

Forecasting Covid-19 Related Deaths in Poland

¹Dr. Smartson. P. NYONI, ²Mr. Thabani NYONI, ³Mr. Tatenda. A. CHIHOHO

¹ZICHIRE Project, University of Zimbabwe, Harare, Zimbabwe

²SAGIT Innovation Center, Harare, Zimbabwe

³Independent Health Economist, Harare, Zimbabwe

Abstract - It is a public secret that COVID-19 is of serious concern worldwide and considered as the supreme crisis of the present era. In this research article, the ANN approach was applied to analyze COVID-19 deaths in Poland. This study is based on daily COVID-19 deaths in Poland 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 show that the model is stable. It is projected that daily COVID-19 deaths in Poland are likely to continue to decline over the out-of-sample period. The government should, however, continue to ensure that there is compliance to control and preventive COVID-19 measures such as social distancing, quarantine, isolation, face-mask wearing and so on. There is also need to embrace the vaccination programme in the country.

Keywords: ANN, COVID-19, Forecasting.

I. INTRODUCTION

The Corona Virus Disease (COVID-19) is a global pandemic that was discovered by a Chinese physician in Wuhan, the capital city of Hubei province in mainland China, in December 2019 (WHO, 2020). It then propagated worldwide, and was declared a pandemic by the World Health Organization (WHO) at the tail end of January 2020 (Butt *et al.*, 2020). Symptoms of the disease include dry cough, sore throat and fever. Although, the majority of the cases are mild, some cases may lead to Acute Respiratory Distress Syndrome (ARDS), severe pneumonia, pulmonary oedema and organ failure (Chen *et al.*, 2020). COVID-19 propagation is faster when people are in close proximity. Thus, travel restrictions control the spread of the disease, and frequent hand washing is always recommended to prevent potential viral infections (Alazab *et al.*, 2020). Forecasting COVID-19 case volumes is very important (Medina-Mendieta *et al.*, 2020). In the first place, to inform government and healthcare professionals on what to expect and which measures to impose, and secondly, to motivate the wider public to adhere to the measures that were imposed to decelerate the spreading before a regrettable scenario unfolds (McCloskey *et al.*, 2020). Thirdly, forecasting models are used as a reference to make new policies and to evaluate the conditions of COVID-19 curfews (Remuzzi & Remuzzi, 2020). Dean *et al.* (2020) averred that accurate forecasts in relation to the COVID-19 pandemic are very important in improving situational awareness of decision makers and facilitate tasks such as resource allocation or planning of vaccine trials. Although studies such as Orzechowska & Bednarek (2020) have investigated the pandemic in the country, not even a single study has been carried out to forecast the trends of daily COVID-19 related deaths in Poland. It is this informational gap that we seek to address.

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 Poland.

Data Issues

This study is based on daily COVID-19 deaths in Poland 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	P
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	0.087437
MSE	2156.566496
MAE	30.701922

