
19/05/21	855.8467
20/05/21	861.2600
21/05/21	857.8537
22/05/21	841.5207
23/05/21	815.4481
24/05/21	789.9275
25/05/21	777.8888
26/05/21	787.1951
27/05/21	812.8263
28/05/21	844.2932
29/05/21	880.5958
30/05/21	928.5113
31/05/21	990.5114
01/06/21	1050.6087
02/06/21	1090.2428
03/06/21	1111.3545
04/06/21	1120.6387
05/06/21	1124.3552
06/06/21	1127.5763
07/06/21	1128.6044
08/06/21	1123.7053
09/06/21	1110.6571
10/06/21	1089.5619
11/06/21	1056.9026
12/06/21	1008.2900
13/06/21	947.5526
14/06/21	893.7168
15/06/21	863.2438
16/06/21	852.6943
17/06/21	854.2027
18/06/21	860.2489
19/06/21	859.9917
20/06/21	847.2383
21/06/21	823.1604
22/06/21	796.3144
23/06/21	779.4736
24/06/21	782.8149
25/06/21	805.1654
26/06/21	835.6620
27/06/21	870.1954
28/06/21	914.2452
29/06/21	973.1545
30/06/21	1036.1253
01/07/21	1081.8271
02/07/21	1107.0954
03/07/21	1119.0580
04/07/21	1123.5614

05/07/21	1126.8205
06/07/21	1128.7770
07/07/21	1125.7999
08/07/21	1114.9338
09/07/21	1096.1089
10/07/21	1067.0690
11/07/21	1022.8583
12/07/21	964.0565
13/07/21	906.1036
14/07/21	869.0044
15/07/21	854.0783
16/07/21	852.9550
17/07/21	858.8206
18/07/21	861.1757
19/07/21	851.9216
20/07/21	830.3157
21/07/21	803.0178
22/07/21	782.2550
23/07/21	779.7141
24/07/21	797.9337
25/07/21	827.1614
26/07/21	860.3596
27/07/21	901.0759
28/07/21	956.1664
29/07/21	1020.2497
30/07/21	1071.8993
31/07/21	1101.8873

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

#### IV. CONCLUSION AND POLICY RECOMMENDATIONS

Researchers around the world continue to employ various prediction models for COVID-19 to make informed decisions and impose appropriate control measures. In this piece of work, we used a basic ANN (12, 12, 1) model to analyze COVID-19 daily cases in Venezuela. We find that the pandemic is far from ending in Venezuela. We advise the relevant authorities in the country to continue strictly enforcing WHO recommended control and prevention measures, especially the vaccinations.

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