

# Forecasting Covid-19 New Cases in South Korea

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**Abstract -** In this research article, the ANN approach was applied to forecast the future trend of COVID case volumes in South Korea. This study is based on daily new cases of COVID-19 in South Korea 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 very stable and quite acceptable in forecasting COVID-19 infections in South Korea. The study suggests that the number of daily new COVID-19 cases is likely to follow a downwards trend over the out-of sample period. The South Korean government is encouraged to continue enforcing WHO guidelines on the prevention and control of the pandemic, including vaccinations and also people in the country are advised to continue behaving in a responsible manner with regards to face-mask wearing and following all sanitary rules put forward by WHO.

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

## I. INTRODUCTION

COVID-19; believed to have been contracted from wild animals; was initially identified in the Wuhan city of China (Paules *et al.*, 2020). This disease has affected millions upon millions of people worldwide. The World Health Organization (WHO) declared it as a pandemic on March 11 (WHO, 2020). Causing a respiratory illness, COVID-19 has a number of symptoms but the most common ones include fever and cough (BioGaia, 2020). COVID-19 has surprised the whole world due to the fact that it is highly contagious (Fong *et al.*, 2020). The fatality rate is higher among the elderly, particularly those aged above 60 years (WHO, 2020). In order to prevent the pandemic from worsening in South Korea, we attempt to model and forecast the disease progression using Artificial Neural Networks (ANNs). The outcome of the study will be used for planning ahead and strengthening existing COVID-19 control and prevention strategies.

## 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 South Korea.

### Data Issues

This study is based on daily new cases of COVID-19 in South Korea 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	SK
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	0.097836
MSE	4520.576722
MAE	43.966491

