

# Forecasting Covid-19 New Cases in Belarus

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**Abstract - In this paper, the basic ANN technique is applied to analyze daily new COVID-19 cases in Belarus. This study is based on daily new cases of COVID-19 in Belarus 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 (that is; Error, MSE and MAE) of the applied model indicate that the model is stable and adequate in forecasting daily new COVID-19 cases. The results of the study indicate that daily COVID-19 cases in Belarus are likely to remain significantly high, characterized by an equilibrium case volume of 1826 cases per day over the out-of-sample period. This simply implies that the current preventive and control measures for the pandemic such as quarantining, isolation, treatment, testing, tracing contacts, social distancing, regular and consistent washing of hands and so on; must be adhered to strictly. The people in the country are advised to embrace the vaccination program in order to win the war against the pandemic.**

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

## I. INTRODUCTION

Currently, the world is facing a deadly pandemic with a new coronavirus SARS-Cov-2 (Severe Acute Respiratory Syndrome Corona Virus Type 2) causing an infectious disease named COVID-19 (Corona Virus Infectious Disease 2019) (Leulseged *et al.*, 2020a). COVID-19 was first identified in China on December 2019 and later spread to the entire world and declared to be a pandemic by WHO on March 11, 2020 (WHO, 2020b). The infection basically targets the human respiratory system and is mainly transmitted by respiratory droplets and close contact with an infected person (Rothan & Byrareddy, 2020). Common signs of COVID-19 include fever, shortness of breath and dry coughs. Its uncommon symptoms include muscle pain, mild diarrhoea, abdominal pain, sputum production, loss of smell and sore throat (Wang *et al.*, 2020). Most people who are infected with COVID-19 virus experience mild to moderate respiratory illness, and they recover without requiring special treatment (WHO, 2020b). In Belarus, the first case of COVID-19 was officially confirmed on February 28, 2020 in Minsk. Artificial Neural Networks (ANN) are increasingly becoming an essential tool in understanding the dynamics of disease transmission and consequently in decision making processes regarding intervention programs for disease control. The main aim of this paper is to model and forecast daily new COVID-19 infections in Belarus.

## 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 Belarus.

### Data Issues

This study is based on daily new cases of COVID-19 in Belarus 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	0.108675
MSE	14218.201286
MAE	91.540560

