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The Prediction of Recovery Rate of Covid 19 Case in Kabupaten Bandung Barat using Neural Network Algorithm

Tarihoran, Conrad Michael Kenneth[1,*], Hutapea, Lyna M.N[2]

[1,2]Faculty of Nursing, Universitas Advent Indonesia, Indonesia

*Corresponding author: 1951041@unai.edu

Abstract

The COVID-19 pandemic that happens worldwide has affected not only human health, social activities, the economy, education but also the death rate caused by this pandemic. Although the death rate from COVID-19 worldwide is quite high, the recovery rate is also quite promising. Therefore, this study is conducted to predict the recovery rate of COVID-19 cases in Indonesia, specifically in Kabupaten Bandung Barat, which was analyzed using the Neural Network Algorithm. The method of this study is data mining, using the neural network algorithm that analyzed data, consisting of 2 attributes and 1 class attribute, namely: Daily Case that represent the daily new confirmed case in the observed location, Daily Death that represents the daily new number of confirmed deaths in observed location. The class attributes are using Daily Recovered, which represents the daily new number of confirmed recoveries in the observed location. The findings of this study indicate that the neural network models in this study have a Root Mean Square Error (RMSE) 102.168 to predict the recovery rate of COVID-19 cases in the observed location.

Keywords: Recovery Rate, Covid 19, Neural Network Algorithm

INTRODUCTION

The Coronavirus pandemic that has hit the whole world has been going on for almost two years, since its first occurrence in Wuhan, Hubei Province, China. The first case appeared in December 2019, and until the present, the corona pandemic is still ongoing. The Covid 19 (Corona Virus Diseases 2019) pandemic has resulted in many deaths worldwide; this virus that spreads through fluids from the mouth (droplets) causes respiratory infections, ranging from mild symptoms such as flu to severe infections such as lung infections (pneumonia). The death rate due to the pandemic is also exacerbated by the presence of other diseases (comorbid) in the patients who have it. The World Health Organization (WHO) stated in its announcement on March 11, 2020, that the COVID-19 virus that hit the entire world was designated as a global pandemic. When the announcement was made, WHO noted that in the past two weeks, the number of COVID-19 cases outside China had increased 13-fold, and the number of affected countries had tripled. There were more than 118,000 cases in 114 countries, and 4,291 people lost their lives. This

number has also doubled. Data obtained from WHO through its official website for Coronavirus Disease (WHO, 2020) shows that in September 2021, there were 229,858,719 confirmed cases, 4,713,543 confirmed deaths, and 5,874,934. There have been 542 doses of vaccine administered. In Indonesia, based on data obtained from the Peta Sebaran | Covid19.go.id, (SATGAS, 2021) there were 4,201,559 confirmed cases, of which 47,997 or (1.1%) were active cases, 141,114 or (3.4%) died, and 4,012,448 or (95.5) %) cases recovered. The coronavirus is spreading fast and can infect anyone; however, even though there have been many victims who suffered or even died because of this virus, the recovery rate is quite promising. Therefore, in this study, the authors are interested in conducting a study that aims to predict the recovery rate in cases COVID-19 in Indonesia, specifically in Kabupaten Bandung Barat, where Universitas Advent Indonesia is located, using the Neural Network Algorithm

LITERATURE REVIEW

Covid 19 (CoronaVirus Diseases 2019)

Based on information obtained from the official WHO website, Corona Virus Diseases 2019 or COVID-19 is defined as "a disease caused by a new coronavirus called SARS-CoV-2" (WHO, 2020). Based on information obtained from the official WHO website, Corona Virus Diseases 2019 or COVID-19 is defined as "the disease caused by a new coronavirus called SARS-CoV-2" (WHO, 2020). The virus was first discovered in December 2019, along with a number of reports of pneumonia cases in Wuhan, Hubei Province, China.