Residual Analysis for the Applied Model

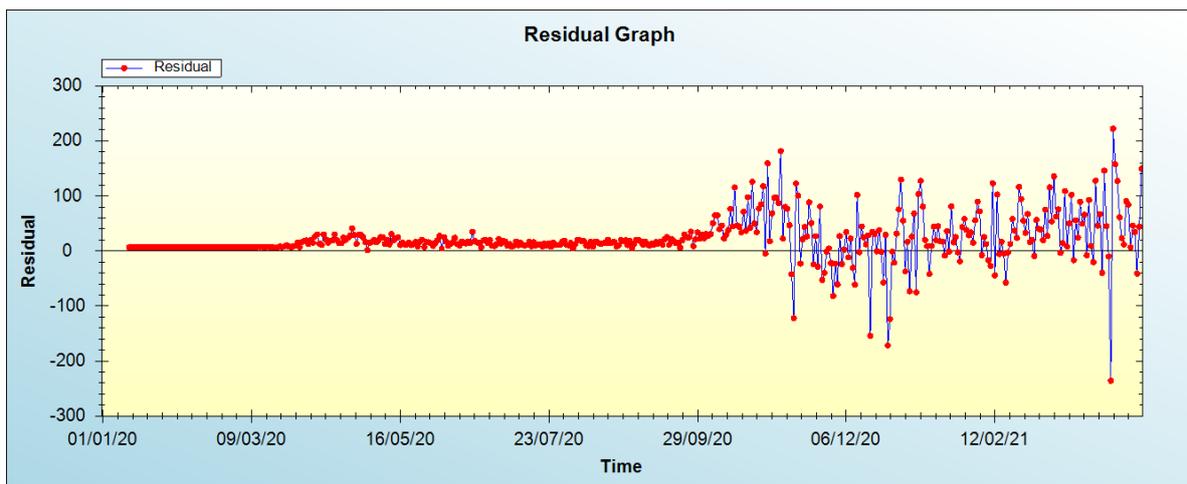


Figure 1: Residual analysis

In-sample Forecast for P

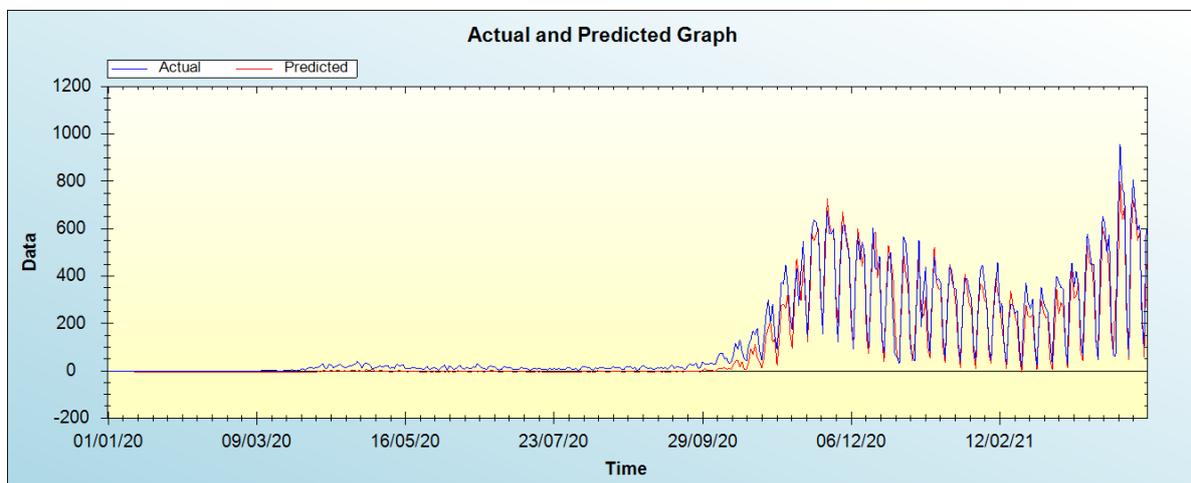


Figure 2: In-sample forecast for the P series

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

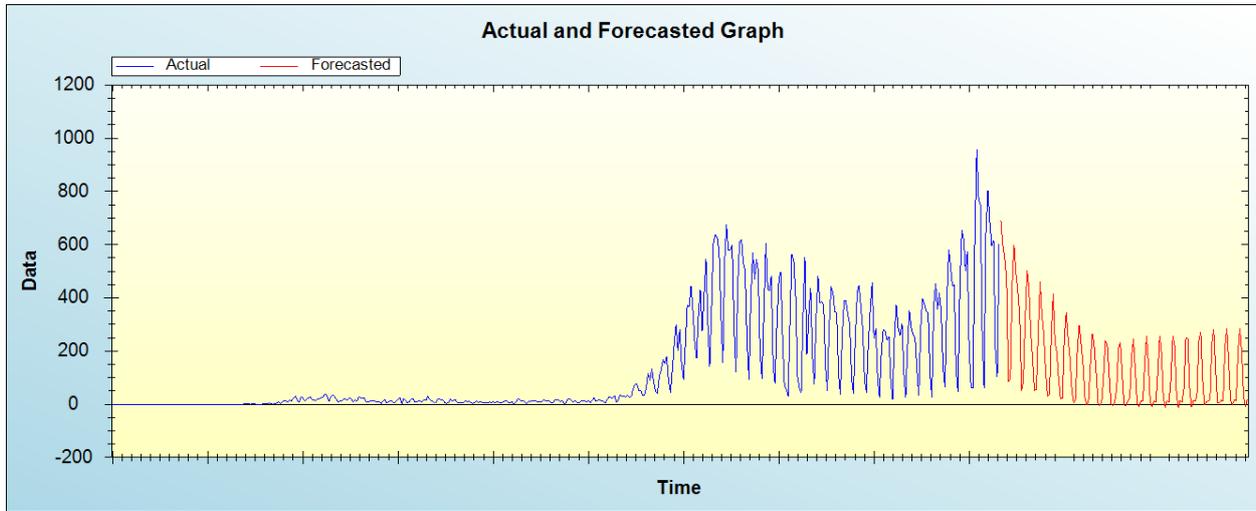


Figure 3: Out-of-sample forecast for P: actual and forecasted graph

Out-of-Sample Forecast for P: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Date	Forecasts
21/04/21	691.5861
22/04/21	598.7046
23/04/21	549.1150
24/04/21	473.6818
25/04/21	85.0816
26/04/21	97.1730
27/04/21	449.1288
28/04/21	598.1833
29/04/21	498.2908
30/04/21	429.5539
01/05/21	338.0316
02/05/21	51.9195
03/05/21	87.4803
04/05/21	321.3419
05/05/21	503.6753
06/05/21	438.0097
07/05/21	267.5746
08/05/21	167.4730
09/05/21	52.4792
10/05/21	55.0234
11/05/21	274.0892
12/05/21	459.4495
13/05/21	333.0537
14/05/21	258.7528
15/05/21	120.3701
16/05/21	29.5219
17/05/21	35.5112
18/05/21	272.2726
19/05/21	412.9654
20/05/21	230.8868
21/05/21	194.5073
22/05/21	92.7272
23/05/21	18.6845
24/05/21	23.7928
25/05/21	245.7953
26/05/21	345.4424

