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Forecasting Covid-19 New Cases in Uzbekistan

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***Abstract* - COVID-19 continues to significantly threaten human lives and economies around the globe. In this study, the ANN approach was applied to analyze COVID-19 cases in Uzbekistan. This study is based on monthly new cases of COVID-19 in Uzbekistan 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 reveal that the model is stable in forecasting COVID-19 cases in Uzbekistan. It is projected that daily COVID-19 cases in Uzbekistan are likely to decline significantly over the out-of-sample period. The government should ensure the continued compliance to control and preventive COVID-19 measures such as social distancing, quarantine, isolation, face-mask wearing and so on, as well as vaccinations, in consistency with WHO guidelines on COVID-19 mitigation strategies.**

Keywords: ANN, COVID-19, Forecasting.

I. INTRODUCTION

COVID-19 was first reported in Wuhan, Hubei province, China, in late December 2019 (Yang *et al*., 2020). The infection generally targets the human respiratory system and is primarily transmitted by respiratory droplets and close contact with an infected person (Rothan & Byrareddy, 2020). Common signs of COVID-19 include fever, shortness of breath and dry coughs. Uncommon symptoms of COVID-19 include muscle pain, mild diarrhoea, abdominal pain, sputum production, loss of smell and sore throat (Wang *et al*., 2020; Hu *et al*., 2020; Tao *et al*., 2020). Most COVID-19 patients experience mild to moderate respiratory illness, and they recover without requiring special treatment (Guan *et al*., 2020). In this paper, we propose the use a basic Artificial Neural Network (ANN) model, a deep learning approach; that can adequately and accurate forecast COVID-19 cases in Uzbekistan.

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 Uzbekistan.

Data Issues

This study is based on daily new cases of COVID-19 in Uzbekistan 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	UZ
Observations	438 (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:	

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Learning Rate	0.005
Momentum	0.05
Criteria:	
Error	0.126948
MSE	4786.791338
MAE	45.683877

