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Forecasting Covid-19 New Cases in Grenada

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***Abstract* – In this study, the ANN approach was applied to analyze COVID-19 new cases in Grenada. The employed data covers the period 1 January 2020 – 25 March 2021 and the out-of-sample period ranges over the period 26 March – 31 July 2021. The residuals and forecast evaluation criteria (Error, MSE and MAE) of the applied model indicate that the model is quite stable. The results of the study indicate that daily COVID-19 cases in Grenada are likely to be almost zero over the out-of-sample period. Amongst other suggested policy directions, there is need for the government of Grenada to ensure adherence to safety guidelines while continuing to create awareness about the COVID-19 pandemic.**

Keywords: ANN, COVID-19, Forecasting.

I. INTRODUCTION

The COVID-19 pandemic has serious negative effects on the environment, ecology, society and human health (Guo et al, 2020). Modeling and forecasting daily COVID-19 cases is very critical in order to understand the likely future trends of diseases thereby facilitating allocation of resources to control the pandemic. Artificial intelligence (AI) techniques are useful in the analysis of COVID-19 cases and able to handle large complex data sets. Artificial neural networks (ANNs) are the widely used machine learning method in time series forecasting (Nyoni et al, 2020; Zhao et al, 2020; Kaushik & Sahi, 2018; Yan et al, 2018; Scavuzzo et al, 2018; Gambhir et al, 2018; Laurean-Rosario et al, 2018; Weng et al, 2017; Guo et al, 2017; Althouse et al, 2011 Fojnica et al, 2016; Zhang, 2003; Kishan, 1997; Patterson, 1995). The multilayer perceptron (MLP) is the most applied neural network model in predictive modeling and will be applied in this study. The model is made up of 3 layers of neurons connected by acyclic links. The MLP uses the back propagation algorithm for the training process. The findings of this study are envisioned to provide an insight of the likely future trends of daily COVID-19 cases in Grenada and stimulate an appropriate response to the epidemic.

II. LITERATURE REVIEW

Aslam et al (2020) forecasted confirmed cases of COVID-19 in Pakistan using the ARIMA model. The results indicated that there was high exponential growth in the number of confirmed cases. Multiple Linear Regression was found to be reliable for forecasting COVID-19 daily cases in India by Rath et al (2020). Goswami et al (2020) applied the General Additive Modelin forecasting COVID-19 cases in India and the results revealed a statistically significant linear trend for the daily-confirmed cases of COVID-19. A time varying Kalman filter was employed for prediction of Covid-19 cases in Latvia and Greece by Assimakis et al (2020).Preliminary results from Greece and Latvia showed that Kalman Filters can be used for short term forecasting of CoVID-19 cases. Compartmental models have also been applied in Epidemiology to understand the evolution of infectious diseases. Researchers such as Alsayed et al (2020) predicted the epidemic peak using the Susceptible–Exposed–Infectious–Recovered (SEIR) model, with incorporation of the mortality cases in Malaysia. The infection rate was estimated using the Genetic Algorithm (GA), while the Adaptive Neuro-Fuzzy Inference System (ANFIS) model was used to provide short-time forecasting of the number of infected cases. The results show that the estimated infection rate is 0.228 ± 0.013, while the basic reproductive number is 2.28 ± 0.13. The epidemic peak of COVID-19 in Malaysia could be reached on 26 July 2020, with an uncertain period of 30 days (12 July–11 August).

III. 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 Grenada.

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Data Issues

This study is based on daily new cases of COVID-19 in Grenada 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).

IV. FINDINGS OF THE STUDY

ANN Model Summary

Table 1: ANN model summary

Variable	G
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	0.101615
MSE	2.154356
MAE	0.559305