27/05/21	242.6655
28/05/21	172.7631
29/05/21	53.7720
30/05/21	5.4012
31/05/21	18.2479
01/06/21	202.1065
02/06/21	297.4824
03/06/21	223.4086
04/06/21	146.9065
05/06/21	22.0991
06/06/21	-3.4755
07/06/21	14.7541
08/06/21	152.1770
09/06/21	266.0455
10/06/21	220.1308
11/06/21	124.4984
12/06/21	5.9422
13/06/21	-5.9798
14/06/21	14.0463
15/06/21	103.3218
16/06/21	238.9499
17/06/21	224.1869
18/06/21	112.8719
19/06/21	-0.2767
20/06/21	-6.1882
21/06/21	12.4345
22/06/21	58.2896
23/06/21	210.7128
24/06/21	232.6631
25/06/21	113.0968
26/06/21	-1.5159
27/06/21	-6.5847
28/06/21	11.0050
29/06/21	26.9174
30/06/21	181.3512
01/07/21	244.6495
02/07/21	126.8861
03/07/21	1.7825
04/07/21	-7.5446
05/07/21	11.1018
06/07/21	12.3057
07/07/21	153.5120
08/07/21	254.3093
09/07/21	153.1585
10/07/21	9.8225
11/07/21	-9.3278
12/07/21	12.4005
13/07/21	7.8745
14/07/21	124.6139
15/07/21	257.5747
16/07/21	187.4142
17/07/21	22.6133
18/07/21	-11.3213
19/07/21	13.7205
20/07/21	7.7628
21/07/21	90.8167
22/07/21	255.1424
23/07/21	221.5291
24/07/21	40.2861
25/07/21	-11.7250
26/07/21	14.0757
27/07/21	9.1047
28/07/21	55.3217
29/07/21	248.5646

