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Forecasting Covid-19 New Cases in St Vincent & The Grenadines

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Abstract **- St Vincent and the Grenadines (SVG), just like other countries, has not been able to escape from the deadly pandemic. Here, the ANN approach was applied to analyze COVID-19 case volumes for all age groups in SVG. This study is based on monthly new cases of COVID-19 in St Vincent and the Grenadines 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 this model indicate that the model is quite stable. The results of the study indicate that daily COVID-19 cases will hover around an equilibrium level of about 4 cases per day. It is important for the government to note that the projected pattern in COVID-19 cases is a product of the current prevention and control measures being consistently taken. We therefore encourage the government to continue making sure that these measures are taken seriously, especially by the general public. More, importantly, there is need for vaccine uptake in the country in order to adequately save life.**

Keywords: ANN, COVID-19, Forecasting.

I. INTRODUCTION

COVID-19 originated from Wuhan, China in December 2019 and eventually spread to rest of the world (Badillo-Rivera *et al*., 2020) including St Vincent and the Grenadines (SVG). Studies related to forecasting the future trends of the pandemic are, however, scanty in SVG. In order to help the SVG government in managing the pandemic, this study attempts to model and forecast daily new 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 St Vincent and the Grenadines.

Data Issues

This study is based on daily new cases of COVID-19 in St Vincent and the Grenadines 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	SVG
Observations	438 (After Adjusting Endpoints)
Neural Network Architecture:	
Input Layer Neurons	12

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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	0.071422
MSE	39.304106
MAE	3.779488

