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Forecasting Covid-19 New Cases in Switzerland

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***Abstract* - In this research article, the ANN approach was applied to investigate COVID-19 cases in Switzerland. This study is based on monthly new cases of COVID-19 in Switzerland for the period 1 January 2020 – 25 March 2021. The out-of-sample forecast covers the period 26 March 2021 – 31 July 2021. The residuals and forecast evaluation criteria (Error, MSE and MAE) of the applied model indicate that the model is stable in forecasting daily COVID-19 cases in Switzerland. The results of the study generally suggest that daily COVID-19 cases in Switzerland are likely to remain significantly high over the out-of-sample period. The government should continue to enforce sanitary rules postulated by the WHO and also embrace vaccine uptake in the country. We also encourage people in the country to always behave responsibly with regards to face-mask wearing, social distancing and so on., in order to stop avoidable infections in the country.**

Keywords: ANN, COVID-19, Forecasting.

I. INTRODUCTION

The index case of COVID-19 occurred in late December 2019 in Wuhan in China (Zhu *et al*., 2020). Since then, cases have been exported to other Chinese cities, as well as internationally, highlighting concern of a global outbreak (Wu *et al*., 2020). COVID-19 symptoms include dry cough, fever, difficulty of breathing, and in some cases diarrhoea (Huang *et al*., 2020). There is need for a predictive model for the pandemic in Switzerland in order to enhance planning and strategizing by public health policy makers. In an attempt to help relevant authorities in better managing the pandemic, the study seeks to model and forecast daily COVID-19 cases in Switzerland.

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 new COVID-19 cases in Switzerland.

Data Issues

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

III. FINDINGS OF THE STUDY

ANN Model Summary

Table 1: ANN model summary

Variable	S
Observations	438 (After Adjusting Endpoints)
Neural Network Architecture:	
Input Layer Neurons	12
Hidden Layer Neurons	12
Output Layer Neurons	1

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Activation Function	Hyperbolic Tangent Function
Back Propagation Learning:	
Learning Rate	0.005
Momentum	0.05
Criteria:	
Error	0.045368
MSE	305404.433983
MAE	347.055561

