

# Forecasting Covid-19 New Cases in Albania

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**Abstract - As COVID-19 rages throughout the globe, reliable modeling and forecasting of the dynamics thereof is critical. In this research work, the ANN technique was applied to forecast daily COVID-19 cases in Albania. This study is based on daily new cases of COVID-19 in Albania 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 employed model suggest that the model is stable. It is projected that daily COVID-19 cases in Albania are likely to remain very high over the out-of-sample period. We strongly recommend that the government of Albania should continue to ensure vaccine uptake and strict adherence to lock-down measures while creating awareness about the COVID-19 pandemic.**

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

## I. INTRODUCTION

In mid to late December 2019, Chinese authorities in Wuhan reported a novel pneumonia caused by a corona virus disease (COVID-19) which has spread domestically and internationally since then (Huang *et al.*, 2020; Zhu *et al.*, 2020). COVID-19 is highly infectious and its main clinical symptoms fever, fatigue or myalgia, dry cough and shortness of breath or difficulty breathing (Sohrabi *et al.*, 2020; Nicola *et al.*, 2020; Tian *et al.*, 2020; Wang *et al.*, 2020). Due to fast transmission of COVID-19, the incidence and mortality rates are rapidly growing worldwide (Guan *et al.*, 2020). With the rapid spread of the COVID-19 outbreak, people have been highly concerned by its spread, severity and tremendous negative effects on public health and society (Yildirim & Guler, 2020). Therefore, it is necessary to come up with forecasting and control models for the pandemic. The purpose of this study is to analyze the trends of daily COVID-19 cases in Albania and consequently make predictions for the future trends.

## II. METHODOLOGY

The Artificial Neural Networks (ANN) method, 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 Albania.

### Data Issues

This study is based on daily new cases of COVID-19 in Albania 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                     | A                               |
| 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                      | 0.095814                    |
| MSE                        | 4349.619878                 |
| MAE                        | 43.622630                   |

