

# Forecasting Covid-19 New Cases in Malaysia

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**Abstract -** In this study, the ANN approach was applied to analyze COVID-19 new cases in Malaysia. 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 the pandemic may disappear in the country around late April 2021. Amongst other suggested policy directions, there is need for the government of Malaysia to ensure adherence to safety guidelines while continuing to create awareness about the COVID-19 pandemic.

**Keywords:** ANN, COVID-19, Forecasting.

## I. INTRODUCTION

In December 2019, a new coronavirus was detected in Wuhan, China and was then declared a public health emergency by WHO (WHO, 2020). The first case of COVID-19 in Malaysia was detected on the 25th of January 2020 in travelers who were returning from China via Singapore (Pfordten & Ahmad, 2020). The Malaysian government was well prepared to tackle the COVID-19 outbreak. During the first wave of COVID-19 virus the authorities identified health facilities that were going to handle COVID-19 patients. Enforcement of public health measures such as wearing face masks, social distancing, contact tracing, isolation and treatment of cases was done (Habibu, 2020; Kit, 2020). The second wave was witnessed from the 27th of February 2020 to March 2020 and the government had to step up efforts to control the spread of the virus. According to WHO situation report April 2021, as of 4 April 2021 the country had reported total confirmed cases of 350 959. Several models have been applied to model the evolution of the infectious diseases and such models include logistic growth model, SIR model, and natural growth model (Roda et al, 2020; Raissi et al, 2019; Nsoesie et al, 2014). In this study we apply the artificial neural approach to model and predict daily COVID-19 cases in Malaysia. The findings of this study are expected to highlight the likely future trends of the SARS-COV2 virus and facilitate planning, decision making and allocation of resources towards prevention and control of the epidemic.

## II. LITERATURE REVIEW

Mahmud & Lim (2020) applied the SEIR model to forecast COVID-19 trends in Malaysia using data from March 17 to 27, 2020. Based on several predetermined assumptions, the results of the analyses showed that after the implementation of the 14-day MCO from March 18 to 31, 2020, the epidemic in Malaysia would peak approximately at the end of April 2020 and expected to subside by the first week of July 2020. The MCO would “flatten the epidemic curve” but will prolong the duration of the epidemic. In another study, Singh et al (2020) forecasted daily COVID-19 cases in Malaysia using the ARIMA models using historical data from 22 January 2020 to 31 March 2020. The optimal model was the ARIMA (0,1,0) (random walk model). The results indicated that daily confirmed COVID-19 cases would decline over the out of sample period ending 1 May 2020. A similar study was also performed by Aidid et al (2020) who forecasted COVID-19 incidence in Malaysia using ARIMA and expert Modeler based on the movement control order. All models showed static cases for each MCO 7-day prediction. For prediction until 12 May, the third MCO time frame showed the best model fit for both techniques. Al Sayed et al (2020) outlined in detail the study in which they predicted the Epidemic peak in Malaysia using the SEIR compartmental model with the incorporation of mortality rates. The infection rate was estimated using the Genetic Algorithm (GA), while the Adaptive Neuro-Fuzzy Inference System (ANFIS) model was used to provide short-time forecasting of the number of infected cases. The results show that the estimated infection rate is  $0.228 \pm 0.013$ , while the basic reproductive number is  $2.28 \pm 0.13$ . The epidemic peak of COVID-19 in Malaysia could be reached on 26 July 2020, with an uncertain period of 30 days (12 July–11 August).

## III. 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 Malaysia.

**Data Issues**

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

**IV. FINDINGS OF THE STUDY**

**ANN Model Summary**

Table 1: ANN model summary

Variable	M
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:	
Learning Rate	0.005
Momentum	0.05
Criteria:	
Error	0.079556
MSE	64093.053768
MAE	149.225775

