

# Forecasting Covid-19 New Cases in Saint Lucia

<sup>1</sup>Dr. Smartson. P. NYONI, <sup>2</sup>Mr. Thabani NYONI, <sup>3</sup>Mr. Tatenda. A. CHIHOHO

<sup>1</sup>ZICHIRE Project, University of Zimbabwe, Harare, Zimbabwe

<sup>2</sup>SAGIT Innovation Center, Harare, Zimbabwe

<sup>3</sup>Independent Health Economist, Harare, Zimbabwe

**Abstract - Circulating globally, the ongoing COVID-19 pandemic continues to cause devastating mortality and is indeed a great threat to global public health. In this research paper, the ANN model was applied to analyze daily COVID-19 cases in Saint Lucia. This study is based on daily new cases of COVID-19 in Saint Lucia 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 model reveal that the model is quite stable. The results of the study reveal that daily COVID-19 cases in Saint Lucia are likely to surge significantly until they reach an equilibrium case volume of approximately 408 cases per day over the out-of-sample period. The relevant authorities should ensure the continued compliance to control and preventive COVID-19 measures such as social distancing, quarantine, isolation, face-mask wearing and so on, alongside vaccinations.**

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

## I. INTRODUCTION

COVID-19 started in Wuhan, China, and has extensively spread all over the world since January 2020 (WHO, 2020). The specific symptoms of COVID-19 are fever (98%) and cough (76%) in addition to other non-specific symptoms such as fatigue (44%), headache (8%) and dyspnea (3%) (Wang *et al.*, 2020). Humans can acquire COVID-19 when they come into contact contaminated surfaces or form droplets released by infectious symptomatic and asymptomatic individuals (Bai *et al.*, 2020). Understanding current patterns of COVID-19 and forecasting its trajectory is essential in guiding policies aimed at curtailing the pandemic (Taboe *et al.*, 2020). In order to help the government of Saint Lucia in controlling the pandemic, this research seeks to model and forecast daily confirmed COVID-19 cases in the country.

## 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 Saint Lucia.

### Data Issues

This study is based on daily new cases of COVID-19 in Saint Lucia 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                      | 0.070791                    |
| MSE                        | 234.052295                  |
| MAE                        | 10.862403                   |