*Residual Analysis for the Applied Model*

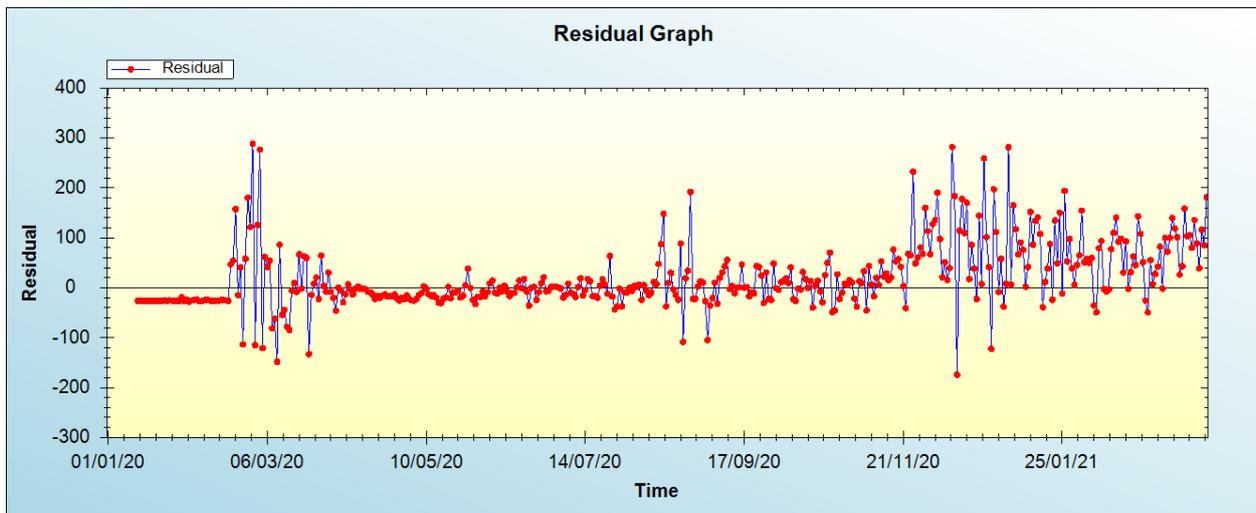


Figure 1: Residual analysis

*In-sample Forecast for SK*

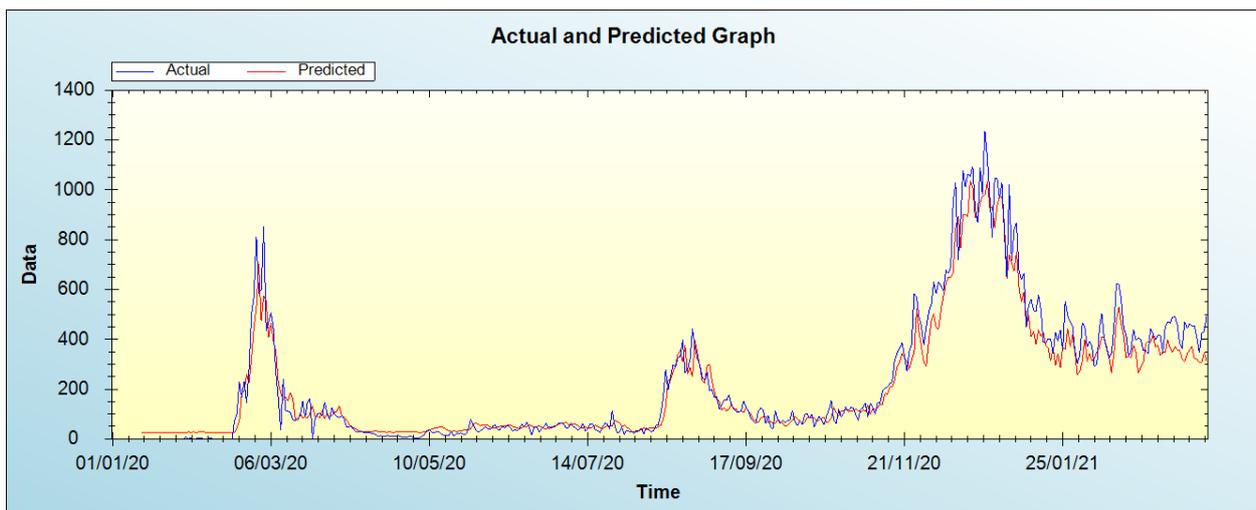


Figure 2: In-sample forecast for the SK series

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

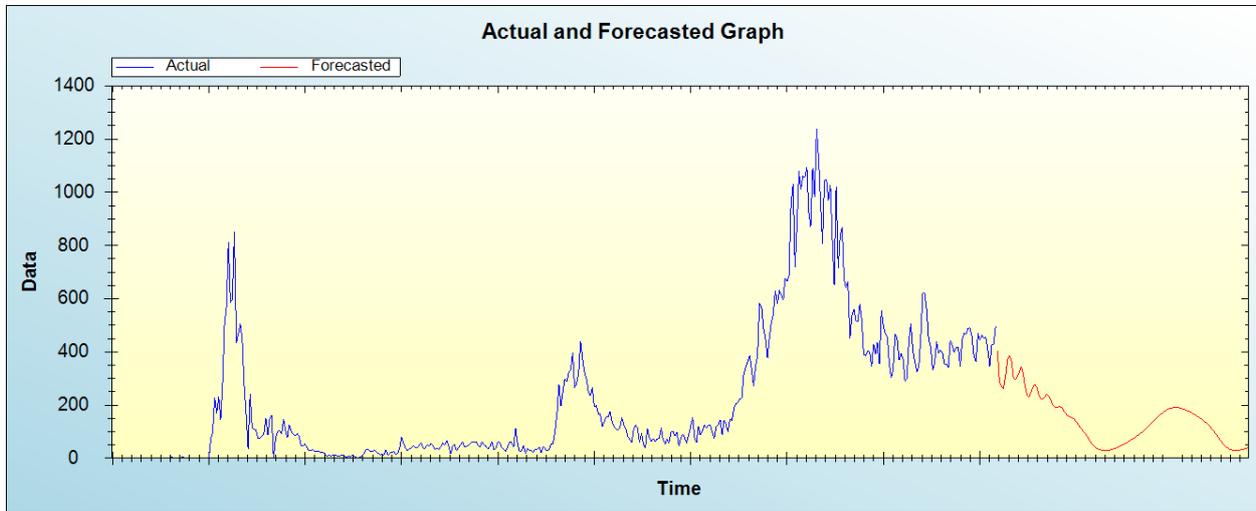


Figure 3: Out-of-sample forecast for SK: actual and forecasted graph

Out-of-Sample Forecast for SK: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Date	Forecasts
26/03/21	402.4238
27/03/21	286.6407
28/03/21	269.6990
29/03/21	262.6530
30/03/21	305.9004
31/03/21	370.7257
01/04/21	386.4316
02/04/21	370.0107
03/04/21	306.8410
04/04/21	294.2655
05/04/21	305.3727
06/04/21	322.9689
07/04/21	344.9862
08/04/21	319.4939
09/04/21	270.8042
10/04/21	236.9302
11/04/21	228.1778
12/04/21	248.0711
13/04/21	266.8834
14/04/21	277.7612
15/04/21	265.6834
16/04/21	238.9204
17/04/21	223.1727
18/04/21	221.1273
19/04/21	230.4999
20/04/21	239.2594
21/04/21	234.5373
22/04/21	220.1085
23/04/21	202.5270
24/04/21	192.4651
25/04/21	191.2380
26/04/21	193.8334
27/04/21	194.4746
28/04/21	187.7675
29/04/21	176.4799

30/04/21	165.6805
01/05/21	158.1676
02/05/21	154.6580
03/05/21	152.0212
04/05/21	147.2866
05/05/21	139.0867
06/05/21	128.4831
07/05/21	117.6422
08/05/21	107.5993
09/05/21	98.3653
10/05/21	88.7854
11/05/21	77.8668
12/05/21	66.0361
13/05/21	54.7688
14/05/21	45.6604
15/05/21	39.2257
16/05/21	34.9673
17/05/21	32.1144
18/05/21	30.1400
19/05/21	28.9344
20/05/21	28.5923
21/05/21	29.1900
22/05/21	30.6591
23/05/21	32.8011
24/05/21	35.3960
25/05/21	38.2720
26/05/21	41.3619
27/05/21	44.6881
28/05/21	48.2896
29/05/21	52.1691
30/05/21	56.2788
31/05/21	60.5518
01/06/21	64.9466
02/06/21	69.4687
03/06/21	74.1629
04/06/21	79.0839
05/06/21	84.2735
06/06/21	89.7513
07/06/21	95.5234
08/06/21	101.5988
09/06/21	107.9957
10/06/21	114.7307
11/06/21	121.7983
12/06/21	129.1496
13/06/21	136.6861
14/06/21	144.2689
15/06/21	151.7386
16/06/21	158.9332
17/06/21	165.6985
18/06/21	171.8884
19/06/21	177.3653
20/06/21	182.0052
21/06/21	185.7105
22/06/21	188.4244
23/06/21	190.1399
24/06/21	190.8975
