Forecasting Covid-19 New Cases in Sri Lanka

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Abstract - **COVID-19 is indeed a serious worldwide public health emergency. In this research paper, the ANN approach was applied to analyze COVID-19 cases in Sri Lanka. This study is based on monthly new cases of COVID-19 in Sri Lanka 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 Sri Lanka. The results of the study indicate that the COVID-19 pandemic may disappear in the country around mid-April 2021. The government, through the ministry of health, should continue to implement COVID-19 control and prevention measures such as isolation, quarantine, testing and tracing, face-mask wearing, sanitization of hands, including vaccinations, amongst other measures in line with WHO guidelines.**

Keywords: ANN, COVID-19, Forecasting.

I. INTRODUCTION

COVID-19 initially came to attention in a series of patients with pneumonia of unknown etiology in Wuhan city in China (Huang et al., 2020). Coronaviruses are single-stranded, positive-sense RNA viruses belonging to the Coronaviridae family (Chen et al., 2020). COVID-19 is transferable from human to human and it's spreading, and infection factors are very high (Jin et al., 2020). It is characterized by respiratory symptoms, which deteriorate into respiratory failure in substantial proportion of cases, requiring intensive care up to a third of patients admitted to hospital (Carsana et al., 2020). The main aim of this study is to use Artificial Neural Networks (ANNs) to explore the transmission dynamics, forecasting and control of COVID-19 in Sri Lanka.

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 Sri Lanka.

Data Issues

This study is based on daily new cases of COVID-19 in Sri Lanka 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	SL
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	0.120709
MSE	4283.849143
MAE	36.518034

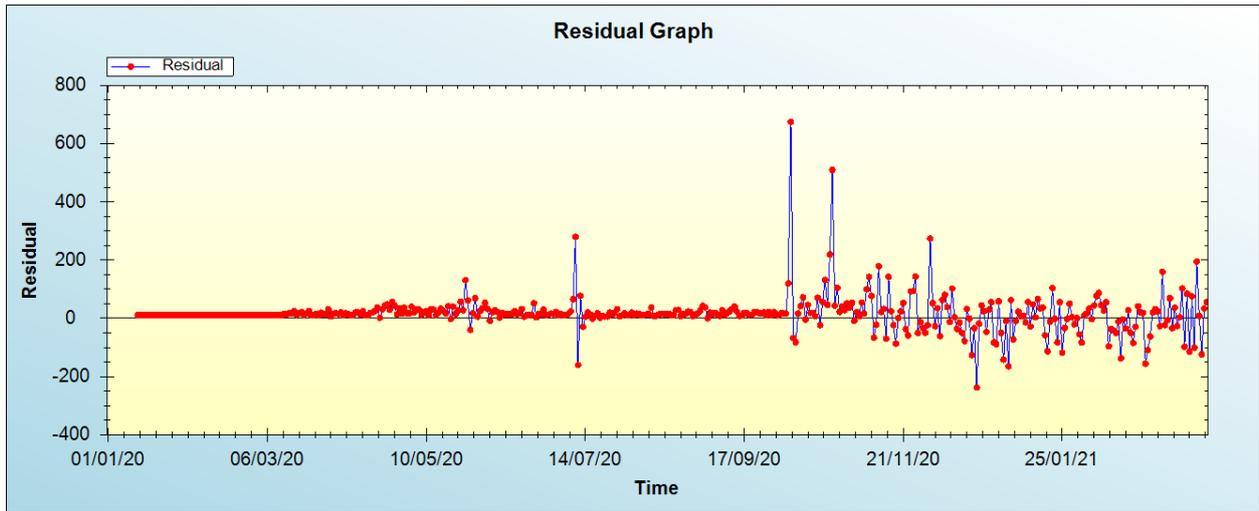*Residual Analysis for the Applied Model*