*Residual Analysis for the Applied Model*

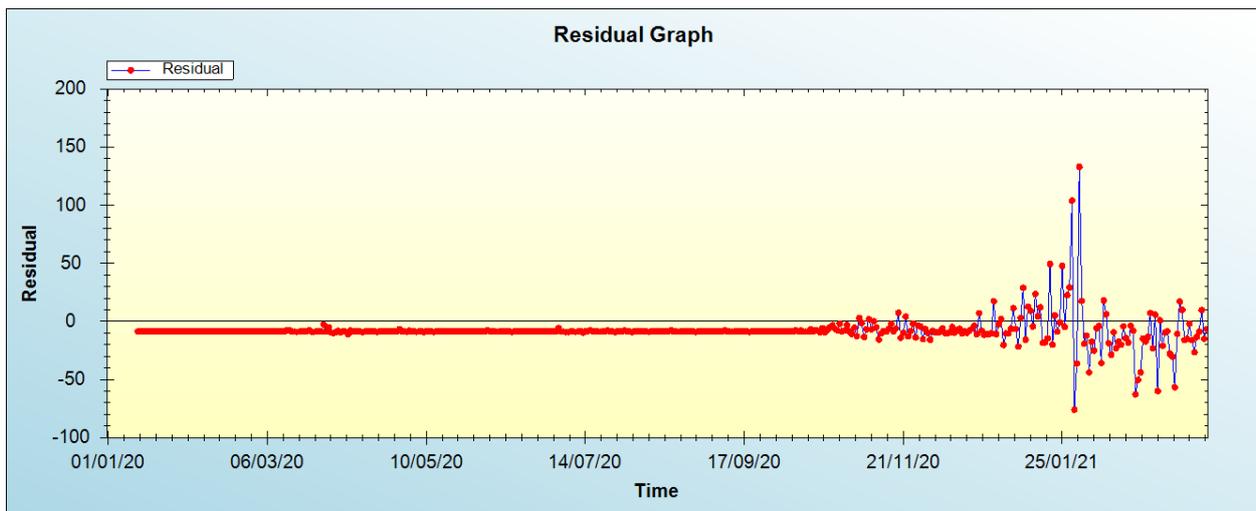


Figure 1: Residual analysis

*In-sample Forecast for SL*

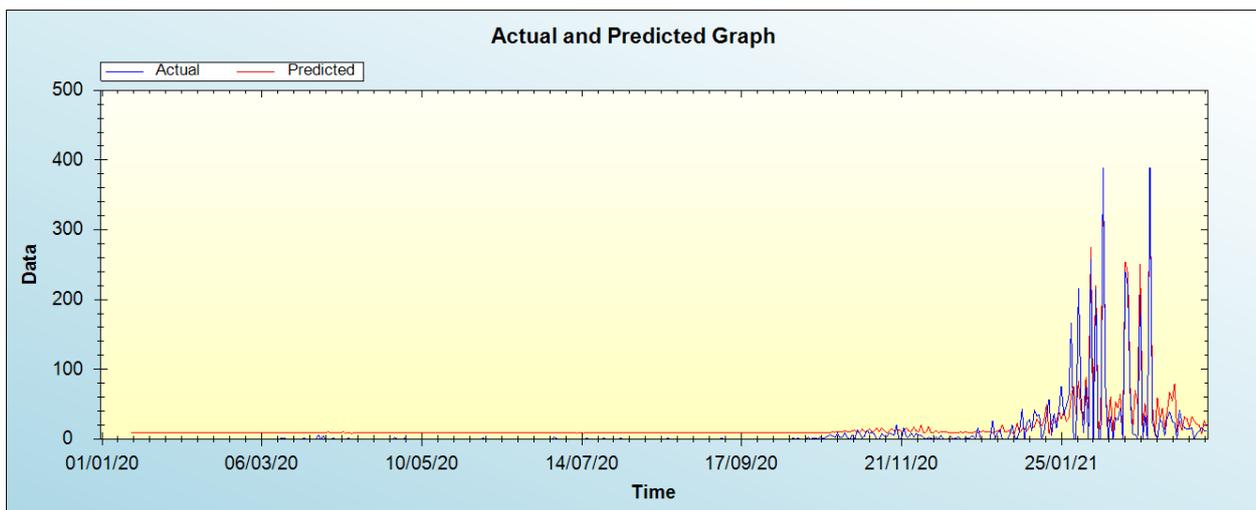


Figure 2: In-sample forecast for the SL series

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

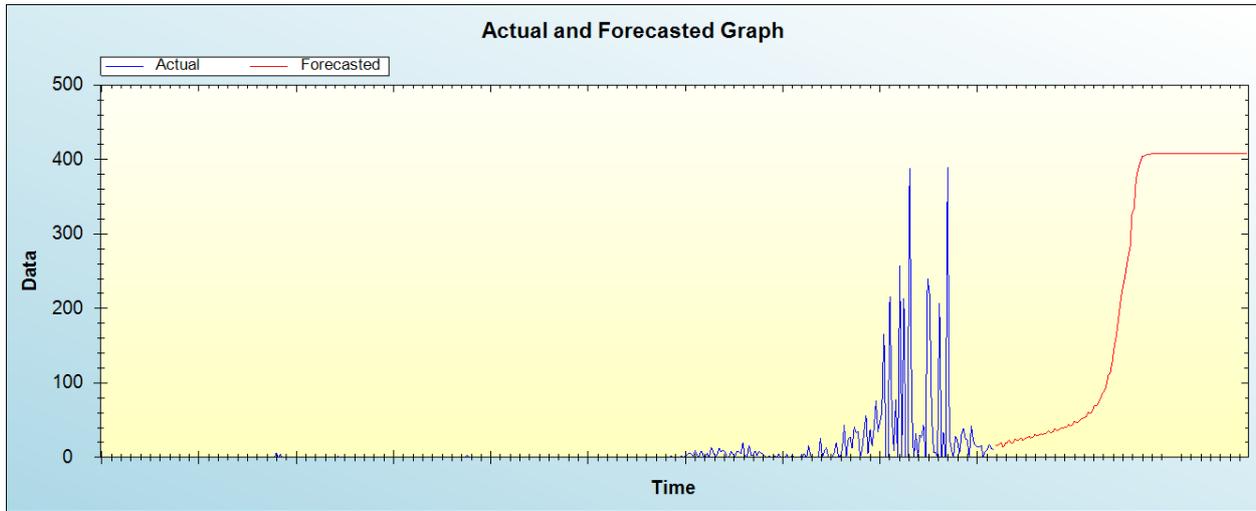


Figure 3: Out-of-sample forecast for SL: actual and forecasted graph

Out-of-Sample Forecast for SL: Forecasts only

Table 2: Tabulated out-of-sample forecasts

| Date     | Forecasts |
|----------|-----------|
| 26/03/21 | 16.2848   |
| 27/03/21 | 16.0079   |
| 28/03/21 | 17.2733   |
| 29/03/21 | 19.9849   |
| 30/03/21 | 13.4183   |
| 31/03/21 | 18.7799   |
| 01/04/21 | 19.7791   |
| 02/04/21 | 23.0507   |
| 03/04/21 | 19.3950   |
| 04/04/21 | 19.8510   |
| 05/04/21 | 24.4326   |
| 06/04/21 | 22.5824   |
| 07/04/21 | 23.5161   |
| 08/04/21 | 25.8461   |
| 09/04/21 | 22.5464   |
| 10/04/21 | 25.8624   |
| 11/04/21 | 26.2851   |
| 12/04/21 | 28.8187   |
| 13/04/21 | 25.9652   |
| 14/04/21 | 26.9414   |
| 15/04/21 | 31.0738   |
| 16/04/21 | 28.7521   |
| 17/04/21 | 29.6770   |
| 18/04/21 | 31.9152   |
| 19/04/21 | 30.3281   |
| 20/04/21 | 32.3120   |
| 21/04/21 | 32.7317   |
| 22/04/21 | 35.3613   |
| 23/04/21 | 32.9207   |
| 24/04/21 | 34.1760   |
| 25/04/21 | 38.2462   |
| 26/04/21 | 35.9500   |
| 27/04/21 | 36.9788   |
| 28/04/21 | 39.4034   |
| 29/04/21 | 39.0865   |
| 30/04/21 | 40.2495   |
| 01/05/21 | 40.9995   |

|          |          |
|----------|----------|