#### Residual Analysis for the Applied Model

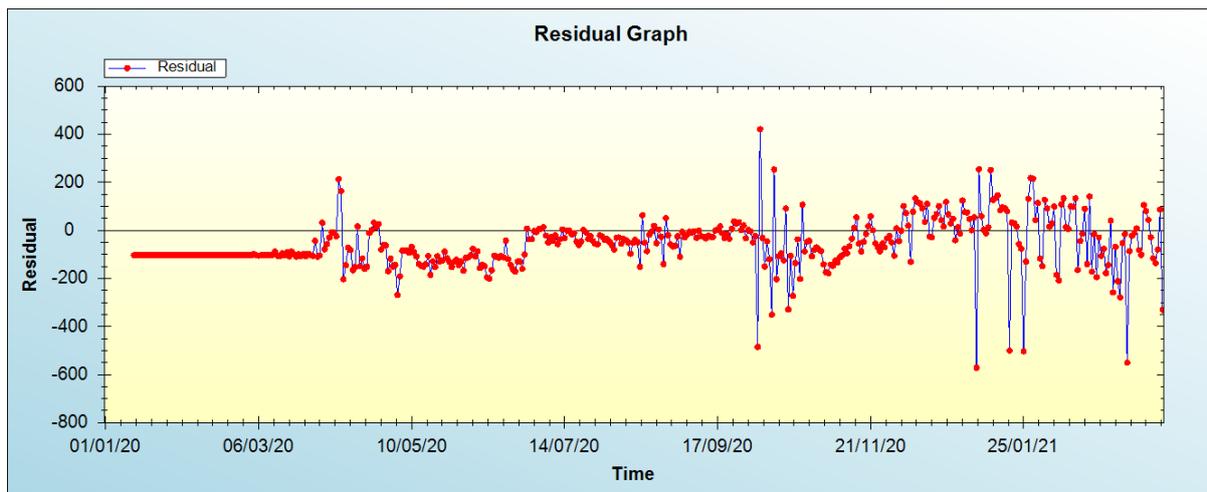


Figure 1: Residual analysis

#### In-sample Forecast for B

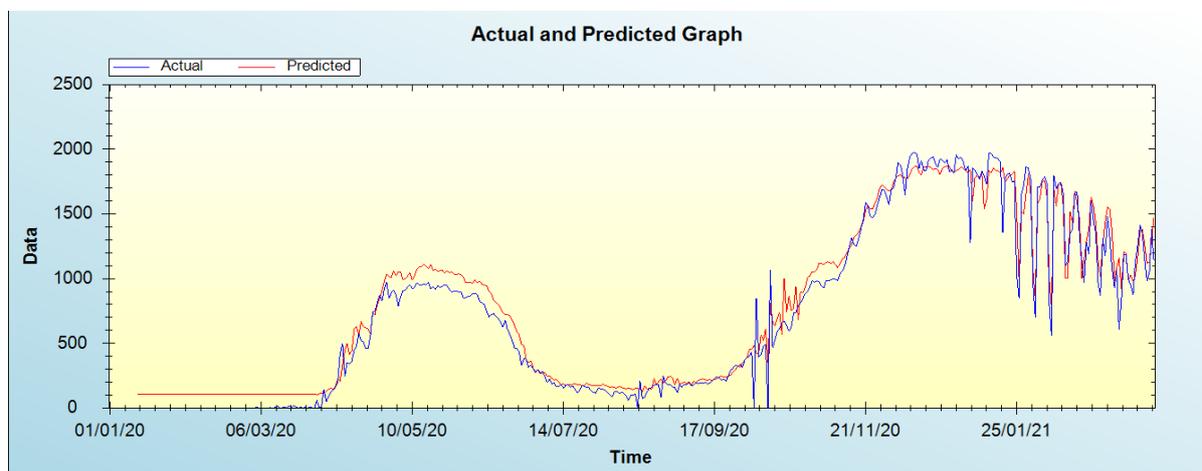


Figure 2: In-sample forecast for the B series

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

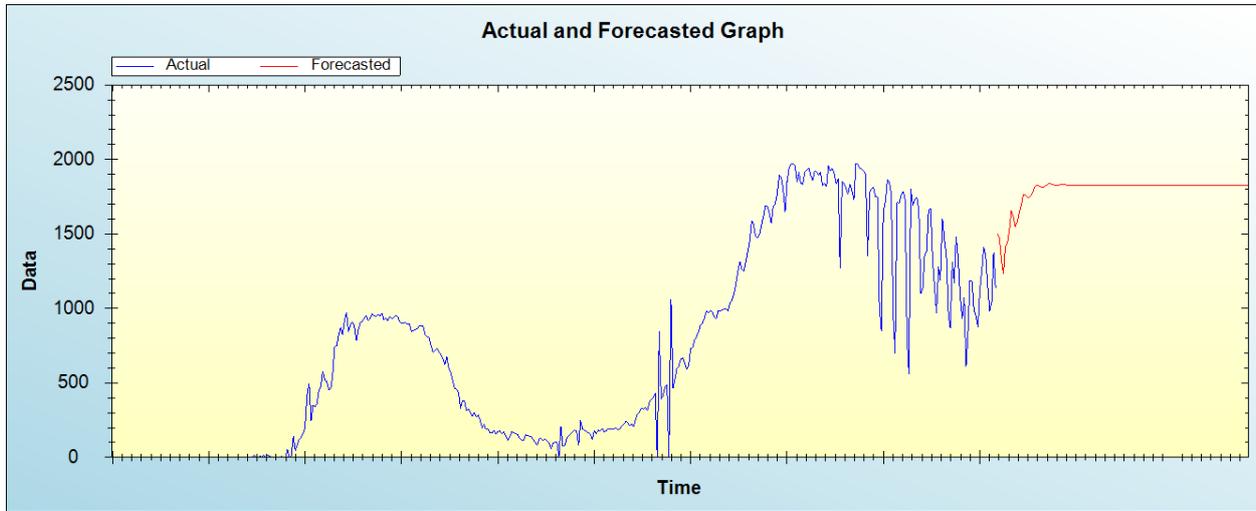


Figure 3: Out-of-sample forecast for B: actual and forecasted graph

Out-of-Sample Forecast for B: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Day/Month/Year	Forecasts
26/03/21	1500.9366
27/03/21	1474.7064
28/03/21	1327.3735
29/03/21	1236.0495
30/03/21	1419.3229
31/03/21	1436.2019
01/04/21	1527.6567
02/04/21	1656.9500
03/04/21	1616.8009
04/04/21	1548.7411
05/04/21	1579.1764
06/04/21	1640.1437
07/04/21	1689.0172
08/04/21	1760.8215
09/04/21	1765.2026
10/04/21	1749.7196
11/04/21	1742.1298
12/04/21	1757.2706
13/04/21	1783.4969
14/04/21	1816.3565
15/04/21	1826.2416
16/04/21	1821.0875
17/04/21	1815.8488
18/04/21	1812.6789
19/04/21	1816.7667
20/04/21	1828.3449
21/04/21	1836.2252
22/04/21	1835.7080
23/04/21	1832.3711
24/04/21	1827.7974
25/04/21	1824.5740
26/04/21	1826.2400
27/04/21	1829.9226
28/04/21	1831.4223
29/04/21	1830.8369
30/04/21	1828.7582
01/05/21	1825.9049

02/05/21	1824.6774
03/05/21	1825.6164
04/05/21	1826.9412
05/05/21	1827.6987
06/05/21	1827.6053
07/05/21	1826.5419
08/05/21	1825.4257
09/05/21	1825.2196
10/05/21	1825.7216
11/05/21	1826.4056
12/05/21	1826.8996
13/05/21	1826.8490
14/05/21	1826.3753
15/05/21	1825.9991
16/05/21	1825.9652
17/05/21	1826.2027
18/05/21	1826.5534
19/05/21	1826.7626
20/05/21	1826.6927
21/05/21	1826.4827
22/05/21	1826.3231
23/05/21	1826.2979
24/05/21	1826.4103
25/05/21	1826.5640
26/05/21	1826.6297
27/05/21	1826.5821
28/05/21	1826.4847
29/05/21	1826.4071
30/05/21	1826.3973
31/05/21	1826.4528
01/06/21	1826.5160
02/06/21	1826.5380
03/06/21	1826.5146
04/06/21	1826.4690
05/06/21	1826.4351
06/06/21	1826.4359
07/06/21	1826.4629
08/06/21	1826.4901
09/06/21	1826.4994
10/06/21	1826.4881
11/06/21	1826.4673
12/06/21	1826.4541
13/06/21	1826.4566