Residual Analysis for the Applied Model

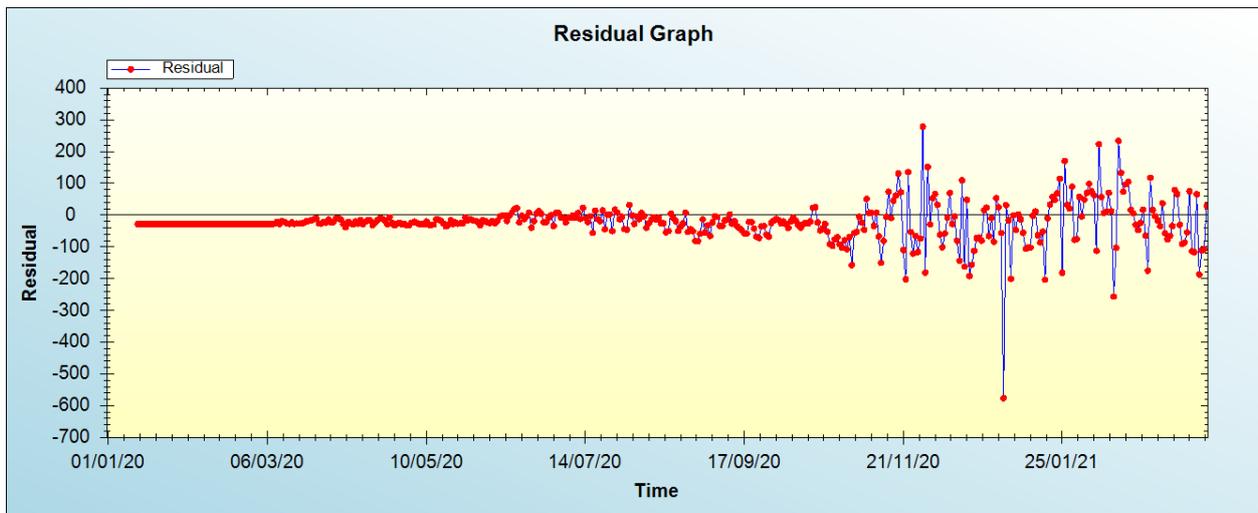


Figure 1: Residual analysis

In-sample Forecast for A

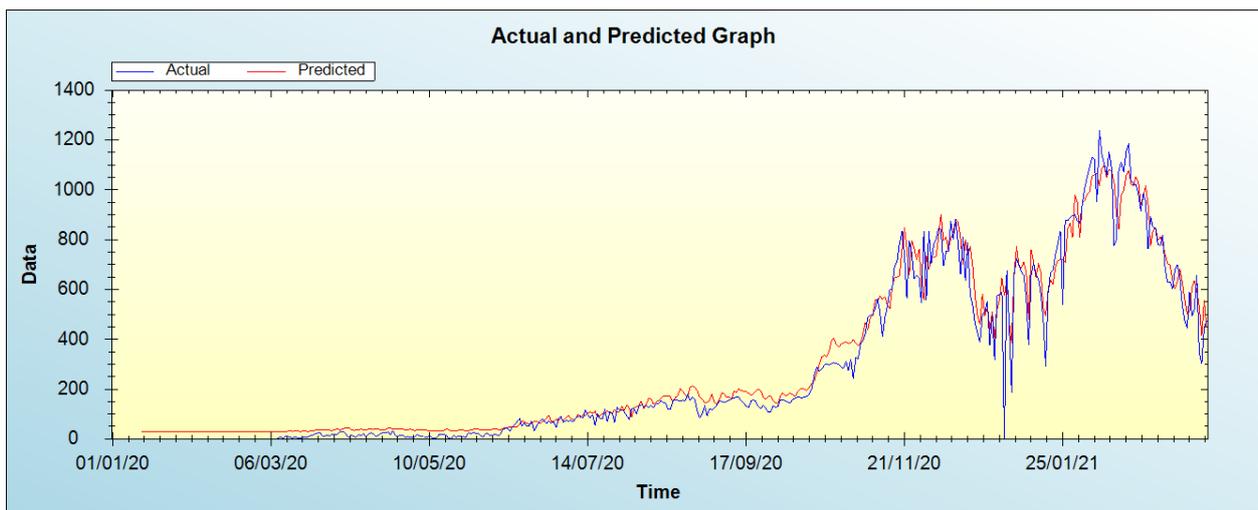


Figure 2: In-sample forecast for the A series

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

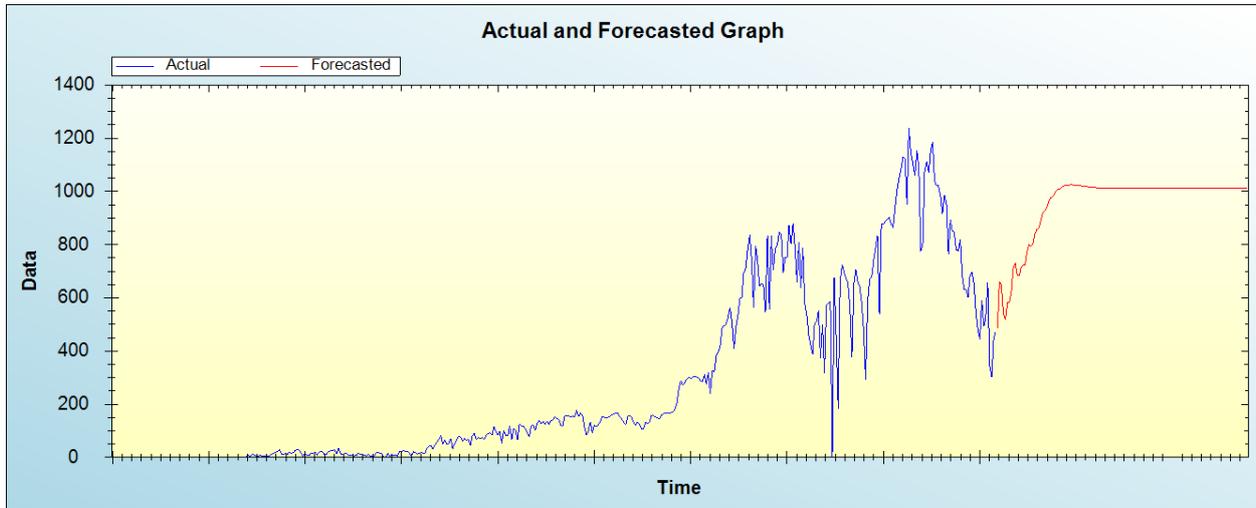


Figure 3: Out-of-sample forecast for A: actual and forecasted graph

Out-of-Sample Forecast for A: Forecasts only

Table 2: Tabulated out-of-sample forecasts

| Day/Month/Year | Forecasts |
|----------------|-----------|
| 26/03/21       | 486.4450  |
| 27/03/21       | 661.4199  |
| 28/03/21       | 647.3310  |
| 29/03/21       | 539.1580  |
| 30/03/21       | 520.2208  |
| 31/03/21       | 581.9065  |
| 01/04/21       | 583.4067  |
| 02/04/21       | 619.4069  |
| 03/04/21       | 712.3250  |
| 04/04/21       | 730.2422  |
| 05/04/21       | 684.9168  |
| 06/04/21       | 681.9056  |
| 07/04/21       | 716.0444  |
| 08/04/21       | 721.3224  |
| 09/04/21       | 724.8377  |
| 10/04/21       | 772.2911  |
| 11/04/21       | 801.5822  |
| 12/04/21       | 794.4167  |
| 13/04/21       | 804.1496  |
| 14/04/21       | 839.2306  |
| 15/04/21       | 857.2387  |
| 16/04/21       | 861.8217  |
| 17/04/21       | 889.0603  |
| 18/04/21       | 917.4540  |
| 19/04/21       | 926.2370  |
| 20/04/21       | 936.5853  |
| 21/04/21       | 961.1000  |
| 22/04/21       | 976.1508  |
| 23/04/21       | 979.3064  |
| 24/04/21       | 989.9957  |
| 25/04/21       | 1003.7194 |
| 26/04/21       | 1007.8201 |
| 27/04/21       | 1009.0808 |
| 28/04/21       | 1016.8079 |
| 29/04/21       | 1021.7649 |
| 30/04/21       | 1020.6385 |
| 01/05/21       | 1021.3167 |

