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Forecasting Covid-19 New Cases in Burma

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***Abstract* - In this study, the ANN approach was applied to analyze COVID-19 new cases in Burma. The employed data covers the period 1 January 2020 – 25 March 2021 and the out-of-sample period ranges over the period 26 March – 31 July 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 cases in Burma are likely to hover around an equilibrium case volume of 50 cases per day over the out-of-sample period. Amongst other suggested policy directions, there is need for the government of Burma to ensure adherence to safety guidelines while continuing to create awareness about the COVID-19 pandemic.**

Keywords: ANN, COVID-19, Forecasting.

I. INTRODUCTION

Having started in Wuhan, China, in late December 2019 (Hernandez-Matamoros *et al*., 2020), COVID-19 is an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (Katris, 2020). The first case outside of China was reported in Thailand on January 13, 2020 (Hui *et al*., 2020). Since then, this ongoing outbreak has spread to the rest of the world. The symptoms of COVID-19 infection include fever, cough, shortness of breath, and diarrhoea. In more severe cases, COVID-19 can cause pneumonia and even death (WHO, 2020). COVID-19 eruption has not only disrupted the global healthcare networks but also it has demised the world economy (Hazarika & Gupta, 2020). In Burma, the first case was confirmed on the 23rd of March 2020 in Tedim, Chin State. Forecasting is a very essential (Fong *et al*., 2020) and yet challenging task (Rizk-Allah & Hassanien, 2020), especially for COVID-19. Accurate modelling and future forecast of daily number of confirmed COVID-19 cases can help the treatment system in providing services for the new patients (Katris, 2020). In this paper, we seek to model and forecast COVID-19 cases in Burma using Artificial Neural Networks (ANNs).

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 Burma.

Data Issues

This study is based on daily new cases of COVID-19 in Burma 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	BM
Observations	438 (After Adjusting Endpoints)
Neural Network Architecture:	
Input Layer Neurons	12
Hidden Layer Neurons	12

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Output Layer Neurons	1
Activation Function	Hyperbolic Tangent Function
Back Propagation Learning:	
Learning Rate	0.005
Momentum	0.05
Criteria:	
Error	0.076711
MSE	8458.076495
MAE	55.460177