Residual Analysis for the Applied Model

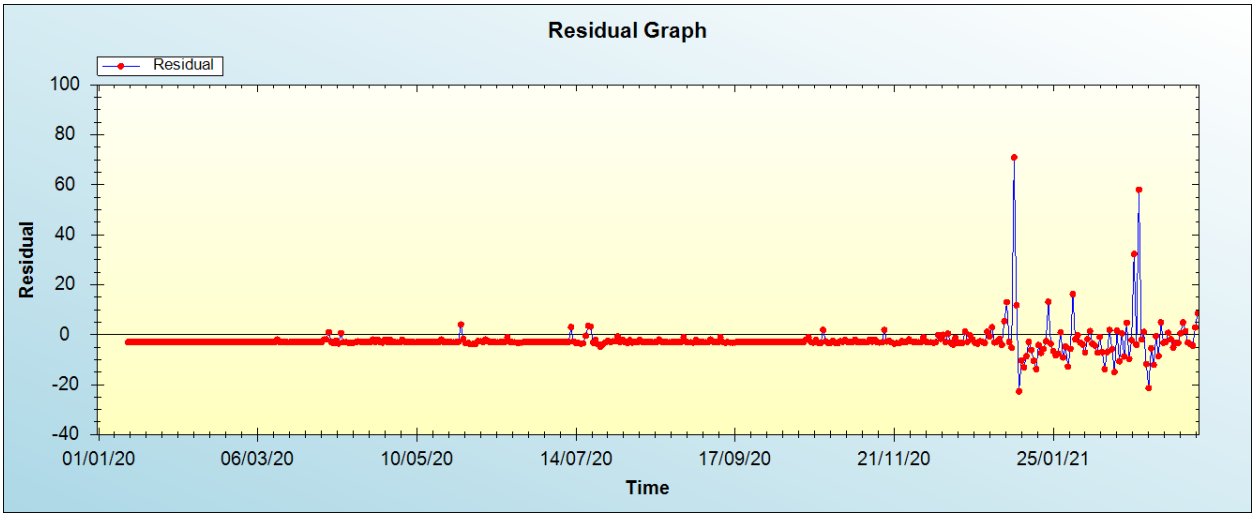

Figure 1: Residual analysis

In-sample Forecast for SVG

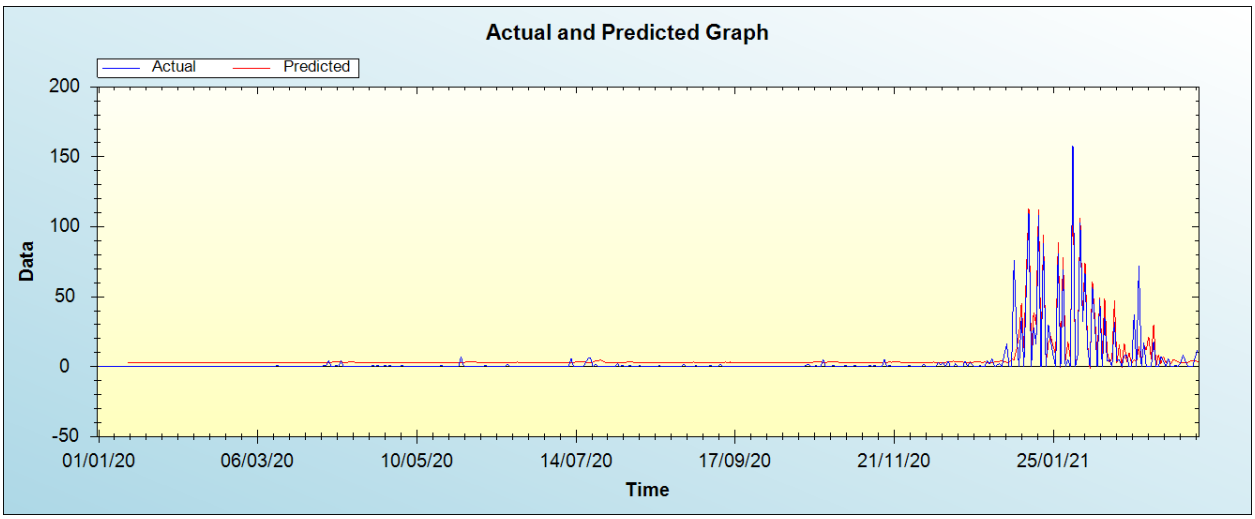

Figure 2: In-sample forecast for the SVG series

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

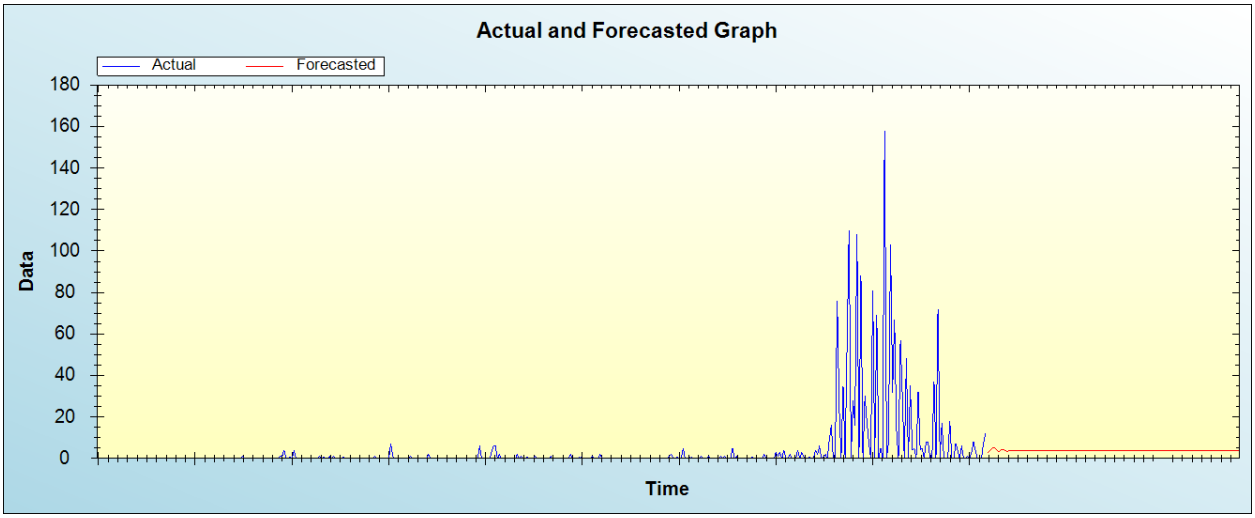

Figure 3: Out-of-sample forecast for SVG: actual and forecasted graph

Out-of-Sample Forecast for SVG: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Date	Forecasts
26/03/21	2.5755
27/03/21	3.5085
28/03/21	4.3510
29/03/21	5.3790
30/03/21	4.9170
31/03/21	3.8620
01/04/21	3.2673
02/04/21	4.1534
03/04/21	4.2952
04/04/21	3.7650
05/04/21	3.3509
06/04/21	3.7567
07/04/21	3.7464
08/04/21	3.8364
09/04/21	3.6473
10/04/21	3.6216
11/04/21	3.6998
12/04/21	3.8063
13/04/21	3.7178
14/04/21	3.7092
15/04/21	3.7110
16/04/21	3.7628
17/04/21	3.7474
18/04/21	3.7503
19/04/21	3.7260
20/04/21	3.7478
21/04/21	3.7511
22/04/21	3.7520
23/04/21	3.7390
24/04/21	3.7458
25/04/21	3.7446
26/04/21	3.7495
27/04/21	3.7439
28/04/21	3.7447
29/04/21	3.7432
30/04/21	3.7467
01/05/21	3.7445

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02/05/21	3.7448
03/05/21	3.7436
04/05/21	3.7451
05/05/21	3.7445
06/05/21	3.7450
07/05/21	3.7441
08/05/21	3.7447
09/05/21	3.7445
10/05/21	3.7449
11/05/21	3.7444
12/05/21	3.7447
13/05/21	3.7445
14/05/21	3.7447
15/05/21	3.7446
16/05/21	3.7447
17/05/21	3.7445
18/05/21	3.7447
19/05/21	3.7446
20/05/21	3.7447
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30/05/21	3.7446
31/05/21	3.7446
01/06/21	3.7446
02/06/21	3.7446
03/06/21	3.7446
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30/06/21	3.7446
01/07/21	3.7446
02/07/21	3.7446
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08/07/21	3.7446
09/07/21	3.7446
10/07/21	3.7446
11/07/21	3.7446
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25/07/21	3.7446
26/07/21	3.7446
27/07/21	3.7446
28/07/21	3.7446
29/07/21	3.7446
30/07/21	3.7446
31/07/21	3.7446

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 St Vincent and the Grenadines (SVG) are likely to remain around an equilibrium case volume of 4 cases per day over the out-of-sample period.

IV. CONCLUSION & RECOMMENDATIONS

COVID-19 has spread all over the globe and SVG has received her share too. In this paper, we applied a basic ANN (12, 12, 1) model. Residual diagnostics of the model used show that the model is stable and acceptable for forecasting COVID-19 cases in the country. The results of the model reveal that the pandemic may not end anytime soon in the country. We note that an equilibrium level of almost 4 cases per day will be experienced in the bulk of the out-of-sample period. The government is encouraged to continue implementing control and preventive measures, especially the vaccination programme, until the situation is stable.

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[1] Badillo-Rivera, E., et al. (2020). Environmental and Social Analysis as Risk Factors for the Spread of the Novel Coronavirus (SARS-CoV-2) Using Remote Sensing, GIS and Analytical Hierarchy Process (AHP): Case of Peru, medRxiv, pp: 1 – 33.

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