The Covid 19 has common symptoms, such as Fever, Dry Cough, and Fatigue. Other symptoms that may occur such as loss of smell and taste, stuffy nose, conjunctivitis, sore throat, headache, muscle or joint pain, various types of skin rashes, nausea or vomiting, diarrhea, chills, or dizziness. In worse cases, symptoms may also: Shortness of breath, loss of appetite, confusion, Persistent pain or pressure in the chest, High temperature (above 38 °C), Decreased consciousness, more severe neurological complications such as stroke, inflammation brain, delirium, and nerve damage. The incubation period of the covid 19 virus from exposure to COVID-19 until the time the symptoms begin to appear about 5-6 days and can range from 1-14 days. Individuals who have confirmed COVID-19 are advised to do self-isolation, stay at home and stay isolated for more than 14 days to prevent the spreading of the virus.

Data Mining

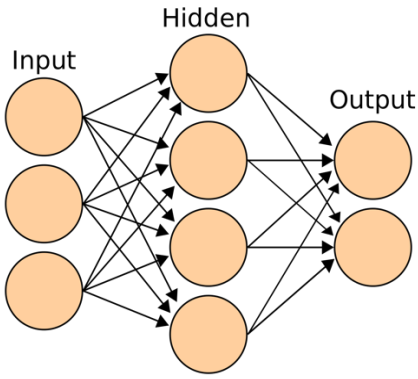
Data mining is a process of extracting and collecting large amounts of data or information. (Hutapea, 2019) stated that "Data mining is a process of gathering data or information to find certain patterns from large amounts of data." Related to this, (Han et al., 2012) stated that "Data mining is the process of discovering interesting patterns and knowledge from large amounts of data. The data sources can include databases, data warehouses, the Web, other information repositories, or data that are streamed into the system dynamically". According to (Prasetyo, 2012) Data Mining can be interpreted as extracting new information taken from large chunks of data that helps in decision making. The term data mining is also known as Knowledge Discovery. Data Mining Activities are divided into four groups, namely: Prediction Modelling, Cluster Analysis,

Association Analysis, dan Anomaly Detection (Prasetyo, 2012). In this study, the activity carried out is prediction modeling using the Artificial Neural Network.

Artificial Neural Network

An Artificial Neural network is a network of a group of neurons that function as small processors that works like the human nervous system. Neural Network is an adaptive system that can change its structure to solve problems based on external and internal information flowing through the network (Nasution et al., 2015). The configuration of a neural network can consist of several layers, which are generally divided into an input layer, a hidden layer, and an output layer, where each neuron has an input value, weight, and activation function (Hornik et al., 1989).

Figure 1: Neural Network Configuration



Root Mean Square Error (RMSE)

Root Mean Square Error (RMSE) is a measurement method that measures the difference in the value of the prediction of a model such as the Neural Network Model with the actual value. Root Mean Square Error is the result of the square root of Mean Square Error. The smaller the RMSE value, the closer the prediction and actual measurements are. In other words, the smaller the RMSE value, the better.

RMSE formula:

$$RMSE = \sqrt{\frac{\sum_{t=1}^{n}(A_t - F_t)^2}{n}}$$

Where:

At = Actual Data Value

Ft = Predicted Value

N= Number of Data

$\sum$ = Summation

Related Research

Several studies related to the prediction of COVID-19 cases using the data mining method show that the algorithm model in data mining can be used in making predictions. Some of these studies are summarized in the table below.

