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Forecasting Covid-19 Mortality in the Dominican Republic

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***Abstract* - In this study, the ANN approach was applied to analyze COVID-19 deaths in the Dominican Republic. The employed data covers the period 1 January 2020 to 20 April 2021 and the out-of-sample period ranges over the period 21 April to 31 August 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 the daily COVID-19 deaths in the Dominican Republic are likely to be close to 0 over the out-of-sample period. Therefore there is need for the authorities in the Dominican Republic to ensure adherence to safety guidelines while continuing to create awareness about the COVID-19 pandemic and scale up COVID-19 vaccination.**

Keywords: ANN, COVID-19, Forecasting.

I. INTRODUCTION

The beginning of the COVID-19 pandemic has stimulated a lot of research in the fields of virology, psychiatry, infectious disease modeling, and economics. The emergence of new variants is giving virologists sleepless nights. These variants are more transmissible than the original variant (Mahase, 2021). The pandemic has brought negative health impacts of which depression and stress related disorders are part of the package (Wong et al, 2021; Brooks et al, 2020; Ettman et al, 2020). Some studies have reported an increase in suicidal deaths in certain regions of the world (John et al, 2020). In addition other countries have reported a surge in domestic violence and sexual abuse cases during this pandemic (Mamun et al, 2021; Muldoon et al, 2021). The economic down turn that is being experienced during this COVID-19 health crisis was inevitable given the restrictions that have been put in place to curb the spread of the virus. Many countries closed their borders, businesses and temporarily banned both local and international flights. This means that domestic and international trade was significantly affected including tourism, transport, food, agriculture, mining and manufacturing industries which eventually led to job losses (ILO, 2020). In this paper we would want to mention the few COVID-19 studies in the Dominican Republic. Reyes et al (2021) investigated misinformation on COVID-19 origin and its relationship with perception and knowledge about social distancing. Descriptive statistics, stepwise multiple linear regression, and one-way multivariate analysis were implemented to test the hypotheses. The study established that there was possible link between the 'perception of COVID-19 origin' and 'the perception and knowledge about social distancing'. The multilayer perceptron was proposed by Nyoni et al (2020) to forecast daily confirmed COVID-19 cases in the Dominican Republic. The employed data covered the period March 1, 2020 to October 31, 2020 and the out-of-sample period ranged over the period November 2020 to April 2021The results of the study indicated that, daily COVID-19 cases would rise sharply in the Dominican Republic. Barrı´a-Sandova (2021) compared different time series methodologies to predict the number of confirmed cases of and deaths from COVID-19 in Chile. The methodology used in the study consisted of modeling cases of both confirmed cases and deaths from COVID-19 in Chile using Autoregressive Integrated Moving Average (ARIMA) models, Exponential Smoothing techniques, and Poisson models for time-dependent count data. The study concluded that ARIMA models are an alternative to modeling the behavior of the spread of COVID-19; however, depending on the characteristics of the dataset, other methodologies can better.

Infectious disease modeling has gained popularity during this pandemic as many public health specialists are trying to understand the future evolution of the SARS-COV2 virus. Many researchers have applied various methods to predict the spread and COVID-19 mortality. Deep learning approaches have been found to be superior to traditional statistical or mathematical techniques due to their high predictive accuracy (Zhao et al, 2020; Panch et al, 2018). In this study we propose to apply artificial neural networks to predict daily COVID-19 deaths in the Dominican Republic. The findings of this piece of work is expected to reveal future trends of COVID-19 mortality and facilitate an early resource mobilization for the COVID-19 response.

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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 COVID-19 deaths in the Dominican Republic.

Data Issues

This study is based on daily COVID-19 deaths in the Dominican Republic for the period 1 January 2020 – 20 April 2021. The out-of-sample forecast covers the period 21 April – 31 August 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	DR
Observations	464(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	3.118594
MSE	8.063250
MAE	2.305159