25/06/21	190.7729
26/06/21	189.8624
27/06/21	188.2695
28/06/21	186.0970
29/06/21	183.4412
30/06/21	180.3863
01/07/21	176.9998
02/07/21	173.3280

03/07/21	169.3963
04/07/21	165.2119
05/07/21	160.7688
06/07/21	156.0498
07/07/21	151.0265
08/07/21	145.6574
09/07/21	139.8846
10/07/21	133.6331
11/07/21	126.8126
12/07/21	119.3240
13/07/21	111.0736
14/07/21	102.0029
15/07/21	92.1399
16/07/21	81.6722
17/07/21	71.0127
18/07/21	60.7880
19/07/21	51.6844
20/07/21	44.2012
21/07/21	38.4941
22/07/21	34.4202
23/07/21	31.7045
24/07/21	30.0887
25/07/21	29.3975
26/07/21	29.5288
27/07/21	30.4084
28/07/21	31.9511
29/07/21	34.0506
30/07/21	36.5916
31/07/21	39.4728

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 South Korea are likely to continue to follow a downwards trajectory over the out-of-sample period.

#### IV. CONCLUSION & RECOMMENDATIONS

At the moment, COVID-19 is the most frightening outbreak in the globe. We are all afraid of catching the virus. However, as a matter of fact, a significantly high number of infected patients have already recovered from this disease and several people around the world are beginning to realize that the pandemic is not a death sentence. Even in South Korea, during the onset of the pandemic, everyone was extremely afraid of the disease because the virus was not yet well understood, scientifically. Nowadays, South Koreans have adjusted to the new normal and this could lead to positive changes in terms of controlling the spread of COVID-19 in the country. In this study, an ANN model is employed to model and forecast COVID-19 daily cases in South Korea. The model revealed that the number of daily new COVID-19 cases is likely to follow a downwards trend over the out-of sample period. The government is encouraged to continue enforcing WHO guidelines on the prevention and control of the pandemic, including up-scaling vaccine uptake. Furthermore, people in the country are advised to continue behaving in a responsible manner with regards to face-mask wearing and following all sanitary rules postulated by WHO.

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