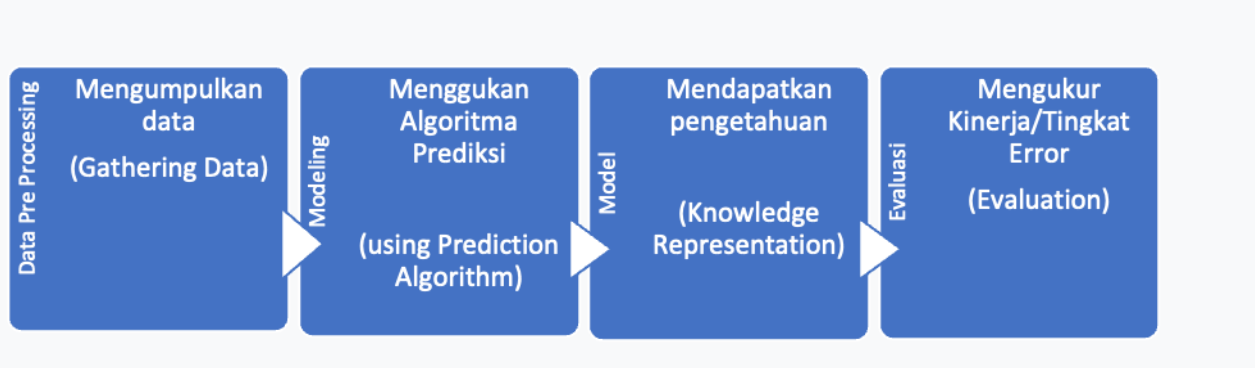
Table 1: Related Research

No	Author	Research Title	Result
1	Dewi Wulan Sari, Mitha Maharani Wahyudi (Sari et al., 2021)	"Analisis dan Perbandingan Algoritma Prediksi Dalam Mengetahui Perkiraan Peningkatan Jumlah kasus COVID-19 Di Indonesia Dengan Metodologi CRISP-DM". Analysis and Comparison of Prediction Algorithms in Knowing the Estimated Increase in the Number of COVID-19 Cases in Indonesia with the CRISP-DM Methodology	The results conclude that the dataset of Covid-19 cases in Indonesia can be predicted using the algorithm model Linear Regression, Results of the prediction accuracy of RMSE 1625.580 +/- 414,224 (micro average: 1671,084 +/- 0.000), the smallest compared to other algorithm models, so this prediction can help predict the total Covid-19 cases in Indonesia.
2	Afifah Cahyaningsih, Novantri Prasetya Putra, Andre Pradika Ekoputro Pratama, Rafian Ramadhani (Cahyaningsih et al., 2020)	"Model Prediksi Jumlah Kumulatif Kasus COVID-19 di Indonesia Menggunakan Metode Neural Network". Prediction Model for the Cumulative Number of COVID-19 Cases in Indonesia Using the Neural Network Method	Using Neural network to perform predictive data modeling. The results of the research conducted, showed an R-squared error of 0.9793. These results explain that the model used is good. The closer the R-squared error value is to 1, the better the model used will be.
3	Wirawan Setialaksana [1], Dwi Rezky Anandari Sulaiman [2], Shabrina Syntha Dewi [3], Chairunnisa Ar Lamasitudju[4], Nini Rahayu Ashadi[5], Muhammad Asriadi[6] (Setialaksana et al., 2020)	"Model Jaringan Syaraf Tiruan dalam Peramalan Kasus Positif Covid-19 di Indonesia" Artificial Neural Network Model in Forecasting Positive Cases of Covid-19 in Indonesia	Data Training used in this study is Indonesian total positive cases of Covid-19 from March 2 until May 26. in 10 days, the data become data testing to show the model accuracy in predicting Covid-19 total cases. Multi-Layer Perceptron (MLP) shows a better prediction compared to Extreme Learning Machine (ELM). Three different prediction accuracy measurement is used – Mean Absolute Error (MAE), Mean Absolute Percent Error (MAPE), and

Root Mean Square Error (RMSE. All of them show less value in MLP than in ELM.

METHODOLOGY

The data used in this study is collected from the West Java province covid 19 information and coordination center, taken from January 1, 2021, to September 26, 2021, which focuses only on West Bandung Area, the district where Universitas Advent Indonesia is located. The data source is downloaded from https://pikobar.jabarprov.go.id/data. The attributes used are the number of cases, numbers of deceased, and the number of patients who recovered. The phases of the recovery rate prediction procedure are as follows:



Data Pre-Processing

The data used in this study consisted of 269 data, taken from January 1, 2021, to September 26, 2021. To simplify, Table 2 below shows only several parts of the data.