Residual Analysis for the Applied Model

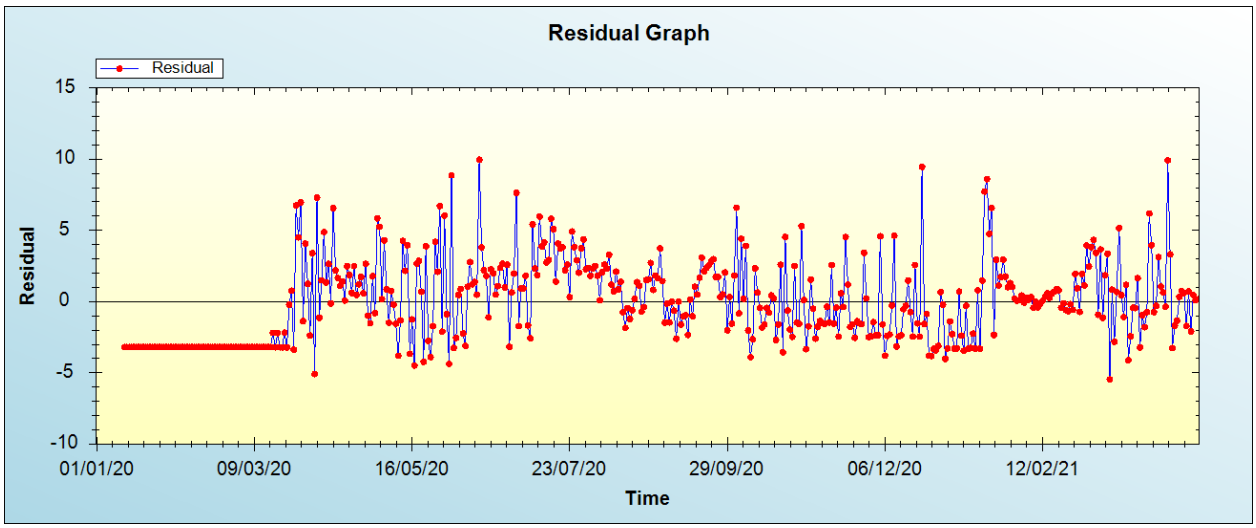

Figure 1: Residual analysis

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In-sample Forecast for DR

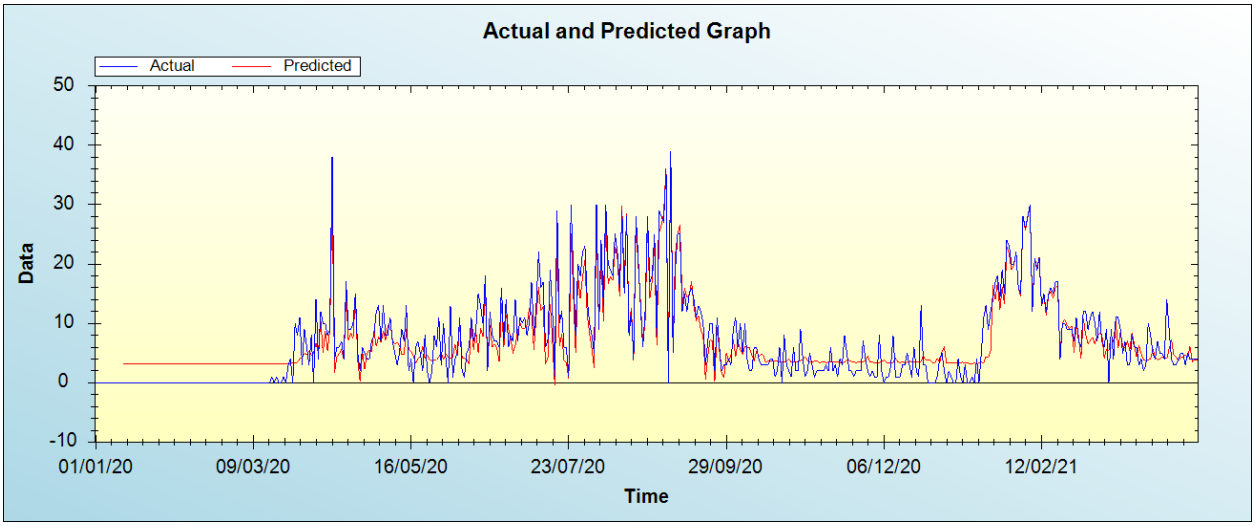

Figure 2: In-sample forecast for the A series

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

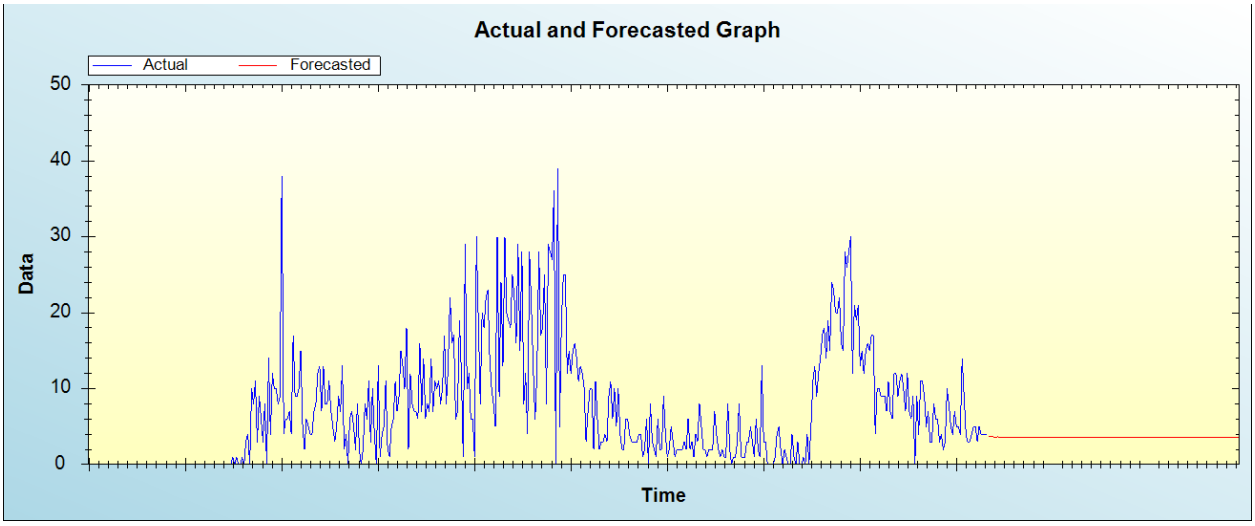

Figure 3: Out-of-sample forecast for DR: actual and forecasted graph

Out-of-Sample Forecast for DR: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Day/Month/Year	Projected COVID-19 deaths
21/04/21	3.6795
22/04/21	3.6387
23/04/21	3.6781
24/04/21	3.6199
25/04/21	3.6210
26/04/21	3.6751
27/04/21	3.5734
28/04/21	3.6105
29/04/21	3.5866
30/04/21	3.5820
01/05/21	3.5720
02/05/21	3.5771

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03/05/21	3.5709
04/05/21	3.5664
05/05/21	3.5682
06/05/21	3.5659
07/05/21	3.5637
08/05/21	3.5656
09/05/21	3.5630
10/05/21	3.5634
11/05/21	3.5627
12/05/21	3.5627
13/05/21	3.5622
14/05/21	3.5623
15/05/21	3.5622
16/05/21	3.5619
17/05/21	3.5620
18/05/21	3.5619
19/05/21	3.5618
20/05/21	3.5618
21/05/21	3.5618
22/05/21	3.5618
23/05/21	3.5617
24/05/21	3.5617
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07/07/21	3.5617
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09/07/21	3.5617
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11/07/21	3.5617
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25/08/21	3.5617
26/08/21	3.5617
27/08/21	3.5617
28/08/21	3.5617
29/08/21	3.5617
30/08/21	3.5617
31/08/21	3.5617

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 deaths in the Dominican Republic are likely to be close to 0 over the out-of-sample period.

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IV. CONCLUSION AND POLICY RECOMMENDATIONS

The COVID-19 emergence in Wuhan City of China in December 2019 shocked the entire world. The daily infection rates and deaths were alarming with no hope of surviving. As the pandemic was under control as a result of lockdowns and other mitigations measures, the world united in mobilizing resources for prevention and control of COVID-19.The development of COVID-19 vaccines brought joy and hope to many countries as scientists indicated that the