

Forecasting Covid-19 Deaths in Austria

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Abstract - In this study, the ANN approach was applied to analyze COVID-19 new deaths in Austria. 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 2020 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 daily COVID-19 deaths in Austria are likely to rise up to the equilibrium level of 101 deaths per day over the out-of-sample period. Therefore there is need for the government of Austria to ensure adherence to safety guidelines while continuing to create awareness about the COVID-19 pandemic and to speed up COVID-19 vaccination.

Keywords: ANN, COVID-19, Forecasting.

I. INTRODUCTION

The COVID-19 pandemic is worsening in many countries with thousands of deaths being reported in countries like Brazil, Mexico and Argentina (Congressional Research Service, 2021). Austria has not been spared by the negative impacts of the COVID-19 crisis. The country is vulnerable to the highly contagious disease due to behavioral risk factors which are the major drivers of morbidity and mortality e.g. poor diets, smoking and alcohol consumption (OECD, 2019). Cardiovascular disease continues to be the major cause of death but mortality from diabetes is rising (OECD, 2019). The first 2 cases of COVID-19 were reported in Austria on the 25th of February 2020 (Meyer et al, 2020). On the 13th of March 2020 the government enacted a national lockdown which saw the closure of schools, universities, shops, restaurants and bars (Meyer et al, 2020). The government adopted the WHO protocols to control and prevent COVID-19. As of 18 June 2021 the country had reported 649 309 confirmed cases, 10 677 deaths and 635 544 recoveries (Worldometer, 2021). By the 31st of May 2021, a total of 3 648 255 people had received at least one dose of the COVID-19 vaccine representing 41.2 % of the population and a total of 1 553 023 people were fully vaccinated against COVID-19 representing 17.5 % of the total population (Our World in data, 2021). In this paper we aim to model and predict daily COVID-19 deaths in Austria using an artificial intelligence technique. The findings of the study are expected to reveal the likely future trends of COVID-19 deaths in the country and help in the evaluation of COVID-19 mitigation strategies and facilitate resource mobilization for the COVID-19 response.

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 Austria.

Data Issues

This study is based on daily COVID-19 deaths in Austria 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	A
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	0.091607
MSE	124.223676
MAE	7.527268