| 02/05/21 | 44.3634  |
| 03/05/21 | 42.1715  |
| 04/05/21 | 43.8408  |
| 05/05/21 | 48.4871  |
| 06/05/21 | 46.6493  |
| 07/05/21 | 48.0519  |
| 08/05/21 | 51.2169  |
| 09/05/21 | 52.5815  |
| 10/05/21 | 53.5343  |
| 11/05/21 | 55.2847  |
| 12/05/21 | 60.7088  |
| 13/05/21 | 59.1477  |
| 14/05/21 | 62.2815  |
| 15/05/21 | 69.2825  |
| 16/05/21 | 69.3833  |
| 17/05/21 | 72.7685  |
| 18/05/21 | 79.0116  |
| 19/05/21 | 85.4035  |
| 20/05/21 | 88.9390  |
| 21/05/21 | 95.9853  |
| 22/05/21 | 110.1242 |
| 23/05/21 | 114.4022 |
| 24/05/21 | 128.6215 |
| 25/05/21 | 148.6762 |
| 26/05/21 | 163.0954 |
| 27/05/21 | 183.2519 |
| 28/05/21 | 205.0386 |
| 29/05/21 | 224.7697 |
| 30/05/21 | 235.8303 |
| 31/05/21 | 253.3937 |
| 01/06/21 | 269.2601 |
| 02/06/21 | 283.0174 |
| 03/06/21 | 329.1674 |
| 04/06/21 | 333.8171 |
| 05/06/21 | 373.7344 |
| 06/06/21 | 386.0624 |
| 07/06/21 | 395.9358 |
| 08/06/21 | 403.8736 |
| 09/06/21 | 404.7531 |
| 10/06/21 | 406.0063 |
| 11/06/21 | 406.5868 |
| 12/06/21 | 406.7585 |
| 13/06/21 | 407.9933 |
| 14/06/21 | 407.7873 |
| 15/06/21 | 408.3874 |
| 16/06/21 | 408.3826 |
| 17/06/21 | 408.3791 |
| 18/06/21 | 408.3809 |
| 19/06/21 | 408.3480 |
| 20/06/21 | 408.3327 |
| 21/06/21 | 408.3231 |
| 22/06/21 | 408.3188 |
| 23/06/21 | 408.3202 |
| 24/06/21 | 408.3163 |
| 25/06/21 | 408.3154 |
| 26/06/21 | 408.3156 |
| 27/06/21 | 408.3138 |
| 28/06/21 | 408.3140 |
| 29/06/21 | 408.3139 |
| 30/06/21 | 408.3139 |
| 01/07/21 | 408.3140 |
| 02/07/21 | 408.3140 |
| 03/07/21 | 408.3141 |
| 04/07/21 | 408.3141 |

