

Forecasting Covid-19 Deaths in Senegal

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Abstract - In this study, the ANN approach was applied to analyze COVID-19 deaths in Senegal. This study is based on daily COVID-19 deaths in Senegal for the period 1 January 2020 – 20 April 2021. The out-of-sample forecast covers the period 21 April – 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 daily COVID-19 mortality cases in Senegal are likely to be rare over the out-of-sample period. Therefore there is need for the government of Senegal to ensure adherence to safety guidelines while continuing to create awareness about the COVID-19 pandemic and COVID-19 vaccination.

Keywords: ANN, COVID-19, Forecasting.

I. INTRODUCTION

The emergence of the deadly novel coronavirus, SARS-COV2 in Wuhan City, China in December 2019 continues to torment the World as millions of people continue to suffer from the COVID-19 disease and continue to die from its complications (WHO, 2020). Many countries are channeling their financial and human resources towards COVID-19 response (Last, 2020). The first case of COVID-19 in Senegal was officially reported on March 2, 2020 (Ministry of Health, 2020). Following the detection of the first case of SARS-COV2 in Israel, the government adopted the WHO guidelines to prevent and control the epidemic which include social distancing, regular hand washing, wearing face masks, contact tracing, quarantine, isolation and treatment of positive cases (Miller et al, 2020). Even-though studies such as Fall *et al.* (2020) have investigated the COVID-19 pandemic in Senegal, no researcher has attempted to predict the pattern of daily COVID-19 deaths in the country. The aim of this study is to predict daily COVID-19 deaths in Senegal using the artificial neural network approach due to its high predictive accuracy (Maradze et al, 2021; Nyoni et al, 2021; Zhao et al, 2020; Nyoni et al, 2020). The study results are envisioned to assist in the evaluation of COVID-19 mitigation measures and to prepare adequate resources to fight the epidemic.

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 Senegal.

Data Issues

This study is based on daily COVID-19 deaths in Senegal 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	S
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	0.146376
MSE	2.142587
MAE	0.972099