Residual Analysis for the Applied Model

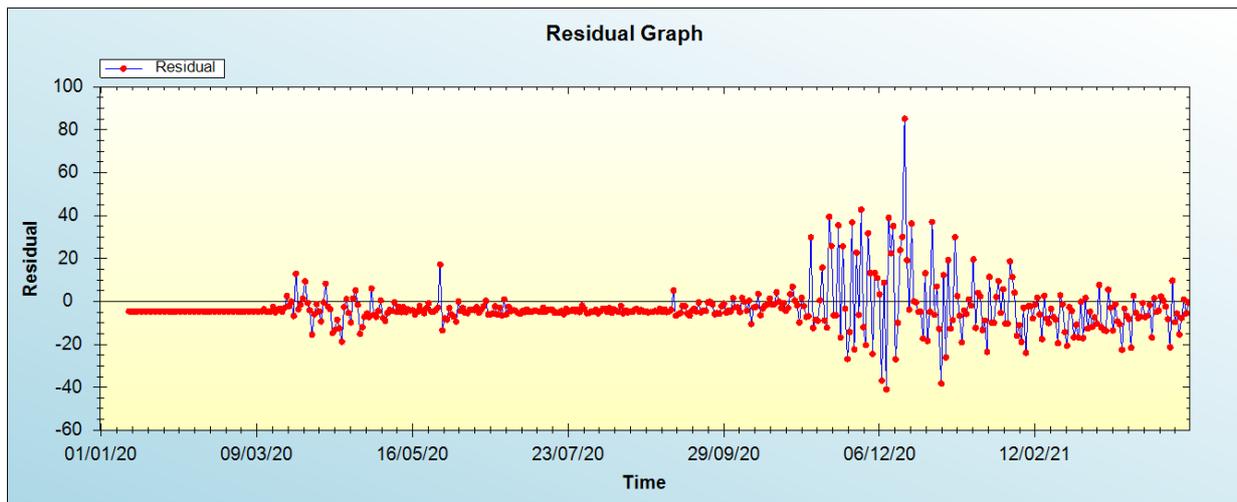


Figure 1: Residual analysis

In-sample Forecast for A

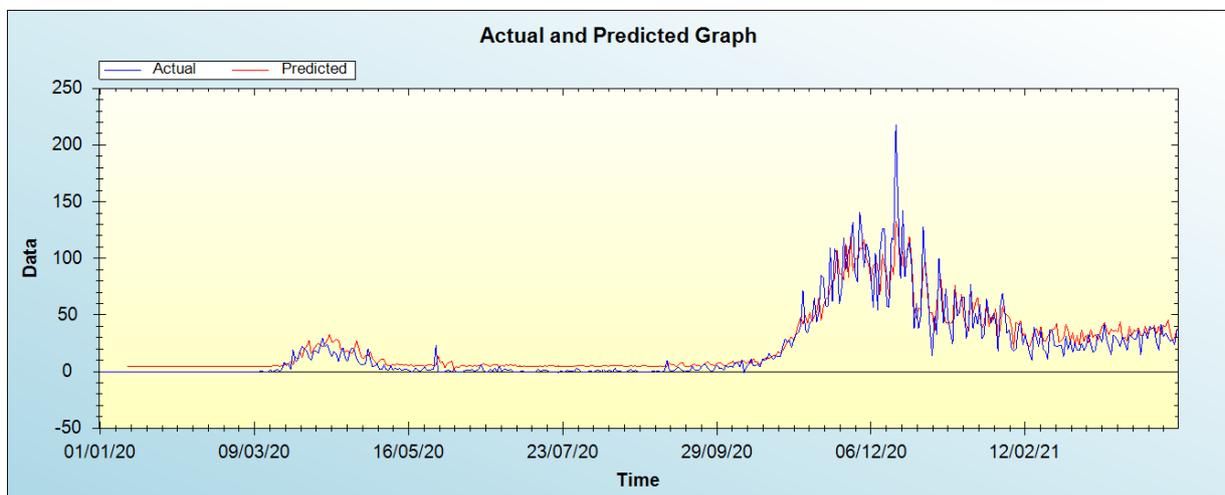


Figure 2: In-sample forecast for the A series

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

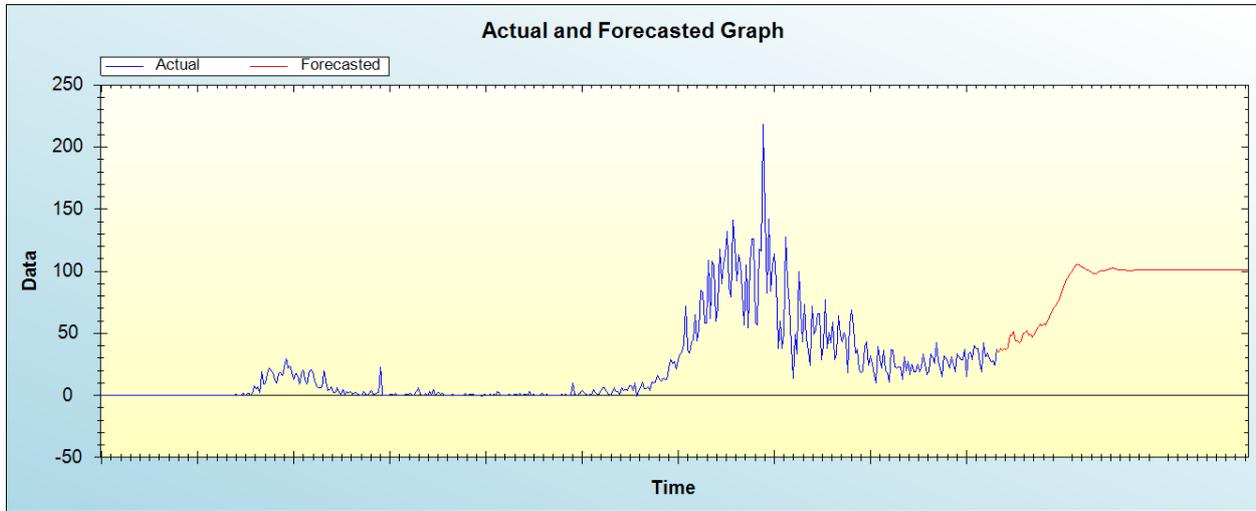


Figure 3: Out-of-sample forecast for A: actual and forecasted graph

Out-of-Sample Forecast for A: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Date	Forecasts
21/04/21	34.9029
22/04/21	37.4436
23/04/21	36.4965
24/04/21	38.0203
25/04/21	36.7731
26/04/21	38.9309
27/04/21	48.1012
28/04/21	48.4535
29/04/21	51.3555
30/04/21	43.6111
01/05/21	44.3112
02/05/21	42.2742
03/05/21	43.7053
04/05/21	49.5185
05/05/21	50.4964
06/05/21	52.2222
07/05/21	48.3942
08/05/21	49.1874
09/05/21	47.1528
10/05/21	49.2839
11/05/21	52.6706
12/05/21	55.0291
13/05/21	57.0664
14/05/21	55.9087
15/05/21	57.5299
16/05/21	56.8283
17/05/21	59.8055
18/05/21	63.2064