Figure 1: Residual analysis
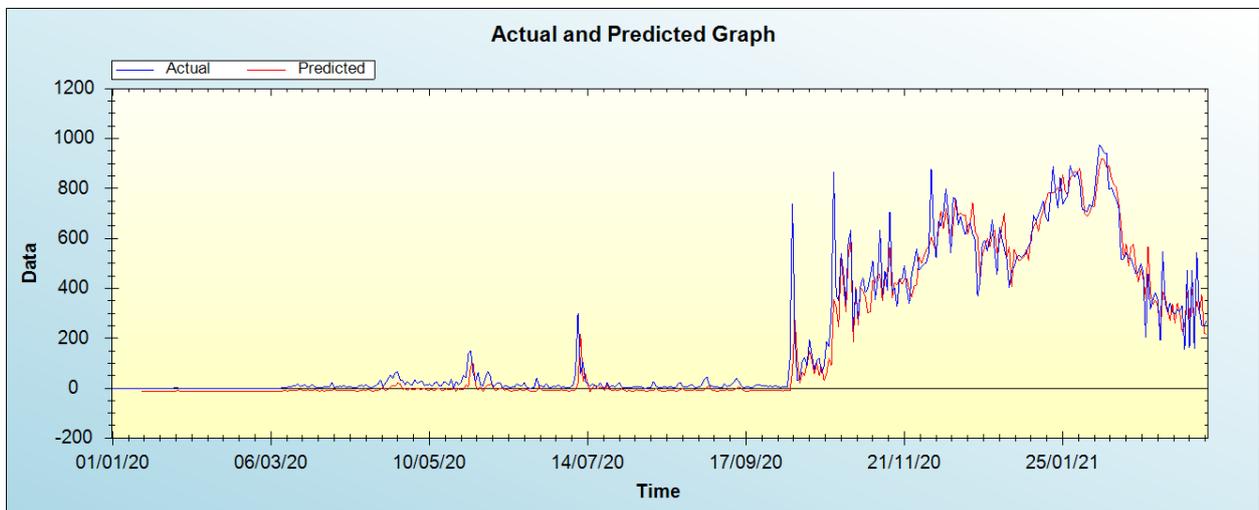
In-sample Forecast for SL

Figure 2: In-sample forecast for the SL series

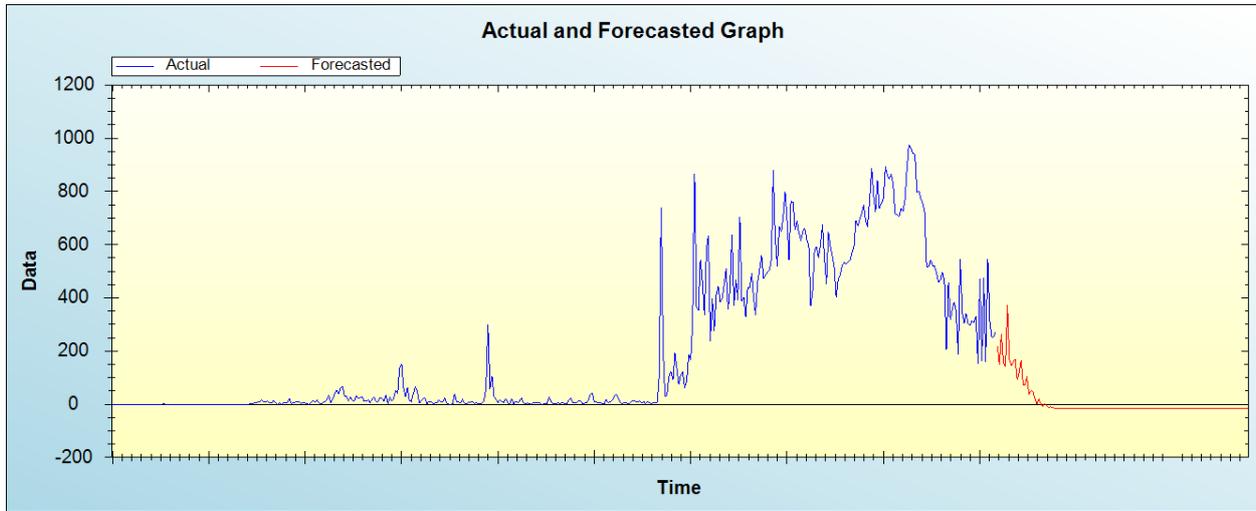*Out-of-Sample Forecast for SL: Actual and Forecasted Graph*