Residual Analysis for the Applied Model

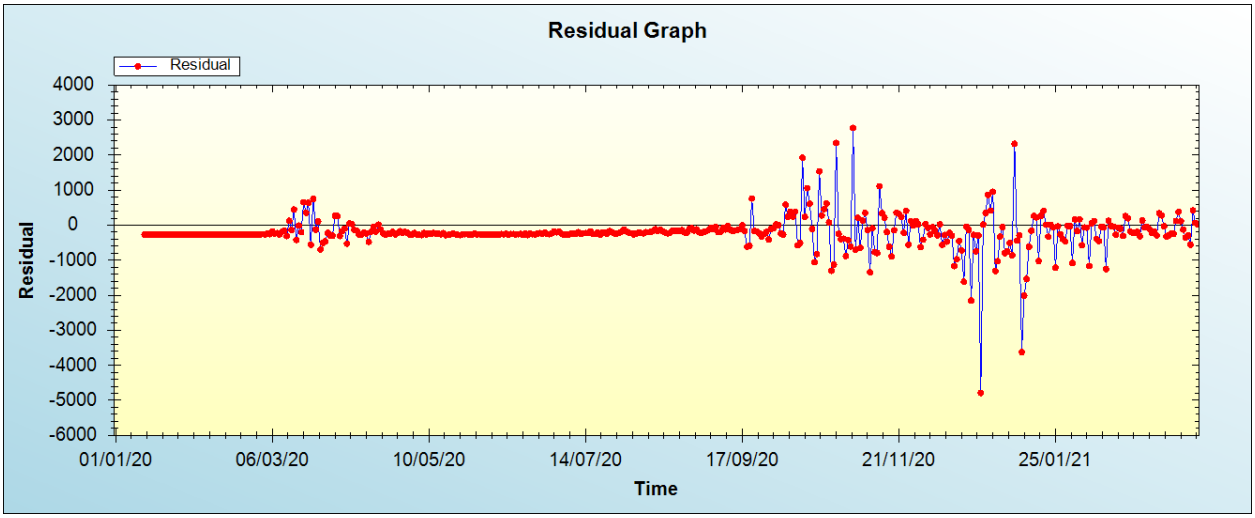

Figure 1: Residual analysis

In-sample Forecast for S

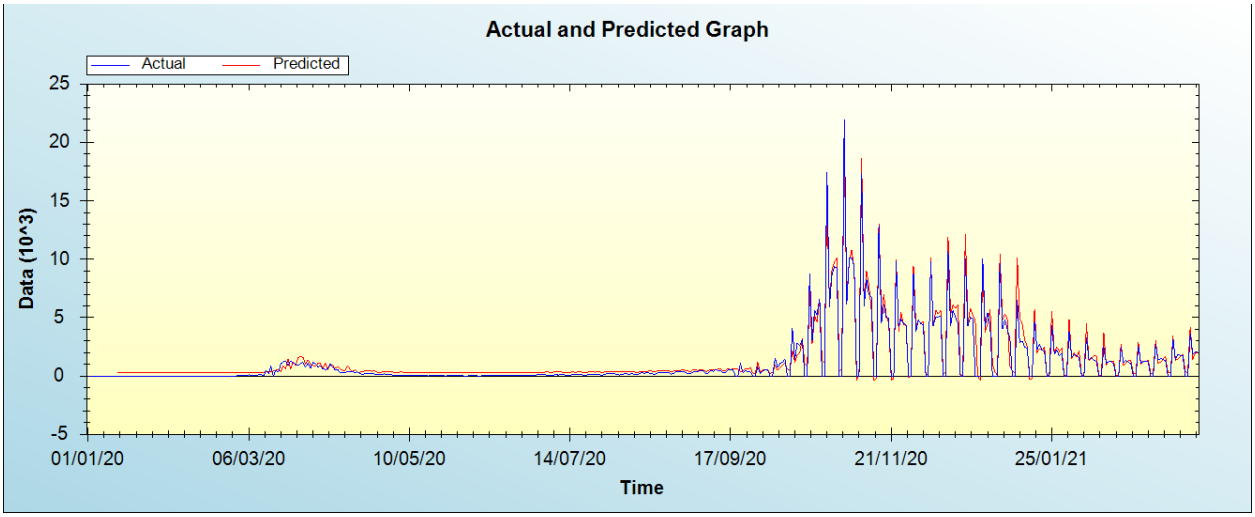

Figure 2: In-sample forecast for the S series

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

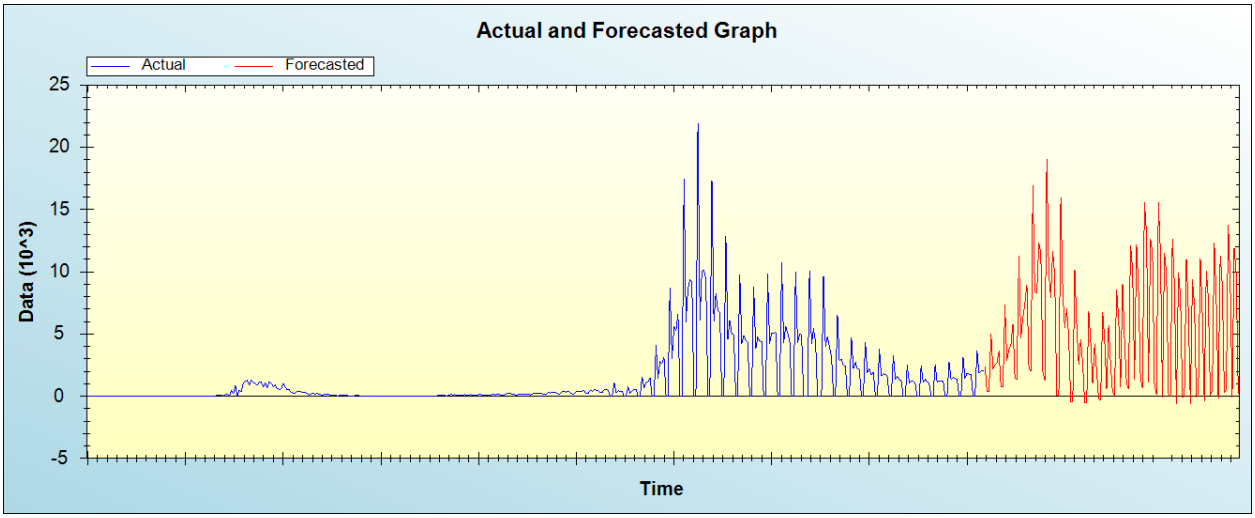

Figure 3: Out-of-sample forecast for S: actual and forecasted graph

Out-of-Sample Forecast for S: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Date	Forecasts
26/03/21	2383.3913
27/03/21	372.4125
28/03/21	364.0047
29/03/21	5013.6491
30/03/21	2163.9126
31/03/21	2550.1734
01/04/21	2726.7242
02/04/21	3626.0416
03/04/21	789.4006
04/04/21	745.7947
05/04/21	7306.3419
06/04/21	2878.6071
07/04/21	3815.6583
08/04/21	4101.6957
09/04/21	5802.8543
10/04/21	1445.9540
11/04/21	1377.7577
12/04/21	11282.9965
13/04/21	4685.3440
14/04/21	6281.7693
15/04/21	7458.4201
16/04/21	8981.7223
17/04/21	2352.5867
18/04/21	2004.3733
19/04/21	16900.0671
20/04/21	8345.9424
21/04/21	8299.7538
22/04/21	12307.6360
23/04/21	11486.0904
24/04/21	2010.8226
25/04/21	1294.7619
26/04/21	19063.1832
27/04/21	9896.8567
28/04/21	7918.9841
29/04/21	11636.6243
30/04/21	9661.9538
01/05/21	93.8031

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02/05/21	79.7456
03/05/21	15928.2534
04/05/21	8351.3209
05/05/21	5534.4023
06/05/21	7009.1758
07/05/21	4911.1519
08/05/21	-440.8778
09/05/21	-425.4081
10/05/21	10176.6677
11/05/21	5579.3208
12/05/21	2550.3691
13/05/21	4552.5620
14/05/21	2624.5022
15/05/21	-499.6923
16/05/21	-541.1028
17/05/21	6852.3270
18/05/21	4370.6313
19/05/21	1003.5660
20/05/21	4191.7019
21/05/21	2010.0366
22/05/21	-251.4423
23/05/21	-327.8469
24/05/21	6741.2697
25/05/21	4521.1921
26/05/21	559.6765
27/05/21	5719.1518
28/05/21	2561.1817
29/05/21	318.6423
30/05/21	79.7381
31/05/21	8575.6148
01/06/21	6289.4651
02/06/21	756.4768
03/06/21	9017.4024
04/06/21	4385.7316
05/06/21	1023.5357
06/06/21	592.2124
07/06/21	12099.9578
08/06/21	10270.9232
09/06/21	1318.7569
10/06/21	12165.2505
11/06/21	8464.1969
12/06/21	1424.3756
13/06/21	652.1899