Residual Analysis for the Applied Model

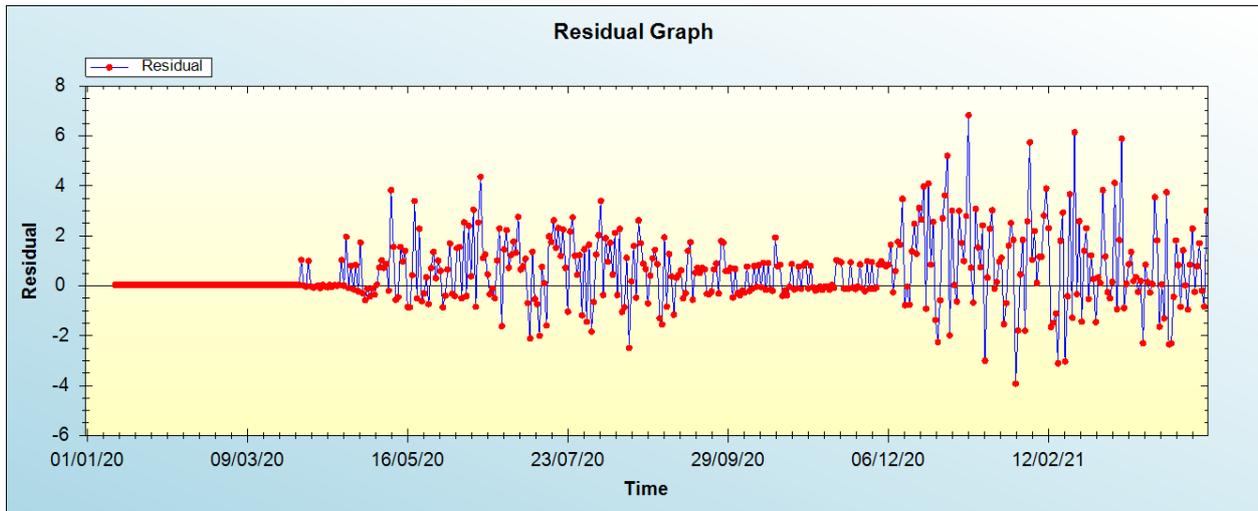


Figure 1: Residual analysis

In-sample Forecast for S

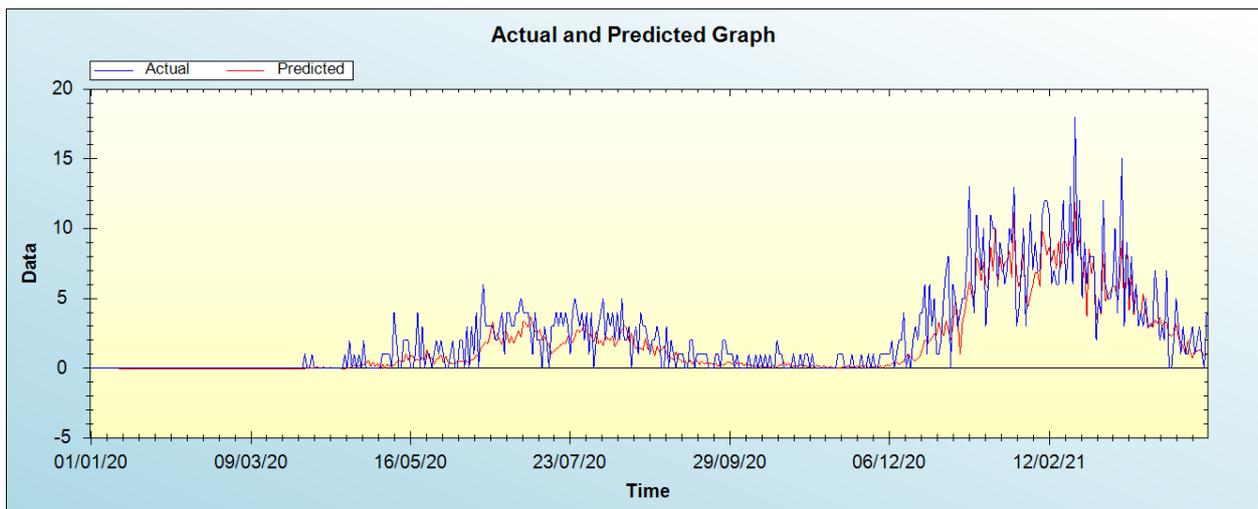


Figure 2: In-sample forecast for the S series

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

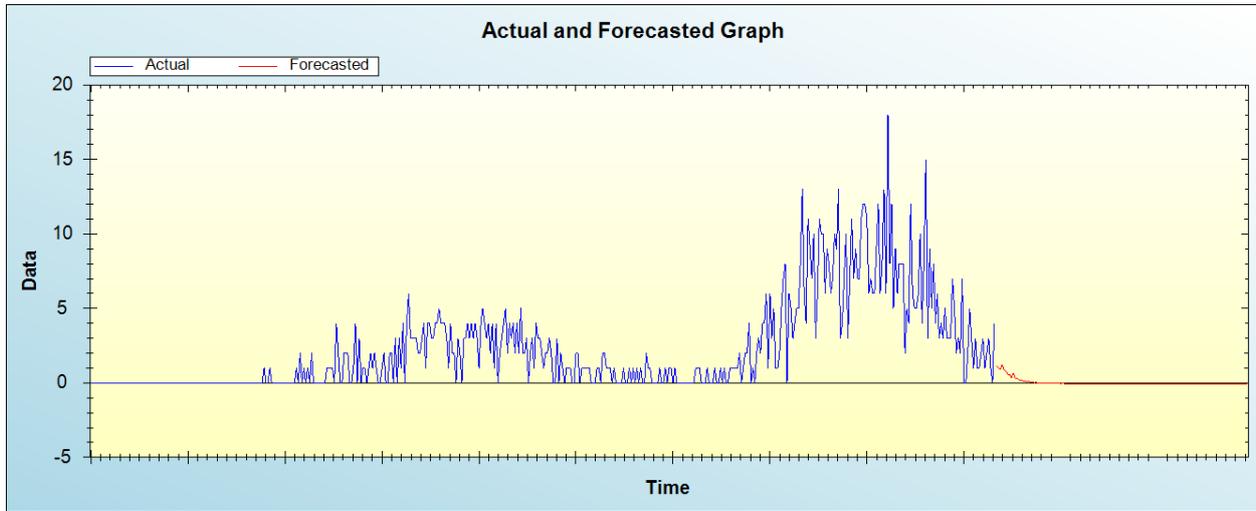


Figure 3: Out-of-sample forecast for S: actual and forecasted graph

Out-of-Sample Forecast for S: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Date	Forecasts
21/04/21	1.1842
22/04/21	1.0376
23/04/21	0.8843
24/04/21	1.2433
25/04/21	0.9202
26/04/21	0.8079
27/04/21	0.5608
28/04/21	0.5651
29/04/21	0.3590
30/04/21	0.6717
01/05/21	0.3072
02/05/21	0.3434
03/05/21	0.1860
04/05/21	0.2163
05/05/21	0.1387
06/05/21	0.1441
07/05/21	0.0688
08/05/21	0.1025
09/05/21	0.0292
10/05/21	0.0696
11/05/21	0.0141
12/05/21	0.0310
13/05/21	-0.0020
14/05/21	0.0040
15/05/21	-0.0154
16/05/21	-0.0091
17/05/21	-0.0264
18/05/21	-0.0182
19/05/21	-0.0327
20/05/21	-0.0260
21/05/21	-0.0358
22/05/21	-0.0323
23/05/21	-0.0383
24/05/21	-0.0365
25/05/21	-0.0407
26/05/21	-0.0389

27/05/21	-0.0424
28/05/21	-0.0407
29/05/21	-0.0434
30/05/21	-0.0422
31/05/21	-0.0440
01/06/21	-0.0432
02/06/21	-0.0444
03/06/21	-0.0439
04/06/21	-0.0448
05/06/21	-0.0444
06/06/21	-0.0451
07/06/21	-0.0447
08/06/21	-0.0452
09/06/21	-0.0450
10/06/21	-0.0453
11/06/21	-0.0452
12/06/21	-0.0454
13/06/21	-0.0453
14/06/21	-0.0455
15/06/21	-0.0454
16/06/21	-0.0455
17/06/21	-0.0454
18/06/21	-0.0455
19/06/21	-0.0455
20/06/21	-0.0455
21/06/21	-0.0455
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27/08/21	-0.0456
28/08/21	-0.0456
29/08/21	-0.0456
30/08/21	-0.0456
31/08/21	-0.0456

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, over the out-of-sample period, no one may die due to COVID-19 in the country. This makes a lot of sense given the preventive measures that the government of Senegal has taken so far.

IV. CONCLUSION AND POLICY RECOMMENDATIONS

Public health surveillance is an important tool for public health programming. It facilitates planning and allocation of resources. In this COVID-19 pandemic predictive modeling becomes one of the main tools for early detection of localized or generalized outbreaks. It provides an insight of the likely future trends of confirmed cases and mortalities. In this study the artificial intelligent technique is applied to predict COVID-19 mortality in the state of Israel. The results of the study suggest that daily COVID-19 mortality cases in Senegal are likely to be rare over the out-of-sample period. Therefore the authorities in Senegal are encouraged to continue COVID-19 vaccination and other recommended WHO guidelines.

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