30/07/21	248.8046
31/07/21	62.8540
01/08/21	-9.4740
02/08/21	12.8079
03/08/21	10.8977
04/08/21	28.5234
05/08/21	239.2446
06/08/21	269.6462
07/08/21	91.4127
08/08/21	-4.2631
09/08/21	9.6409
10/08/21	13.2438
11/08/21	15.6170
12/08/21	229.1053
13/08/21	282.0913
14/08/21	125.4461
15/08/21	3.9876
16/08/21	4.2401
17/08/21	15.5274
18/08/21	12.2602
19/08/21	216.8243
20/08/21	285.1848
21/08/21	162.5574
22/08/21	14.9710
23/08/21	-2.4833
24/08/21	16.9717
25/08/21	13.2003
26/08/21	198.9270
27/08/21	283.0290
28/08/21	199.2570
29/08/21	28.6755
30/08/21	-7.6643
31/08/21	17.6352

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 Poland are likely to continue to decline over the out-of-sample period.

IV. CONCLUSION & RECOMMENDATIONS

The rapid spread of COVID-19 across the globe as well as the increasing number of deaths requires swift actions from all sectors. Future forecasting of potential infections will enable authorities to tackle the consequences effectively (Alazab *et al.*, 2020). This study used the ANN (12, 12, 1) model to come up with reliable predictions of the daily deaths in the country. It is projected that daily COVID-19 deaths in Poland are likely to continue to decline over the out-of-sample period. The government of Poland should, however, continue to ensure that there is compliance to control and preventive COVID-19 measures such as social distancing, quarantine, isolation, face-mask wearing and so on. There is also need to embrace the vaccination programme in the country.

REFERENCES

- [1] Alazab, M., *et al.* (2020). COVID-19 Prediction and Detection Using Deep Learning, *International Journal of Computer Information Systems and Industrial Management Applications*, 12: 168 – 181.
- [2] Butt, C., *et al.* (2020). Deep Learning System to Screen Coronavirus Disease 2019 Pneumonia, *Applied Intelligence*, pp: 1 – 7.
- [3] Chen, N., *et al.* (2020). Epidemiological and Clinical Characteristics of 99 Cases of 2019 Novel Coronavirus Pneumonia in Wuhan, China: A Descriptive Study, *Lancet*, 395: 507 – 513.
- [4] Dean, N. E., *et al.* (2020). Ensemble Forecast Modelling for the Design of COVID-19 Vaccine Efficacy Trials, *Vaccine*, 38 (46): 7213 – 7216.

- [5] McCloskey, B., *et al.* (2020). Mass Gathering Events and Reducing Further Spread of COVID-19: A Political and Public Health Dilemma, *Lancet*, 395: 1096 – 1099.
- [6] Medina-Mendieta, J. F., *et al.* (2020). COVID-19 Forecasts for Cuba Using Logistic Regression and Gompertz Curves, *MEDICC*, 22 (3): 32 – 39.
- [7] Remuzzi, A., & Remuzzi, G. (2020). COVID-19 and Italy: What Next? *Lancet*, pp: 1 – 13.
- [8] Orzechowska, M., & Bednarek, A. K. (2020). Forecasting COVID-19 Pandemic in Poland according to Government Regulations and People Behavior, *Frontiers*, pp: 1 – 12.
- [9] WHO (2020). Laboratory Testing for Coronavirus Disease 2019 (COVID-19) in Suspected Human Cases: Interim Guidance, *WHO*, Geneva.

Citation of this Article:

Dr. Smartson. P. NYONI, Mr. Thabani NYONI, Mr. Tatenda. A. CHIHOHO, “Forecasting Covid-19 Related Deaths in Poland” Published in *International Research Journal of Innovations in Engineering and Technology - IRJIET*, Volume 5, Issue 6, pp 878-883, June 2021. Article DOI <https://doi.org/10.47001/IRJIET/2021.506153>