Residual Analysis for the Applied Model

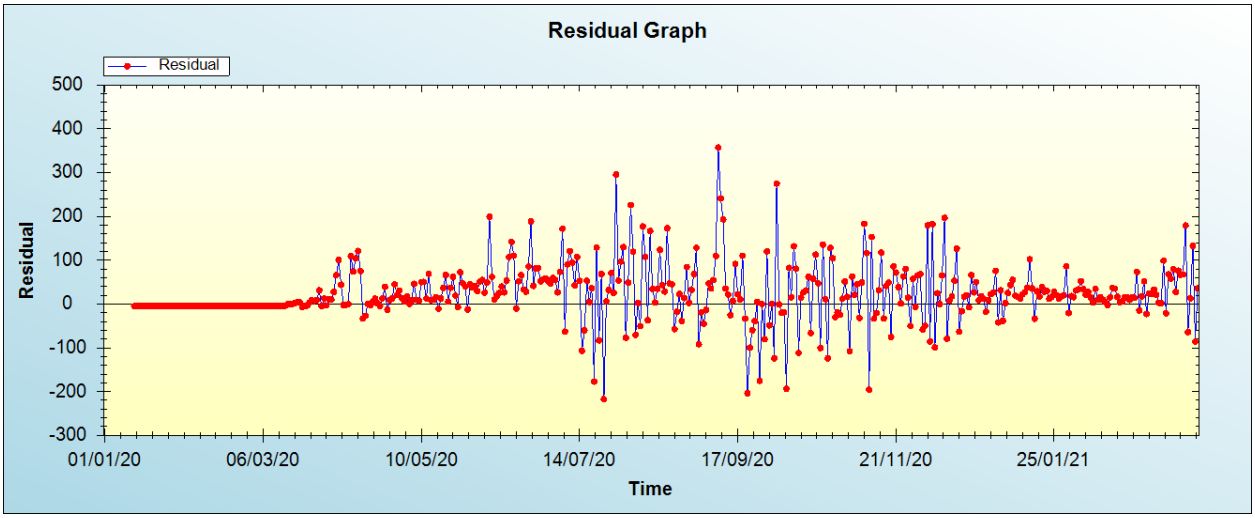

Figure 1: Residual analysis

In-sample Forecast for UZ

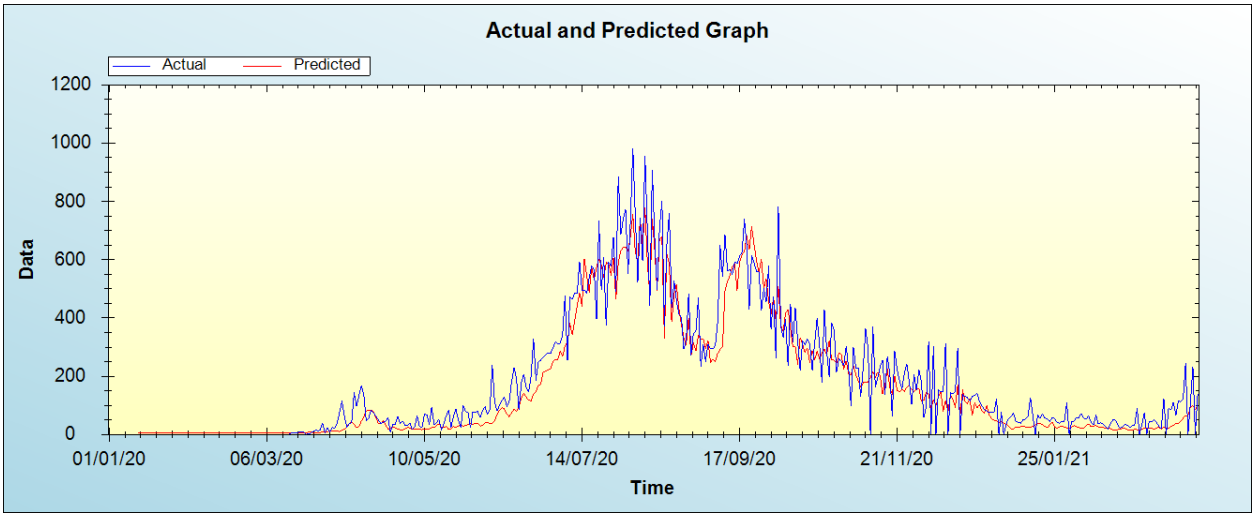

Figure 2: In-sample forecast for the UZ series

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

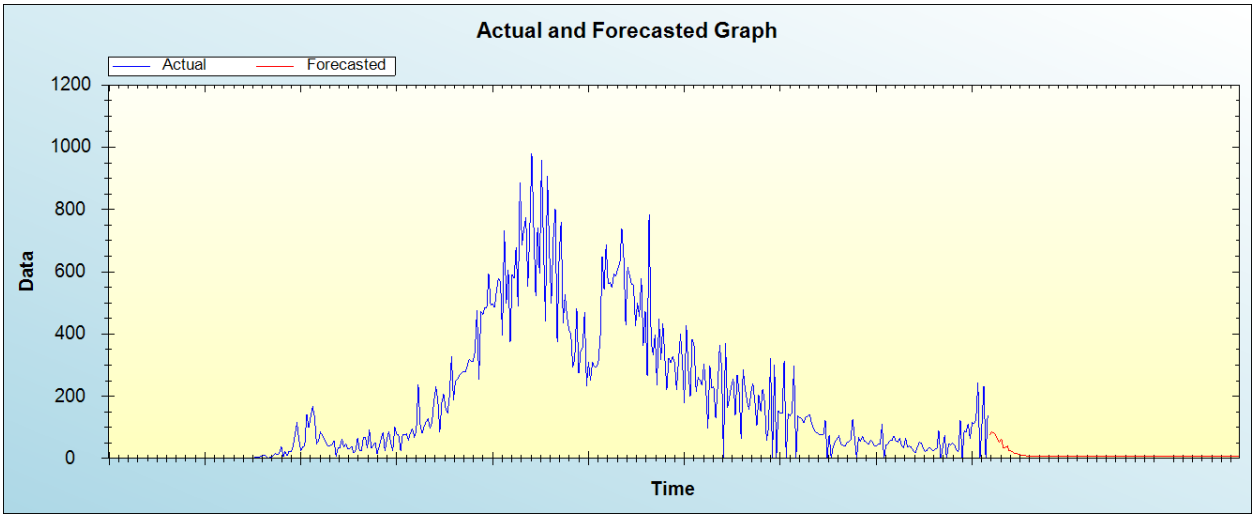

Figure 3: Out-of-sample forecast for UZ: actual and forecasted graph

Out-of-Sample Forecast for UZ: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Date	Forecasts
26/03/21	75.5676
27/03/21	84.2166
28/03/21	83.1267
29/03/21	75.9732
30/03/21	60.9459
31/03/21	53.0565
01/04/21	62.5298
02/04/21	33.5537
03/04/21	34.7386
04/04/21	40.4788
05/04/21	23.9166
06/04/21	23.9136
07/04/21	19.0045
08/04/21	14.8181
09/04/21	14.9180
10/04/21	13.3644
11/04/21	9.6625
12/04/21	10.0596
13/04/21	9.6662
14/04/21	8.2256
15/04/21	8.1099
16/04/21	7.5486
17/04/21	7.3864
18/04/21	7.4950
19/04/21	7.2443
20/04/21	7.0276
21/04/21	7.1673
22/04/21	7.1297
23/04/21	7.0900
24/04/21	7.0953
25/04/21	7.0726
26/04/21	7.1118
27/04/21	7.1333
28/04/21	7.1130
29/04/21	7.1155
30/04/21	7.1367
01/05/21	7.1388

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02/05/21	7.1421
03/05/21	7.1417
04/05/21	7.1436
05/05/21	7.1505
06/05/21	7.1515
07/05/21	7.1494
08/05/21	7.1507
09/05/21	7.1525
10/05/21	7.1529
11/05/21	7.1529
12/05/21	7.1524
13/05/21	7.1528
14/05/21	7.1533
15/05/21	7.1531
16/05/21	7.1528
17/05/21	7.1529
18/05/21	7.1530
19/05/21	7.1530
20/05/21	7.1529
21/05/21	7.1529
22/05/21	7.1529
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24/05/21	7.1529
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05/07/21	7.1529
06/07/21	7.1529
07/07/21	7.1529
08/07/21	7.1529
09/07/21	7.1529
10/07/21	7.1529
11/07/21	7.1529
12/07/21	7.1529
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25/07/21	7.1529
26/07/21	7.1529
27/07/21	7.1529
28/07/21	7.1529
29/07/21	7.1529
30/07/21	7.1529
31/07/21	7.1529

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 Uzbekistan are likely to decline significantly over the out-of-sample period.

IV. CONCLUSION & RECOMMENDATIONS

Using daily observations of COVID-19 cases in Uzbekistan, this study employed the ANN (12, 12, 1) model to come up with forecasts. It is projected that daily COVID-19 cases in Uzbekistan are likely to decline significantly over the out-of-sample period. The government should ensure the continued compliance to control and preventive COVID-19 measures such as social distancing, quarantine, isolation, face-mask wearing and so on., as well as vaccinations, in consistency with WHO guidelines on COVID-19 mitigation strategies.

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