19/05/21	66.9362
20/05/21	70.0233
21/05/21	71.5079
22/05/21	74.5555
23/05/21	76.2127
24/05/21	80.6591
25/05/21	85.0788
26/05/21	89.4879
27/05/21	93.0505
28/05/21	95.2725
29/05/21	98.1333
30/05/21	100.0394
31/05/21	102.9171
01/06/21	104.8076
02/06/21	105.4625
03/06/21	105.2186
04/06/21	103.8119
05/06/21	102.8602
06/06/21	101.8270
07/06/21	101.2468
08/06/21	100.4233
09/06/21	99.3120
10/06/21	98.5349
11/06/21	98.0174
12/06/21	98.4814
13/06/21	99.2572
14/06/21	100.0571
15/06/21	100.5410
16/06/21	100.6641
17/06/21	100.9419
18/06/21	101.3145
19/06/21	101.9424
20/06/21	102.3403
21/06/21	102.3178
22/06/21	101.9638
23/06/21	101.4411
24/06/21	101.1723
25/06/21	101.0942
26/06/21	101.1301
27/06/21	101.0223
28/06/21	100.7268
29/06/21	100.4528
30/06/21	100.3385
01/07/21	100.5284
02/07/21	100.8316
03/07/21	101.0640
04/07/21	101.1129
05/07/21	101.0287

06/07/21	101.0066
07/07/21	101.1055
08/07/21	101.3046
09/07/21	101.4314
10/07/21	101.3884
11/07/21	101.2167
12/07/21	101.0345
13/07/21	100.9785
14/07/21	101.0327
15/07/21	101.1095
16/07/21	101.1005
17/07/21	100.9945
18/07/21	100.8838
19/07/21	100.8556
20/07/21	100.9429
21/07/21	101.0675
22/07/21	101.1374
23/07/21	101.1149
24/07/21	101.0439
25/07/21	101.0108
26/07/21	101.0501
27/07/21	101.1326
28/07/21	101.1819
29/07/21	101.1553
30/07/21	101.0771
31/07/21	101.0102
01/08/21	101.0059
02/08/21	101.0525
03/08/21	101.0983
04/08/21	101.0965
05/08/21	101.0483
06/08/21	100.9993
07/08/21	100.9925
08/08/21	101.0345
09/08/21	101.0873
10/08/21	101.1080
11/08/21	101.0850
12/08/21	101.0453
13/08/21	101.0286
14/08/21	101.0493
15/08/21	101.0875
16/08/21	101.1076
17/08/21	101.0921
18/08/21	101.0560
19/08/21	101.0305
20/08/21	101.0356
21/08/21	101.0626
22/08/21	101.0847

23/08/21	101.0817
24/08/21	101.0577
25/08/21	101.0357
26/08/21	101.0352
27/08/21	101.0560
28/08/21	101.0789
29/08/21	101.0844
30/08/21	101.0698
31/08/21	101.0502

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 Austria are likely to rise up to the equilibrium level of 101 deaths per day over the out-of-sample period.

IV. CONCLUSION AND POLICY RECOMMENDATIONS

The COVID-19 pandemic came as a strong test of health systems capacity in many countries around the World. The pandemic is characterized by an increase in demand of medical supplies and other related commodities with many countries failing to provide satisfactory health care to COVID-19 patients. Shortage of hospital beds and oxygen is the main devastating issue when COVID-19 patients present themselves at health care facilities around the world. Financial constraints and shortage of staff have unfortunately led to the death of many people in health care settings. With proper planning and timely resource mobilization such calamities can be avoided. Forecasting is an essential tool that will guide planning and decision making so as to detect outbreaks early and put aside resources for the COVID-19 response. In this study we applied the artificial neural network approach to predict daily COVID-19 deaths in Austria. The results indicate that daily COVID-19 deaths in Austria are likely to rise up to the equilibrium level of 101 deaths per day over the out-of-sample period. Hence we implore the government to focus on scaling up the COVID-19 vaccination programme amongst other mitigation measures.

REFERENCES

- [1] Worldometer (2021). Austria COVID-19 update. <https://www.worldometers.info>.
- [2] Our world in data (2021). Austria COVID-19 update. <https://ourworldindata.org/Austria>
- [3] OECD (2019). The state of health in the EU, Austria country profile 2019.
- [4] Congressional Research Service (2021). Latin America and the Caribbean: The impact of COVID-19. <https://crsreports.congress.gov>

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