|          |           |
|----------|-----------|
| 02/05/21 | 1024.7678 |
| 03/05/21 | 1024.6659 |
| 04/05/21 | 1022.3255 |
| 05/05/21 | 1022.6982 |
| 06/05/21 | 1023.1906 |
| 07/05/21 | 1021.2285 |
| 08/05/21 | 1019.4230 |
| 09/05/21 | 1019.4517 |
| 10/05/21 | 1018.6459 |
| 11/05/21 | 1016.7341 |
| 12/05/21 | 1015.8544 |
| 13/05/21 | 1015.6836 |
| 14/05/21 | 1014.7044 |
| 15/05/21 | 1013.5770 |
| 16/05/21 | 1013.3901 |
| 17/05/21 | 1013.2165 |
| 18/05/21 | 1012.5601 |
| 19/05/21 | 1012.2016 |
| 20/05/21 | 1012.3465 |
| 21/05/21 | 1012.2592 |
| 22/05/21 | 1011.9964 |
| 23/05/21 | 1012.0884 |
| 24/05/21 | 1012.3053 |
| 25/05/21 | 1012.2948 |
| 26/05/21 | 1012.2982 |
| 27/05/21 | 1012.5275 |
| 28/05/21 | 1012.6917 |
| 29/05/21 | 1012.7176 |
| 30/05/21 | 1012.8279 |
| 31/05/21 | 1013.0165 |
| 01/06/21 | 1013.0984 |
| 02/06/21 | 1013.1293 |
| 03/06/21 | 1013.2373 |
| 04/06/21 | 1013.3345 |
| 05/06/21 | 1013.3524 |
| 06/06/21 | 1013.3739 |
| 07/06/21 | 1013.4361 |
| 08/06/21 | 1013.4595 |
| 09/06/21 | 1013.4450 |
| 10/06/21 | 1013.4543 |
| 11/06/21 | 1013.4725 |
| 12/06/21 | 1013.4581 |
| 13/06/21 | 1013.4365 |
| 14/06/21 | 1013.4366 |
| 15/06/21 | 1013.4301 |
| 16/06/21 | 1013.4065 |
| 17/06/21 | 1013.3907 |
| 18/06/21 | 1013.3865 |
| 19/06/21 | 1013.3730 |
| 20/06/21 | 1013.3551 |
| 21/06/21 | 1013.3478 |
| 22/06/21 | 1013.3433 |
| 23/06/21 | 1013.3326 |
| 24/06/21 | 1013.3241 |
| 25/06/21 | 1013.3228 |
| 26/06/21 | 1013.3201 |
| 27/06/21 | 1013.3148 |
| 28/06/21 | 1013.3134 |
| 29/06/21 | 1013.3150 |
| 30/06/21 | 1013.3141 |
| 01/07/21 | 1013.3131 |
| 02/07/21 | 1013.3151 |
| 03/07/21 | 1013.3171 |
| 04/07/21 | 1013.3174 |

|          |           |
|----------|-----------|
| 05/07/21 | 1013.3185 |
| 06/07/21 | 1013.3210 |
| 07/07/21 | 1013.3225 |
| 08/07/21 | 1013.3231 |
| 09/07/21 | 1013.3246 |
| 10/07/21 | 1013.3263 |
| 11/07/21 | 1013.3270 |
| 12/07/21 | 1013.3275 |
| 13/07/21 | 1013.3286 |
| 14/07/21 | 1013.3293 |
| 15/07/21 | 1013.3294 |
| 16/07/21 | 1013.3297 |
| 17/07/21 | 1013.3301 |
| 18/07/21 | 1013.3302 |
| 19/07/21 | 1013.3300 |
| 20/07/21 | 1013.3301 |
| 21/07/21 | 1013.3301 |
| 22/07/21 | 1013.3299 |
| 23/07/21 | 1013.3297 |
| 24/07/21 | 1013.3296 |
| 25/07/21 | 1013.3294 |
| 26/07/21 | 1013.3292 |
| 27/07/21 | 1013.3290 |
| 28/07/21 | 1013.3290 |
| 29/07/21 | 1013.3288 |
| 30/07/21 | 1013.3286 |
| 31/07/21 | 1013.3286 |

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

#### IV. CONCLUSION & RECOMMENDATIONS

COVID-19, declared as a pandemic by WHO, is currently the most dreaded disease in the world, affecting everyone in this world, in one way or the other; directly or indirectly. Albania has not been spared by this deadly virus. It has become critical to forecast the daily new COVID-19 cases in the country: this information is important for policy makers to be in a position to control the pandemic, particularly within the next 6 months. The study made use of a simple ANN (12, 12, 1) model, based on observations of daily new COVID-19 cases. We strongly recommend that the government should continue to ensure vaccine uptake and strict adherence to lock-down measures while creating awareness about the COVID-19 pandemic.

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