Table 2: Data of number of cases, numbers of deceased, and numbers of recovered patients

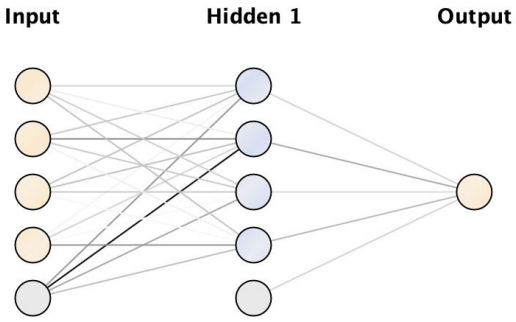
Date	Case	Deaths	Recovered
01-Jan-21	0	0	9
02-Jan-21	12	0	30
03-Jan-21	1	0	63
04-Jan-21	7	0	2
05-Jan-21	110	0	22
06-Jan-21	25	2	31
07-Jan-21	14	0	12

This phase is supposed to make Data Cleaning, Data Integration, Data Reduction, and Data Transformation. But since the data obtained is in accordance with what is desired, then in this phase, the pre-processing activity is to make data reduction, to remove unnecessary attributes from the available data.

Modeling

The algorithm used is a Neural network with a configuration consisting of 3 layers, as shown below:

Figure 2: Neural Network Configuration in this study



The configuration used in this study consists of one input layer, four hidden layers, and one output layer. This configuration uses a training cycle parameter of 200, a learning rate of 0.01, and a momentum of 0.9.

Model

At this phase, a suitable model is obtained to make predictions. Network configuration using rapidminer application ver 9.1.

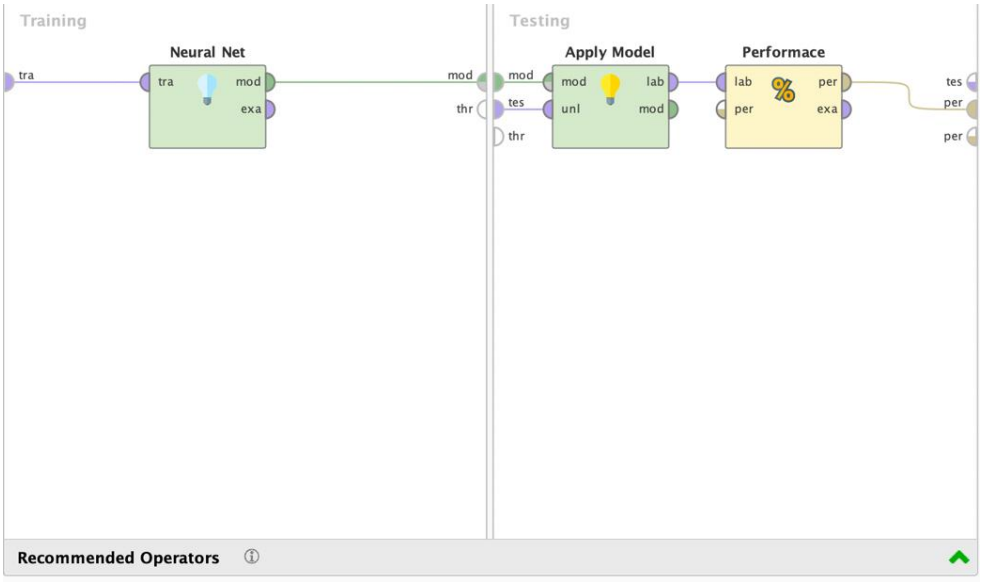
Evaluation

At this phase, the model obtained is evaluated using performance regression analysis, the Root Mean Square Error (RMSE) method. Cross-Validation is mainly used to estimate how accurate a model (learned by a particular learning operator) will perform in practice. The sampling used is linear sampling with a number of folds 10.