Residual Analysis for the Applied Model

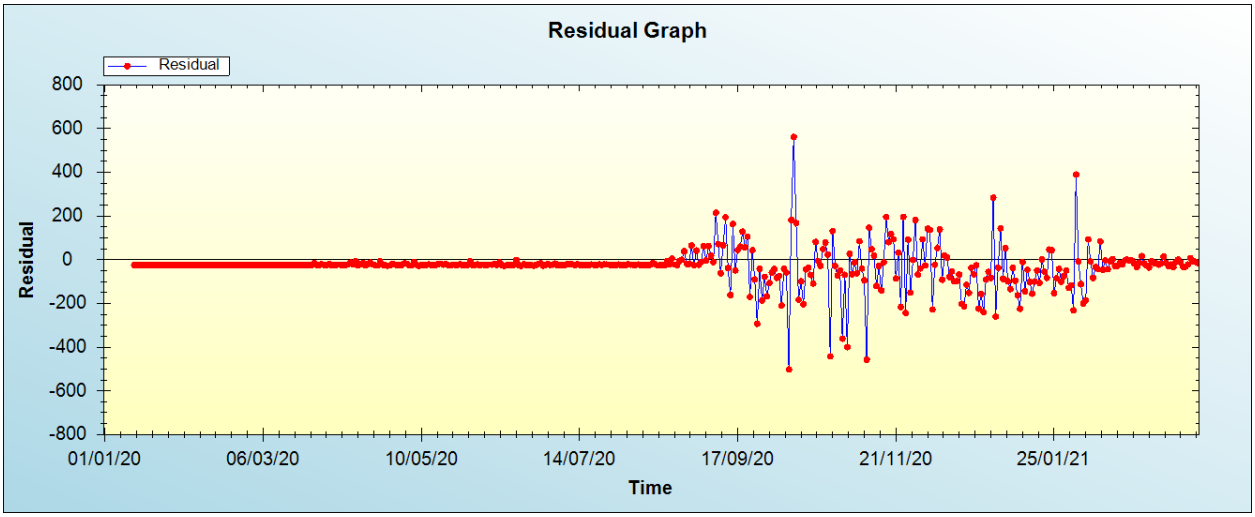

Figure 1: Residual analysis

In-sample Forecast for BM

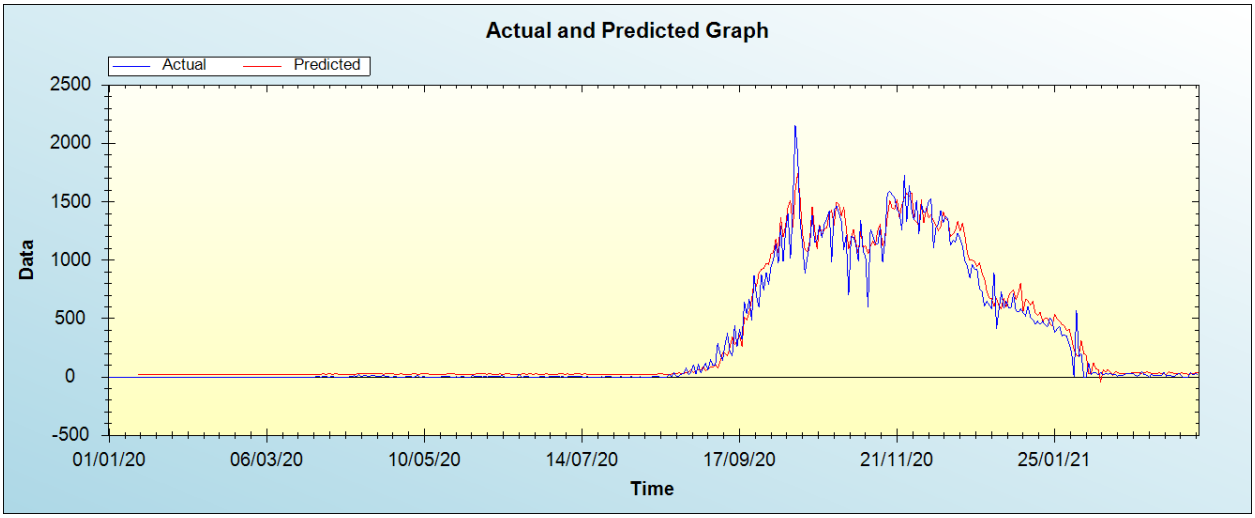

Figure 2: In-sample forecast for the BM series

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

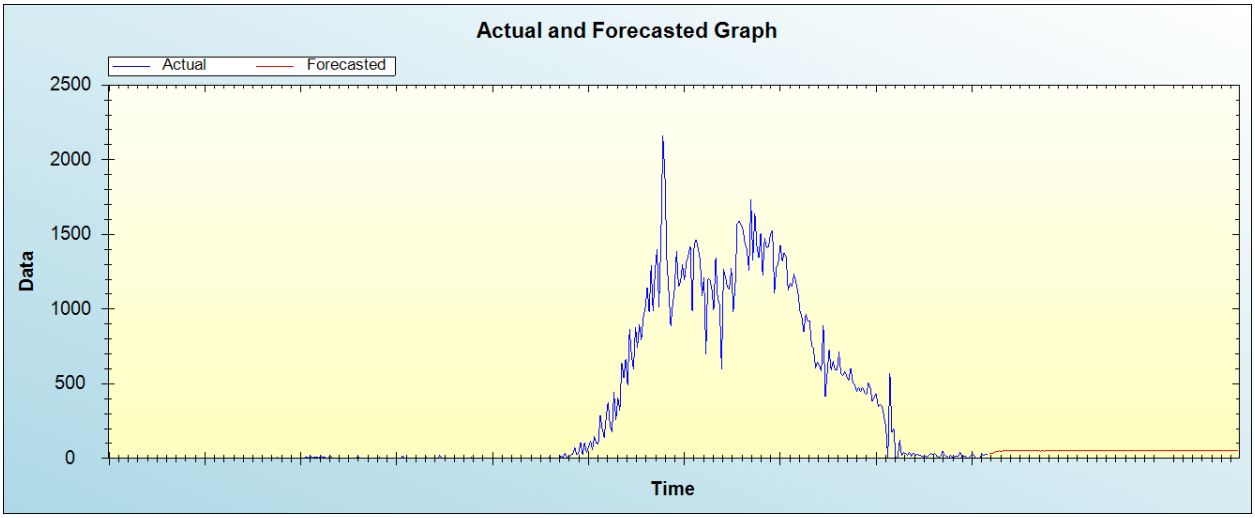

Figure 3: Out-of-sample forecast for BM: actual and forecasted graph

Out-of-Sample Forecast for BM: Forecasts only

Table 2: Tabulated out-of-sample forecasts

Day/Month/Year	Forecasts
26/03/21	32.5324
27/03/21	31.8183
28/03/21	37.4524
29/03/21	49.0312
30/03/21	46.8871
31/03/21	50.8212
01/04/21	44.0912
02/04/21	54.2045
03/04/21	49.4177
04/04/21	54.0055
05/04/21	52.7267
06/04/21	54.5305
07/04/21	53.3626
08/04/21	50.4523
09/04/21	53.4713
10/04/21	51.0929
11/04/21	53.6950
12/04/21	50.0317
13/04/21	52.7664
14/04/21	50.3352
15/04/21	50.8685
16/04/21	50.2886
17/04/21	50.4503
18/04/21	51.1297
19/04/21	49.5595
20/04/21	50.8821
21/04/21	49.5046
22/04/21	50.7906
23/04/21	49.4967
24/04/21	50.5597
25/04/21	50.1063
26/04/21	50.2139
27/04/21	50.2418
28/04/21	49.9681
29/04/21	50.5797
30/04/21	49.8963
01/05/21	50.5892

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02/05/21	50.0221
03/05/21	50.5611
04/05/21	50.1099
05/05/21	50.3725
06/05/21	50.3296
07/05/21	50.2760
08/05/21	50.4264
09/05/21	50.1825
10/05/21	50.4976
11/05/21	50.1704
12/05/21	50.4489
13/05/21	50.2197
14/05/21	50.4085
15/05/21	50.2871
16/05/21	50.3173
17/05/21	50.3520
18/05/21	50.2712
19/05/21	50.3821
20/05/21	50.2435
21/05/21	50.3919
22/05/21	50.2581
23/05/21	50.3626
24/05/21	50.2827
25/05/21	50.3338
26/05/21	50.3173
27/05/21	50.3008
28/05/21	50.3409
29/05/21	50.2872
30/05/21	50.3493
31/05/21	50.2832
01/06/21	50.3448
02/06/21	50.2958
03/06/21	50.3308
