

Forecasting Covid-19 New Cases in Cyprus

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Abstract - In this research article, the ANN approach was applied to forecast the future trend of COVID case volumes in Cyprus. This study is based on monthly new cases of COVID-19 in Cyprus 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 Cyprus. 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 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 Cyprus, 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 Cyprus.

Data Issues

This study is based on daily new cases of COVID-19 in Cyprus for the period 1 January 2020 – 25 March 2021. The out-of-sample forecast covers the period 26 March 2021 – 30 September 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	C
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	0.120329
MSE	3815.422021
MAE	34.623052

Residual Analysis for the Applied Model

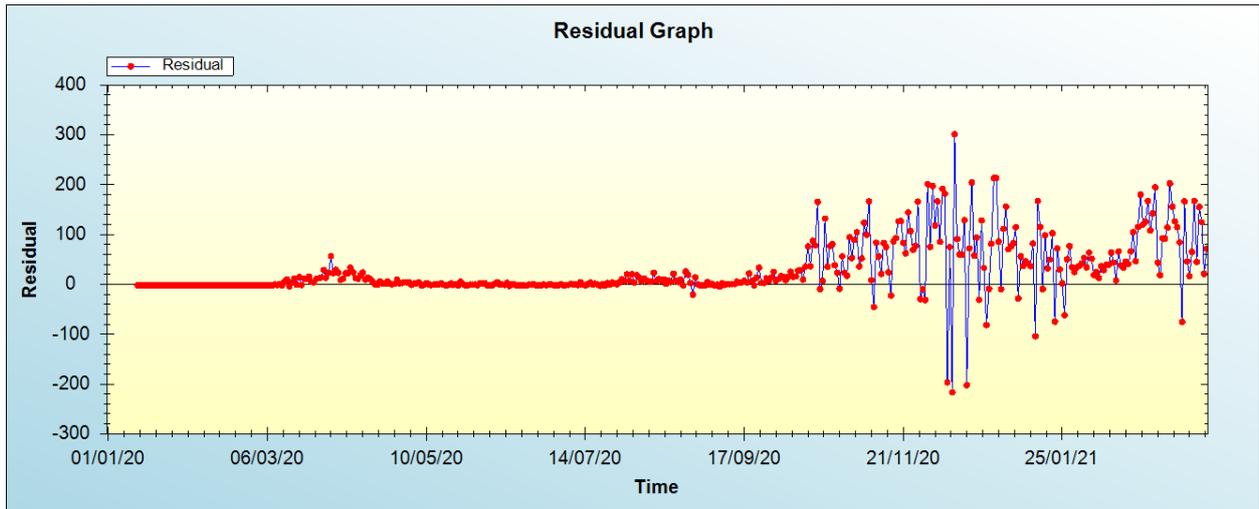


Figure 1: Residual analysis

In-sample Forecast for C

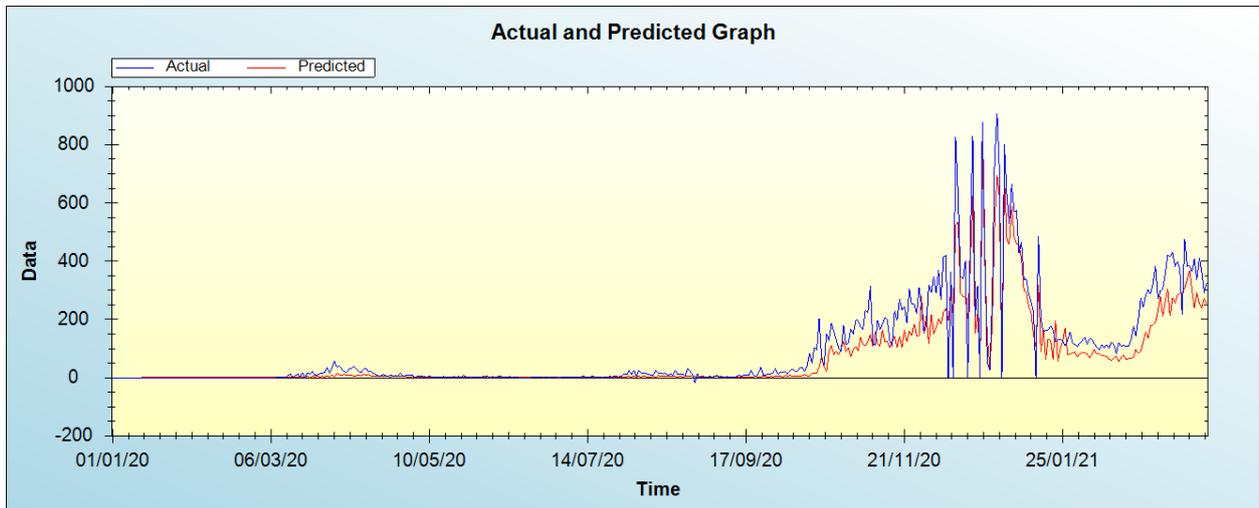


Figure 2: In-sample forecast for the C series

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

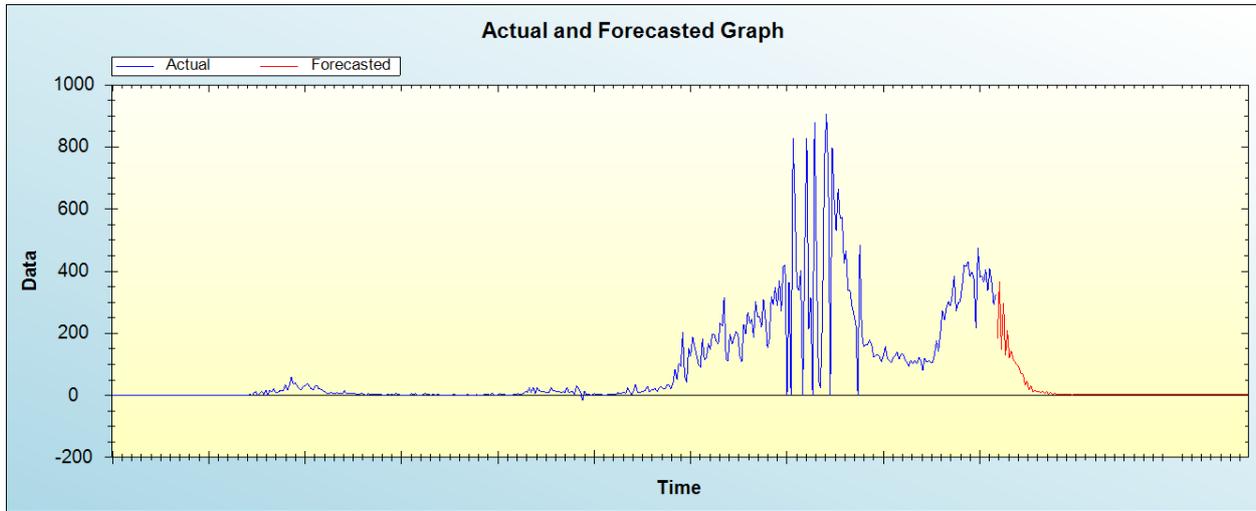


Figure 3: Out-of-sample forecast for C: actual and forecasted graph

Out-of-Sample Forecast for C: Forecasts only

Table 3: Tabulated out-of-sample forecasts

Day/Month/Year	Forecasts
26/03/21	184.2509
27/03/21	364.6751
28/03/21	148.4403
29/03/21	297.3141
30/03/21	128.6097
31/03/21	208.0200
01/04/21	119.3160
02/04/21	144.0273
03/04/21	116.2996
04/04/21	106.0680
05/04/21	99.3676
06/04/21	86.9667
07/04/21	70.1677
08/04/21	68.2585
09/04/21	33.1365
10/04/21	46.9317
11/04/21	17.7287
12/04/21	30.8877
13/04/21	11.0542
14/04/21	17.4207
15/04/21	10.5629
16/04/21	12.5717
17/04/21	10.1616
18/04/21	12.8484
19/04/21	6.9402
20/04/21	12.0799
21/04/21	3.0911
22/04/21	9.6692
23/04/21	1.8778
24/04/21	7.0008
25/04/21	1.7721
26/04/21	4.6866
27/04/21	2.0555
28/04/21	4.0941
29/04/21	2.1779
30/04/21	4.4801
01/05/21	1.8714

02/05/21	4.5579