14/06/21	1826.4693
15/06/21	1826.4815
16/06/21	1826.4852
17/06/21	1826.4793
18/06/21	1826.4700
19/06/21	1826.4649
20/06/21	1826.4665
21/06/21	1826.4724
22/06/21	1826.4777
23/06/21	1826.4789
24/06/21	1826.4758
25/06/21	1826.4717
26/06/21	1826.4696
27/06/21	1826.4705
28/06/21	1826.4732
29/06/21	1826.4755
30/06/21	1826.4757
01/07/21	1826.4742
02/07/21	1826.4724
03/07/21	1826.4716
04/07/21	1826.4721

05/07/21	1826.4733
06/07/21	1826.4743
07/07/21	1826.4743
08/07/21	1826.4736
09/07/21	1826.4728
10/07/21	1826.4725
11/07/21	1826.4728
12/07/21	1826.4733
13/07/21	1826.4737
14/07/21	1826.4737
15/07/21	1826.4734
16/07/21	1826.4730
17/07/21	1826.4729
18/07/21	1826.4730
19/07/21	1826.4733
20/07/21	1826.4735
21/07/21	1826.4734
22/07/21	1826.4733
23/07/21	1826.4731
24/07/21	1826.4731
25/07/21	1826.4732
26/07/21	1826.4733
27/07/21	1826.4733
28/07/21	1826.4733
29/07/21	1826.4733
30/07/21	1826.4732
31/07/21	1826.4732

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 Belarus are likely to remain significantly high, characterized by an equilibrium case volume of 1826 cases per day over the out-of-sample period.

#### IV. CONCLUSION & RECOMMENDATIONS

The outbreak of COVID-19 is a global health and economic security threat with staggering cumulative incidence worldwide (Wu *et al.*, 2020), and has apparently caused massive damage on the global economy (Bogale *et al.*, 2020) and the economy of Belarus is not an exception. The study indicates that COVID-19 cases in the country are expected to remain significantly high over the out-of-sample period. We recommend the following: people in the country should continue to avoid close contact with the sick, continue to avoid touching the eyes, nose and mouth with unwashed hands, consistent washing of hands, wearing of masks, social distancing, seeking medical advice as early as possible in case of need and so on amongst other guidelines set by the WHO. This coupled with vaccinations; will go a long way in controlling the pandemic.

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