*Residual Analysis for the Applied Model*

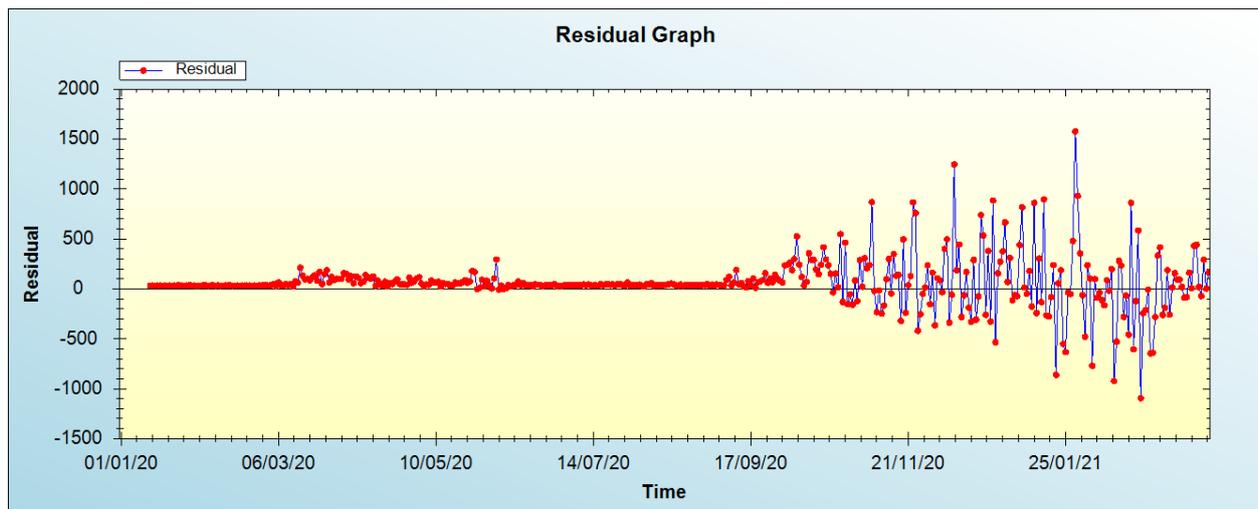


Figure 1: Residual analysis

*In-sample Forecast for M*

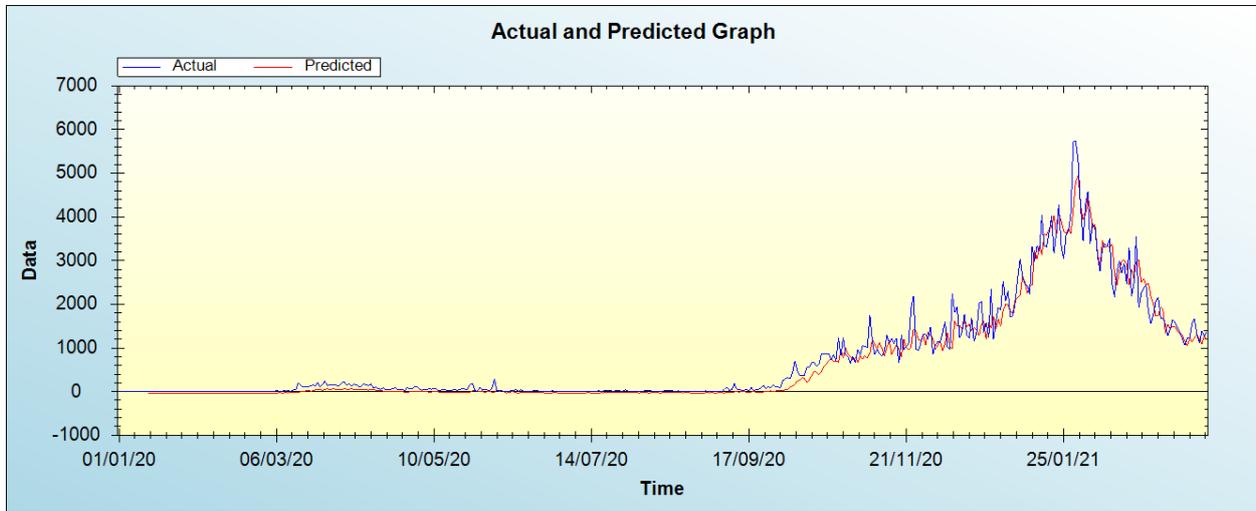


Figure 2: In-sample forecast for the M series

*Out-of-Sample Forecast for M: Actual and Forecasted Graph*

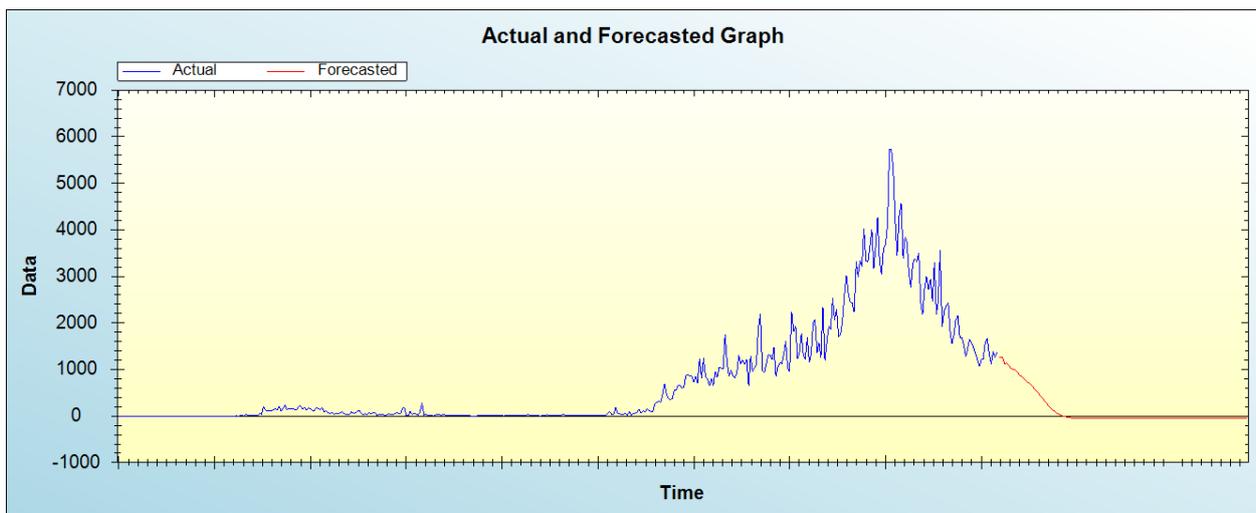


Figure 3: Out-of-sample forecast for M: actual and forecasted graph

*Out-of-Sample Forecast for M: Forecasts only*

Table 2: Tabulated out-of-sample forecasts

Day/Month/Year	Forecasts
26/03/21	1252.8981
27/03/21	1265.9365
28/03/21	1248.2215
29/03/21	1118.6808
30/03/21	1135.1656
31/03/21	1086.5212
01/04/21	1022.6552
02/04/21	1006.9553
03/04/21	1003.3760
04/04/21	957.4695
05/04/21	909.1309
06/04/21	855.1227
07/04/21	840.7008

08/04/21	798.5162
09/04/21	745.7357
10/04/21	722.6669
11/04/21	690.9320
12/04/21	642.7689
13/04/21	589.6989
14/04/21	548.1161
15/04/21	503.7653
16/04/21	447.7840
17/04/21	391.1795
18/04/21	346.5191
19/04/21	297.2518
20/04/21	241.4441
21/04/21	193.4742
22/04/21	154.2310
23/04/21	116.0735
24/04/21	80.0171
25/04/21	52.5306
26/04/21	31.4408
27/04/21	12.0479
28/04/21	-4.6054
29/04/21	-16.1219
30/04/21	-24.7625
01/05/21	-32.5275
02/05/21	-38.5332
03/05/21	-42.3497
04/05/21	-45.2192
05/05/21	-47.8356
06/05/21	-49.7076
07/05/21	-50.7850
08/05/21	-51.6430
09/05/21	-52.4520
10/05/21	-52.9582
11/05/21	-53.2119
12/05/21	-53.4550
13/05/21	-53.6924
14/05/21	-53.8145
15/05/21	-53.8647
16/05/21	-53.9345
17/05/21	-54.0023
18/05/21	-54.0250
19/05/21	-54.0315
20/05/21	-54.0534