03/05/21	1.5727
04/05/21	4.1888
05/05/21	1.6671
06/05/21	3.6309
07/05/21	1.8406
08/05/21	3.1637
09/05/21	1.9479
10/05/21	3.0504
11/05/21	1.9892
12/05/21	3.1211
13/05/21	1.9824
14/05/21	3.1226
15/05/21	2.0129
16/05/21	3.0254
17/05/21	2.1067
18/05/21	2.8872
19/05/21	2.1852
20/05/21	2.7787
21/05/21	2.2240
22/05/21	2.7431
23/05/21	2.2425
24/05/21	2.7408
25/05/21	2.2589
26/05/21	2.7237
27/05/21	2.2891
28/05/21	2.6883
29/05/21	2.3283
30/05/21	2.6484
31/05/21	2.3576
01/06/21	2.6187
02/06/21	2.3735
03/06/21	2.6042
04/06/21	2.3839
05/06/21	2.5956
06/06/21	2.3947
07/06/21	2.5841
08/06/21	2.4089
09/06/21	2.5702
10/06/21	2.4235
11/06/21	2.5570
12/06/21	2.4343
13/06/21	2.5472
14/06/21	2.4413
15/06/21	2.5408
16/06/21	2.4467
17/06/21	2.5356
18/06/21	2.4522
19/06/21	2.5300
20/06/21	2.4581
21/06/21	2.5244
22/06/21	2.4635
23/06/21	2.5196
24/06/21	2.4677
25/06/21	2.5159
26/06/21	2.4708
27/06/21	2.5130
28/06/21	2.4734
29/06/21	2.5105
30/06/21	2.4759
01/07/21	2.5081
02/07/21	2.4783
03/07/21	2.5058
04/07/21	2.4804

05/07/21	2.5040
06/07/21	2.4821
07/07/21	2.5025
08/07/21	2.4834
09/07/21	2.5012
10/07/21	2.4846
11/07/21	2.5001
12/07/21	2.4857
13/07/21	2.4991
14/07/21	2.4866
15/07/21	2.4982
16/07/21	2.4875
17/07/21	2.4974
18/07/21	2.4882
19/07/21	2.4968
20/07/21	2.4887
21/07/21	2.4962
22/07/21	2.4893
23/07/21	2.4957
24/07/21	2.4897
25/07/21	2.4953
26/07/21	2.4901
27/07/21	2.4949
28/07/21	2.4905
29/07/21	2.4946
30/07/21	2.4907
31/07/21	2.4944

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 Cyprus are likely to follow a generally steep downwards trajectory over the out-of-sample period.

IV. CONCLUSION & RECOMMENDATIONS

At the moment, COVID-19 is the most frightening outbreak in the world. Everyone is 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. In this study, an ANN model is employed to model and forecast COVID-19 daily cases in Cyprus. 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 of Cyprus 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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