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Forecasting Covid-19 New Cases in Singapore

[1]Dr. Smartson. P. NYONI, [2]Mr. Thabani NYONI, [3]Mr. Tatenda. A. CHIHOHO

[1]ZICHIRe Project, University of Zimbabwe, Harare, Zimbabwe
[2]SAGIT Innovation Center, Harare, Zimbabwe
[3]Independent Health Economist, Harare, Zimbabwe

***Abstract* - The worldwide spread of COVID-19 has triggered a range of public health responses, including the need for modeling and forecasting the transmission dynamics of the pandemic. The ANN approach was applied to analyze COVID-19 cases in Singapore. This study is based on daily new cases of COVID-19 in Singapore 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 suggest that the model is stable in forecasting daily COVID-19 cases in Singapore. It is projected that daily COVID-19 cases in Singapore are likely to decline to nil over the out-of-sample period. To ensure total public health safety, the government of Singapore should continue to ensure vaccine uptake as well as strict adherence to WHO sanitary rules and guidelines.**

Keywords: ANN, COVID-19, Forecasting.

I. INTRODUCTION

COVID-19 originated from China, specifically from the city of Wuhan, in late 2019. On March 11, 2020; the World Health Organization (WHO) declared it as a pandemic (WHO, 2020). The 1st case of COVID-19 in Singapore was confirmed on 23 January 2020 in Sentosa, Southern Islands. Just like in other countries, early cases were primarily imported until local transmission began to develop. Given the magnitude of destruction caused by the pandemic in the country, there is need for more studies in order to improve policy formulation in Singapore. In an attempt to predict how COVID-19 will spread in Singapore and to influence public health interventions in the country to achieve the greatest impact, the current study will model and forecast daily COVID-19 case volumes in Singapore.

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 Singapore.

Data Issues

This study is based on daily new cases of COVID-19 in Singapore 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	S
Observations	438 (After Adjusting Endpoints)
Neural Network Architecture:	
Input Layer Neurons	12
Hidden Layer Neurons	12
Output Layer Neurons	1

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Activation Function	Hyperbolic Tangent Function
Back Propagation Learning:	
Learning Rate	0.005
Momentum	0.05
Criteria:	
Error	0.084052
MSE	4433.917327
MAE	38.637347