|          |          |
|----------|----------|
| 05/07/21 | 408.3141 |
| 06/07/21 | 408.3141 |
| 07/07/21 | 408.3141 |
| 08/07/21 | 408.3141 |
| 09/07/21 | 408.3141 |
| 10/07/21 | 408.3141 |
| 11/07/21 | 408.3141 |
| 12/07/21 | 408.3141 |
| 13/07/21 | 408.3141 |
| 14/07/21 | 408.3141 |
| 15/07/21 | 408.3141 |
| 16/07/21 | 408.3141 |
| 17/07/21 | 408.3141 |
| 18/07/21 | 408.3141 |
| 19/07/21 | 408.3141 |
| 20/07/21 | 408.3141 |
| 21/07/21 | 408.3141 |
| 22/07/21 | 408.3141 |
| 23/07/21 | 408.3141 |
| 24/07/21 | 408.3141 |
| 25/07/21 | 408.3141 |
| 26/07/21 | 408.3141 |
| 27/07/21 | 408.3141 |
| 28/07/21 | 408.3141 |
| 29/07/21 | 408.3141 |
| 30/07/21 | 408.3141 |
| 31/07/21 | 408.3141 |

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 Saint Lucia are likely to surge significantly until they reach an equilibrium case volume of approximately 408 cases per day over the out-of-sample period.

#### IV. CONCLUSION & RECOMMENDATIONS

COVID-19 is still spreading rapidly in many countries around the globe. This study used the ANN (12, 12, 1) model to come up with forecasts ranging over the period late March 2021 to late July 2021. Given the results of the study, the country should ensure the continued compliance to control and preventive COVID-19 measures such as social distancing, quarantine, isolation, face-mask wearing and so on, including vaccinations.

#### REFERENCES

- [1] Bai, Y., et al. (2020). Presumed Asymptomatic Carrier Transmission of COVID-19, JAMA, 323 (14): 1406 – 1407.
- [2] Taboe, H. B., et al. (2020). Predicting COVID-19 Spread in the Face of Control Measures in West Africa, Mathematical Biosciences, 328: 1 – 9.
- [3] Wang, D., et al. (2020). Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-infected Pneumonia in Wuhan, China, JAMA, 323: 1061 – 1069.
- [4] WHO (2020). Novel Coronavirus (2019-nCoV) Situation Report No. 11, WHO, Geneva.

#### Citation of this Article:

Dr. Smartson. P. NYONI, Mr. Thabani NYONI, Mr. Tatenda. A. CHIHOHO, “Forecasting Covid-19 New Cases in Saint Lucia” Published in *International Research Journal of Innovations in Engineering and Technology - IRJIET*, Volume 5, Issue 6, pp 506-510, June 2021. Article DOI <https://doi.org/10.47001/IRJIET/2021.506088>

\*\*\*\*\*