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

Out-of-Sample Forecast for SL: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Date	Forecasts
26/03/21	218.3923
27/03/21	149.1424
28/03/21	263.5277
29/03/21	155.3069
30/03/21	141.2451
31/03/21	371.4162
01/04/21	170.5563
02/04/21	143.8242
03/04/21	160.0180
04/04/21	170.9680
05/04/21	91.6514
06/04/21	119.9960
07/04/21	164.4585
08/04/21	73.6001
09/04/21	72.5383
10/04/21	103.1496
11/04/21	36.8688
12/04/21	50.3051
13/04/21	49.0291
14/04/21	21.3033
15/04/21	0.6304
16/04/21	19.6511
17/04/21	3.5074
18/04/21	-9.0230
19/04/21	3.9374
20/04/21	-5.7018
21/04/21	-13.2075
22/04/21	-9.8180
23/04/21	-12.4940
24/04/21	-14.9629
25/04/21	-14.8047
26/04/21	-13.8889
27/04/21	-15.5824
28/04/21	-15.4725
29/04/21	-15.0730
30/04/21	-15.6012
01/05/21	-15.4496

02/05/21	-15.2668	
03/05/21	-15.3402	
04/05/21	-15.3331	
05/05/21	-15.3001	
06/05/21	-15.2990	
07/05/21	-15.3411	
08/05/21	-15.2993	
09/05/21	-15.2989	
10/05/21	-15.3109	
11/05/21	-15.3015	
12/05/21	-15.3061	
13/05/21	-15.3118	
14/05/21	-15.3116	
15/05/21	-15.3103	
16/05/21	-15.3102	
17/05/21	-15.3104	
18/05/21	-15.3091	
19/05/21	-15.3103	
20/05/21	-15.3105	
21/05/21	-15.3102	
22/05/21	-15.3103	
23/05/21	-15.3101	
24/05/21	-15.3100	
25/05/21	-15.3100	
26/05/21	-15.3101	
27/05/21	-15.3101	
28/05/21	-15.3101	
29/05/21	-15.3101	
30/05/21	-15.3101	
31/05/21	-15.3101	
01/06/21	-15.3101	
02/06/21	-15.3101	
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25/07/21	-15.3101
26/07/21	-15.3101
27/07/21	-15.3101
28/07/21	-15.3101
29/07/21	-15.3101
30/07/21	-15.3101
31/07/21	-15.3101

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 the COVID-19 pandemic may disappear in the country around mid-April 2021.

IV. CONCLUSION & RECOMMENDATIONS

In this research, we attempt to model and forecast COVID-19 daily cases in Sri Lanka. We applied the basic ANN (12, 12, 1) model and found out that the COVID-19 pandemic may disappear in the country around mid-April 2021. The government, through the ministry of health, should continue to implement COVID-19 control and prevention measures such as isolation, quarantine, testing and tracing, face-mask wearing, sanitization of hands., including vaccinations, amongst other measures in line with WHO guidelines.

REFERENCES

[1] Carsana, L., et al. (2020). Pulmonary Post-mortem Findings in a Series of COVID-19 Cases From Northern Italy: A Two-Centre Descriptive Study, Lancet Infectious Diseases, 20: 1135 – 1140.

[2] Chen, Y., Liu, Q., & Guo, D. (2020). Emerging Coronaviruses: Genome Structure, Replication, and Pathogenesis, Journal of Medical Virology, 92 (4): 418 – 423.

[3] Huang, C., et al. (2020). Clinical Features of Patients Infected With 2019 Novel Coronavirus in Wuhan, China, The Lancet, 395 (10223): 497 – 506.

[4] Jin, Y., et al. (2020). Virology, Epidemiology, Pathogenesis and Control of COVID-19, Viruses, 12 (4): 372 – 381.

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