Results

Data processing in the rapidminer application are shown below:

Figure 3: Processing stage in the rapid miner application



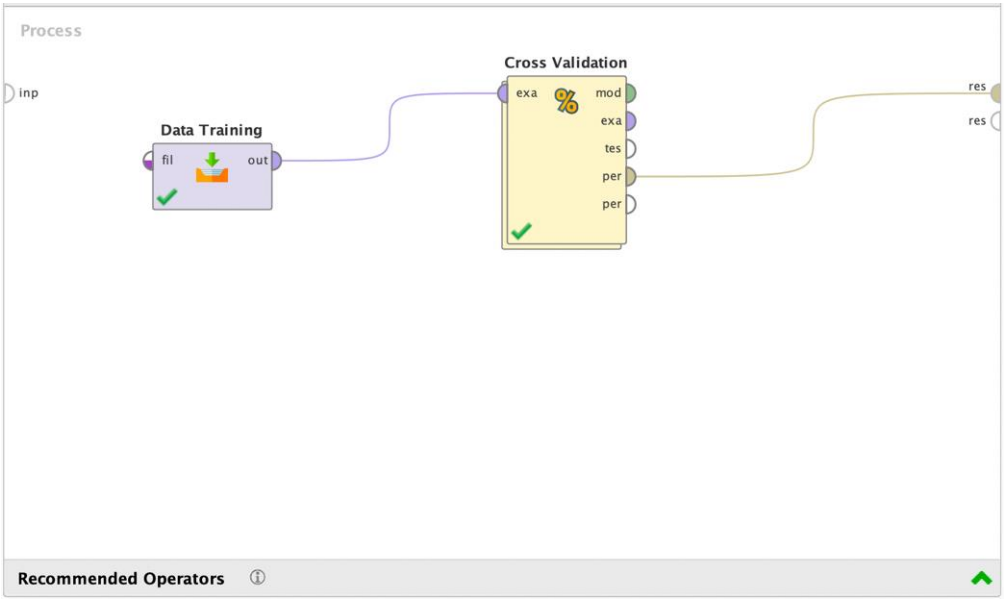


Table 3: Prediction results table of actual data and prediction data

Row No.	Date	Recovered	Prediction	Case	Deaths
1	Jan 1, 2021	9	16.073	0	0
2	Jan 2, 2021	30	19.557	12	0
3	Jan 3, 2021	63	16.364	1	0
4	Jan 4, 2021	2	18.108	7	0
5	Jan 5, 2021	22	47.031	110	0
6	Jan 6, 2021	31	38.163	25	2
7	Jan 7, 2021	12	20.135	14	0

8	Jan 8, 2021	0	26.448	36	0
9	Jan 9, 2021	91	27.072	12	1
10	Jan 10, 2021	2	30.419	50	0
11	Jan 11, 2021	1	21.865	20	0
12	Jan 12, 2021	12	16.655	2	0
13	Jan 13, 2021	0	23.876	27	0
14	Jan 14, 2021	8	28.154	42	0
15	Jan 15, 2021	32	23.876	27	0
16	Jan 16, 2021	100	56.941	147	0
17	Jan 17, 2021	14	31.548	54	0
Example Set (269 examples, 3 special attributes, 2 regular attributes)					

From the processing results, it is found that the number root_mean_squared_error: 102.168 +/- 63,520, which means that the prediction result of the Neural Network configuration above is 102.168.

CONCLUSION

Based on the research that has been done, by analyzing the data on the number of COVID-19 cases in the West Bandung Area, a prediction model has been obtained using the Neural Network algorithm. The model has been created with the rapidminer application. The Root Mean Square Error (RMSE) value is 102.168 +/- 63.520, and this value is the accuracy of the forecasting method by looking at the difference between the prediction and the actual case.

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