Residual Analysis for the Applied Model

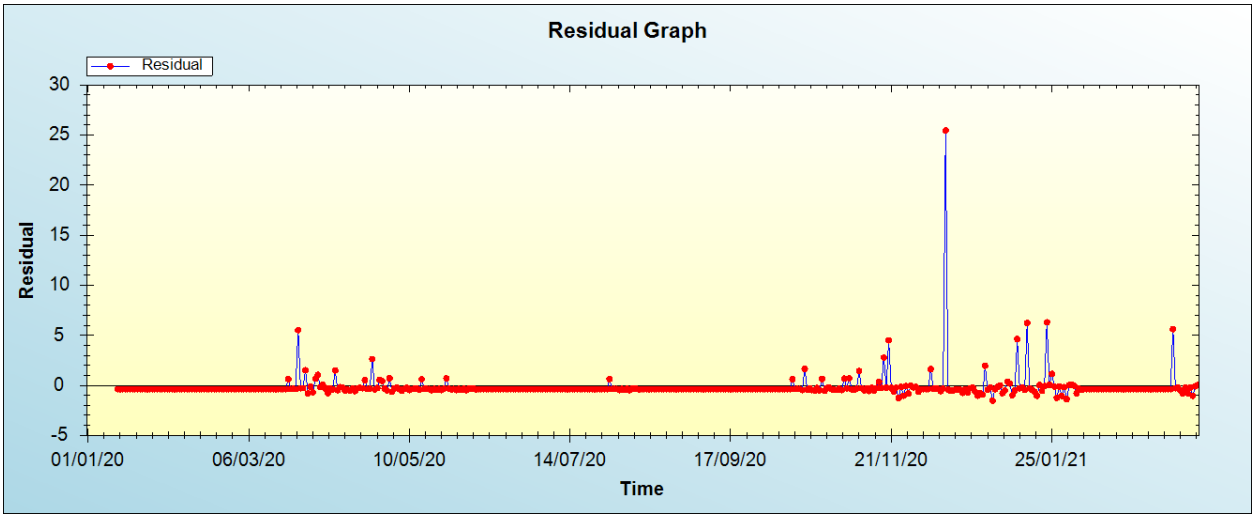

Figure 1: Residual analysis

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In-sample Forecast for G

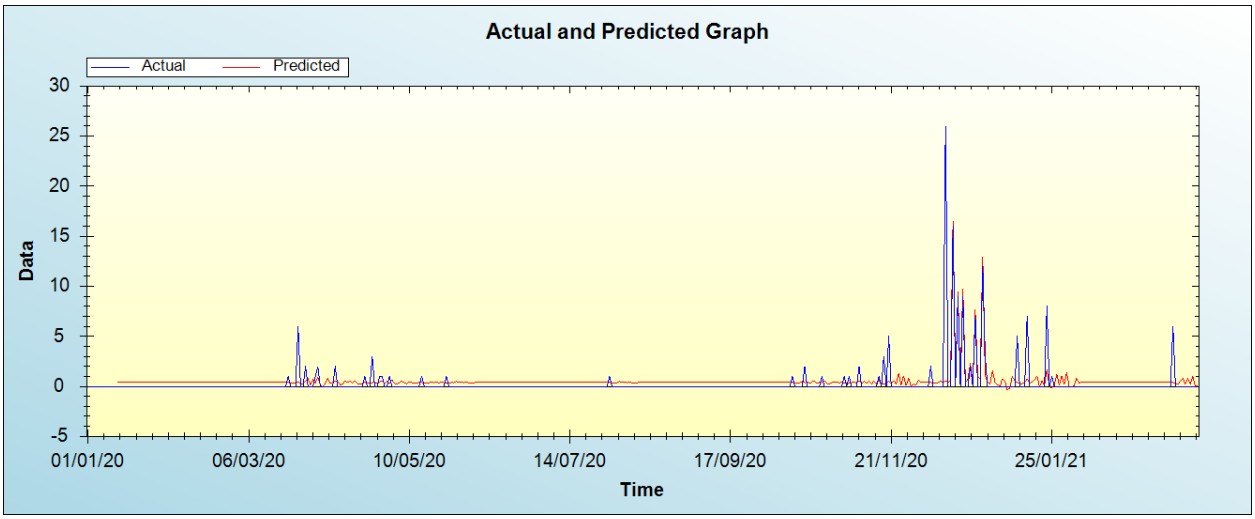

Figure 2: In-sample forecast for the G series

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

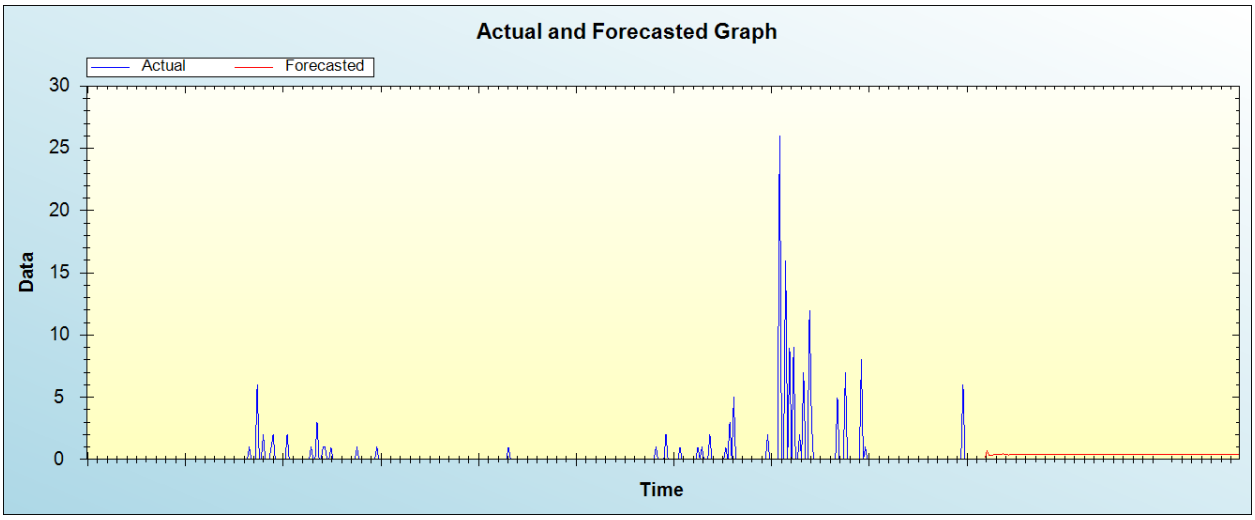

Figure 3: Out-of-sample forecast for G: actual and forecasted graph

Out-of-Sample Forecast for G: Forecasts only

Table 3: Tabulated out-of-sample forecasts

Day/Month/Year	Forecasts
26/03/21	0.1314
27/03/21	0.7089
28/03/21	0.3625
29/03/21	0.3509
30/03/21	0.3676
31/03/21	0.4246
01/04/21	0.3878
02/04/21	0.4377
03/04/21	0.4016
04/04/21	0.4632
05/04/21	0.3917
06/04/21	0.3724
07/04/21	0.3660

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08/04/21	0.4298
09/04/21	0.3925
10/04/21	0.3988
11/04/21	0.3856
12/04/21	0.4019
13/04/21	0.3854
14/04/21	0.3943
15/04/21	0.3878
16/04/21	0.4055
17/04/21	0.3935
18/04/21	0.3940
19/04/21	0.3888
20/04/21	0.3988
21/04/21	0.3928
22/04/21	0.3962
23/04/21	0.3927
24/04/21	0.3972
25/04/21	0.3932
26/04/21	0.3949
27/04/21	0.3927
28/04/21	0.3963
29/04/21	0.3941
30/04/21	0.3951
01/05/21	0.3935
02/05/21	0.3954
03/05/21	0.3940
04/05/21	0.3949
05/05/21	0.3940
06/05/21	0.3951
07/05/21	0.3943
08/05/21	0.3947
09/05/21	0.3941
10/05/21	0.3948
11/05/21	0.3944
12/05/21	0.3947
13/05/21	0.3943
14/05/21	0.3947
15/05/21	0.3944
16/05/21	0.3946
17/05/21	0.3944
18/05/21	0.3947
19/05/21	0.3945
20/05/21	0.3946
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26/05/21	0.3946
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30/05/21	0.3946
31/05/21	0.3945
01/06/21	0.3945
02/06/21	0.3945