21/05/21	-54.0725
22/05/21	-54.0741
23/05/21	-54.0741
24/05/21	-54.0817
25/05/21	-54.0867
26/05/21	-54.0852
27/05/21	-54.0850
28/05/21	-54.0879
29/05/21	-54.0890
30/05/21	-54.0879
31/05/21	-54.0879
01/06/21	-54.0890
02/06/21	-54.0891
03/06/21	-54.0886
04/06/21	-54.0887
05/06/21	-54.0891
06/06/21	-54.0891
07/06/21	-54.0888
08/06/21	-54.0889
09/06/21	-54.0891
10/06/21	-54.0890

11/06/21	-54.0889
12/06/21	-54.0890
13/06/21	-54.0890
14/06/21	-54.0890
15/06/21	-54.0890
16/06/21	-54.0890
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25/07/21	-54.0890
26/07/21	-54.0890
27/07/21	-54.0890
28/07/21	-54.0890
29/07/21	-54.0890
30/07/21	-54.0890
31/07/21	-54.0890

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 the pandemic may disappear in the country around late April 2021.

### V. CONCLUSION AND POLICY RECOMMENDATIONS

The COVID-19 outbreak has triggered research interest from many researchers around the World. Application of machine learning methods in time series forecasting of emerging infectious diseases such COVID-19 is proving to be fruitful since these techniques are capable of modeling nonlinear data and producing very accurate results. The Malaysian government has implemented robust measures to control the COVID-19 outbreak therefore it is important to model and forecast daily COVID-19

cases in order to assess the impact of the mitigation measures. The results of the study indicate that the pandemic may disappear in the country around late April 2021.

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