Residual Analysis for the Applied Model

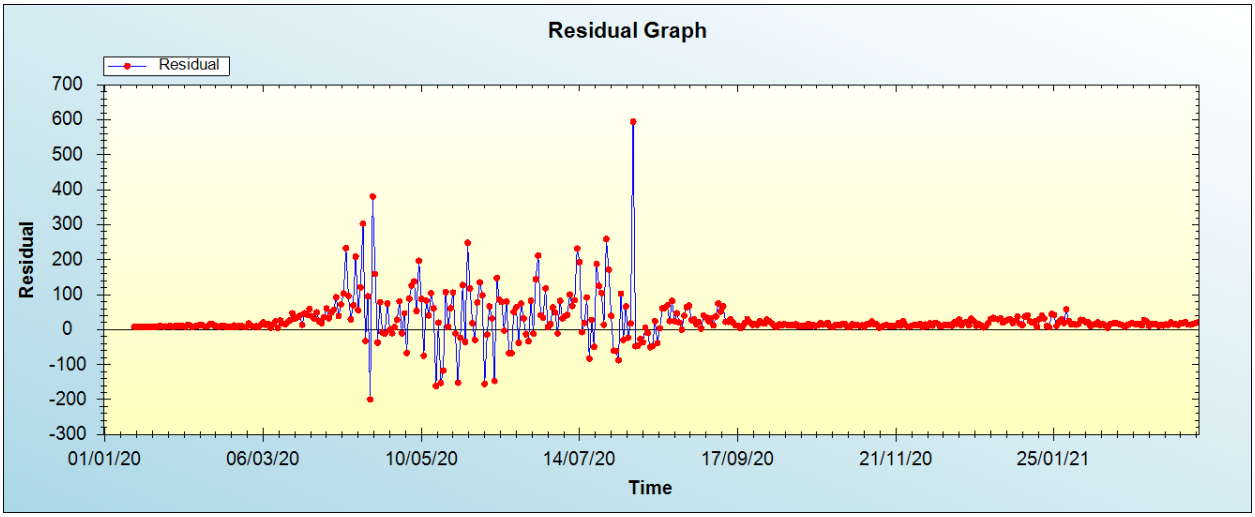

Figure 1: Residual analysis

In-sample Forecast for S

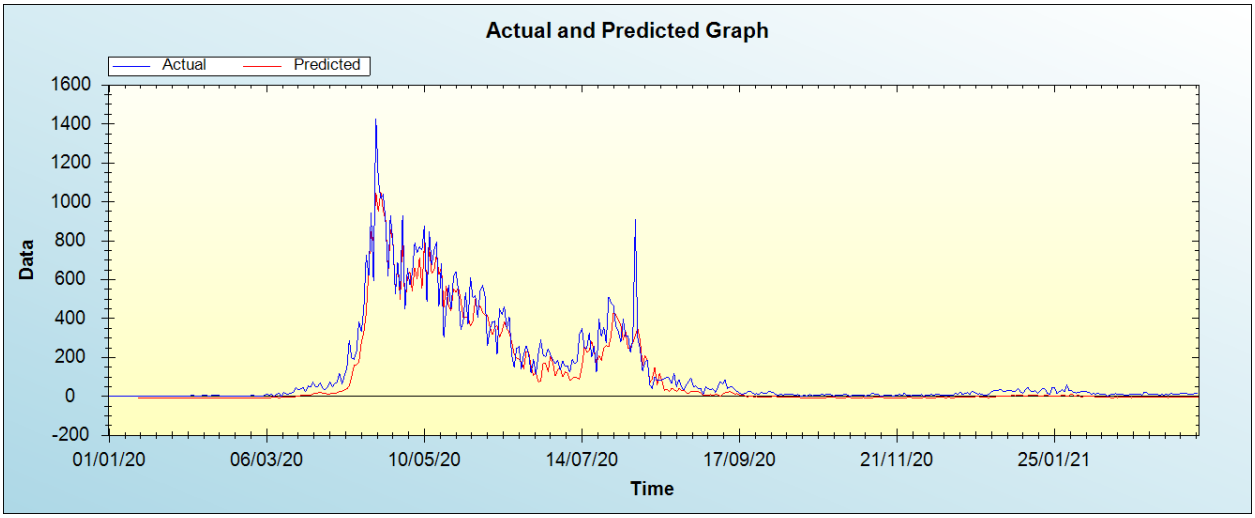

Figure 2: In-sample forecast for the S series

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

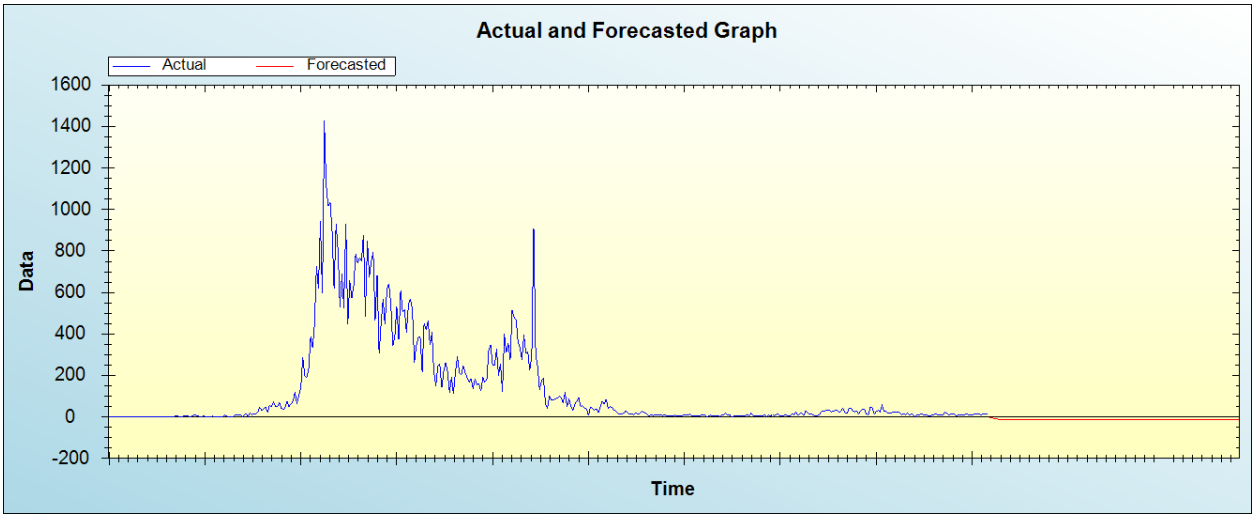

Figure 3: Out-of-sample forecast for S: actual and forecasted graph

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 Singapore are likely to decline to nil over the out-of-sample period.

IV. CONCLUSION & RECOMMENDATIONS

The COVID-19 scourge continues to rapidly spread across the globe with high mortality, severely straining health systems and causing devastating social disruptions and economic damage. Just like any other countries with a fragile healthcare system, Singapore has already suffered significantly to the pandemic. The study projects that the pandemic will soon disappear in Singapore by the tail end of July 2021. To ensure total public health safety, the government of Singapore should continue to engage in vaccination programmes across the country and also ensure strict adherence to WHO sanitary rules and guidelines.

REFERENCES

[1] WHO (2020). Situation Report, WHO, Geneva.

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