14/06/21	15585.5176
15/06/21	13150.6607
16/06/21	1112.4772
17/06/21	12663.5024
18/06/21	11536.5166
19/06/21	1020.7707
20/06/21	137.8489
21/06/21	15542.5374
22/06/21	11706.6492
23/06/21	-97.2176
24/06/21	11502.4455
25/06/21	9944.6032
26/06/21	211.6493
27/06/21	-23.9034
28/06/21	12650.5834
29/06/21	8961.3485
30/06/21	-622.9919
01/07/21	9863.9022
02/07/21	8057.6833
03/07/21	-116.9509
04/07/21	64.4019

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05/07/21	10967.0372
06/07/21	6887.3940
07/07/21	-611.0861
08/07/21	9338.7307
09/07/21	7424.0380
10/07/21	-88.2385
11/07/21	246.3188
12/07/21	11048.2919
13/07/21	6570.7612
14/07/21	-400.2306
15/07/21	10058.2539
16/07/21	7846.1834
17/07/21	114.2724
18/07/21	436.1261
19/07/21	12320.6931
20/07/21	7670.8115
21/07/21	-188.2417
22/07/21	11259.0124
23/07/21	8952.1036
24/07/21	275.6067
25/07/21	475.4238
26/07/21	13756.8852
27/07/21	9116.0349
28/07/21	-134.8838
29/07/21	11864.4562
30/07/21	9862.4416
31/07/21	255.0233

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 Switzerland are likely to remain very high over the out-of-sample period.

IV. CONCLUSION & RECOMMENDATIONS

Declared as a pandemic by WHO, in January 2020, COVID-19 is currently the most troublesome disease in the world, affecting everyone. Switzerland also, just like other countries around the world, was not able to escape from the scourge. Today, the virus is now a big threat in the country. It has become fundamental for us to model and forecast the trends of the pandemic in the country in order to inform policy. The study relied on an ANN model and established that daily COVID-19 cases in Switzerland are likely to remain significantly high over the out-of-sample period. The government should continue to enforce sanitary rules postulated by the WHO and also embrace vaccine uptake in the country. We also encourage people in the country to always behave responsibly with regards to face-mask wearing, social distancing and so on., in order to stop avoidable infections in the country.

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