vaccines were effective against the virus and its emerging variants. In this study we propose the ANN approach to predict daily COVID-19 deaths in the Dominican Republic. The model predictions suggest that that daily COVID-19 deaths in the Dominican Republic are likely to be close to 0 over the out-of-sample period. Therefore we encourage the government to scale up COVID-19 vaccination against other measures.

REFERENCES

[1] Ann John., Jane Pirkis., David Gunnell., Louis Appleby., & Jacqui Morrissey (2020). Trends in suicide during the covid-19 pandemic, BMJ 2020;371:m4352 http://dx.doi.org/10.1136/bmj.m4352

[2] Brooks SK., Webster R K., Smith LE (2020). The psychological impact of quarantine and how to reduce it: rapid review of the evidence. Lancet, 395(10227):912–20. https://doi.org/10.1016/S0140-6736(20)30460-8

[3] Elisabeth Mahase (2021). Covid-19: What new variants are emerging and how are they being investigated? : BMJ 2021;372:n158 http://dx.doi.org/10.1136/bmj.n158

[4] Ettman CK., Abdalla S M., Cohen G H., Sampson L., Vivier PM., & Galea S (2020). Prevalence of depression symptoms in U.S. adults before and during the COVID-19 pandemic. JAMA Netw Open. 2020 ;(9) In Press. https://doi.org/10. 1001/jamanetworkopen.2020.19686.

[5] Firoj al Mamun., HS C., Ismail Hosen., HS C., Mohammed A. Mamun., & HSC (2021). Sexual violence and rapes' increment during the COVID-19 pandemic in Bangladesh, EClinicalMedicine 34 (2021) 100817

[6] ILO (2020). ILO Monitor: COVID-19 and the world of work. Second edition Updated estimates and analysis, pp 1-11.

[7] Katherine A. Muldoon., Kathryn M., Denize., Robert Talarico., Deshayne B. Fel., Agnes Sobiesiak., Melissa Heimerl and Kari Sampsel (2021). COVID-19 pandemic and violence: rising risks and decreasing urgent care-seeking for sexual assault and domestic violence survivors, BMC Medicine (2021) 19:20 https://doi.org/10.1186/s12916-020-01897-z

[8] Wong LP., Alias H., Md Fuzi AA., Omar IS., Mohamad Nor A., Tan MP (2021) Escalating progression of mental health disorders during the COVID-19 pandemic: Evidence from a nationwide survey. PLoS ONE 16(3): e0248916. https://doi.org/10.1371/journal.pone.0248916

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