03/06/21	0.3945
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09/06/21	0.3945
10/06/21	0.3945

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11/06/21	0.3945
12/06/21	0.3945
13/06/21	0.3945
14/06/21	0.3945
15/06/21	0.3945
16/06/21	0.3945
17/06/21	0.3945
18/06/21	0.3945
19/06/21	0.3945
20/06/21	0.3945
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24/06/21	0.3945
25/06/21	0.3945
26/06/21	0.3945
27/06/21	0.3945
28/06/21	0.3945
29/06/21	0.3945
30/06/21	0.3945
01/07/21	0.3945
02/07/21	0.3945
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25/07/21	0.3945
26/07/21	0.3945
27/07/21	0.3945
28/07/21	0.3945
29/07/21	0.3945
30/07/21	0.3945
31/07/21	0.3945

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 Grenada are likely to be almost zero over the out-of-sample period.

V. CONCLUSION AND POLICY RECOMMENDATIONS

Public health surveillance aims to detect disease outbreaks and trends of infectious diseases to facilitate an appropriate response to public health problems. It allows authorities to plan, make decisions and allocate resources so as to address a particular health issue. The use of early warning systems such as forecasting has improved the quality of health care services in many regions of the world. In this paper we applied an artificial intelligence technique to predict daily COVID-19 cases in

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Grenada. The results of this paper indicate that daily COVID-19 cases in Grenada are likely to be almost zero over the out-of-sample period. Therefore the government should continue enforcing public health mitigation measures to curb the spread of COVID-19.

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