04/06/21	50.3097
05/06/21	50.3166
06/06/21	50.3240
07/06/21	50.3051
08/06/21	50.3309
09/06/21	50.3022
10/06/21	50.3318
11/06/21	50.3041
12/06/21	50.3268
13/06/21	50.3109
14/06/21	50.3199
15/06/21	50.3174
16/06/21	50.3138
17/06/21	50.3225
18/06/21	50.3104
19/06/21	50.3239
20/06/21	50.3104
21/06/21	50.3228
22/06/21	50.3126
23/06/21	50.3198
24/06/21	50.3159
25/06/21	50.3167
26/06/21	50.3185
27/06/21	50.3145
28/06/21	50.3201
29/06/21	50.3138
30/06/21	50.3200
01/07/21	50.3144
02/07/21	50.3190
03/07/21	50.3158
04/07/21	50.3175

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05/07/21	50.3172
06/07/21	50.3163
07/07/21	50.3182
08/07/21	50.3156
09/07/21	50.3185
10/07/21	50.3156
11/07/21	50.3182
12/07/21	50.3161
13/07/21	50.3176
14/07/21	50.3168
15/07/21	50.3169
16/07/21	50.3174
17/07/21	50.3165
18/07/21	50.3177
19/07/21	50.3163
20/07/21	50.3176
21/07/21	50.3165
22/07/21	50.3174
23/07/21	50.3168
24/07/21	50.3171
25/07/21	50.3171
26/07/21	50.3168
27/07/21	50.3173
28/07/21	50.3167
29/07/21	50.3173
30/07/21	50.3167
31/07/21	50.3173

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 Burma are likely to hover around an equilibrium case volume of 50 cases per day over the out-of-sample period.

IV. CONCLUSION AND POLICY RECOMMENDATIONS

Researchers around the world continue to apply various prediction models for COVID-19 to make informed decisions and impose appropriate control measures. In this piece of work, we used a basic ANN (12, 12, 1) model to analyze COVID-19 daily cases in Burma. We find that the pandemic is far from ending in the country. We advise the relevant authorities in Burma to continue strictly enforcing WHO recommended control and prevention measures.

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