

# ANALYSIS OF CRONA VIRUS (COVID-19) USING MEMETIC ALGORITHM BASED FEATURE SELECTION AND FEED FORWARD NEURAL NETWORKS FOR CLASSIFIER

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**Abstract:** Coronavirus disease (COVID -19) is the most pandemic disease in the world. Due to this virus, most of the humans are lost their life. It increases the human mortality rate and minimizes the economic rate of the country. As per the World Health Organization (WHO) report, the first case is reported on 31 December 2019 from Wuhan city in china. After that, the affected rate is rapidly increasing and most of the cases are leads to death. At present, 215 countries have affected by this pandemic disease. As per WHO, COVID-19 has infected 3,557,235 people so far. So, the analysis and the prediction of COVID-19 is a very important task to give the awareness among the people for reducing the human mortality rate and also the affected rate of the people. This paper gives the analysis of COVID-19 using Memetic algorithm for feature selection and Feed Forward Neural Network Classifier for classification. The constructed model gives the better performance with low error rate.

**Keywords:** Coronavirus, Analysis, Neural Network, Memetic Algorithm, feature selection.

## 1 INTRODUCTION

Coronaviruses are a large family of viruses, which can cause the illness among animals and a human. There are seven types of coronaviruses that affect the humans as classified as 229E, NL63,OC43, HKU1 and remaining viruses will cause more serious on the human health. Those viruses are SARS –CoV, MERS-CoV and SARS-CoV-2. During 2002-2003, the SARS (Severe Acute Respiratory Syndrome) -CoV affected nearly 8000 people in 26 countries. During 2012 MERS (Middle East Respiratory Syndrome)-CoV affected nearly 2400 people across 27 countries.SARS-CoV-2 virus will affect our upper respiratory tract or lower respiratory tract. The upper respiratory tract consists of sinuses, nose, throat and lower respiratory tract consists of windpipe, lungs. This infection problem is caused by a virus named SARS-CoV-2 (COVID-19) [1].

Coronavirus (COVID-19) was first identified in Wuhan city which belongs to china on December 31, 2019. Within 3 January 2020, china has reported the 44 cases to WHO with unidentified agent. After that, the coronavirus is insulated on 7

January 2020 and nearly 700 cases are affected by this virus within 20 January 2020.The first cases of the pandemic disease COVID -19 was reported in India on 30 January 2020, which was originating from china. As of now, the Ministry of Health and Family Welfare have confirmed the 52,952 cases, 15,267 cases are recovered and 1783 deaths in India. The following figure shows the cases in India upto 3 May 2020. It is collected from the Ministry of Health and Family Welfare website. [1]

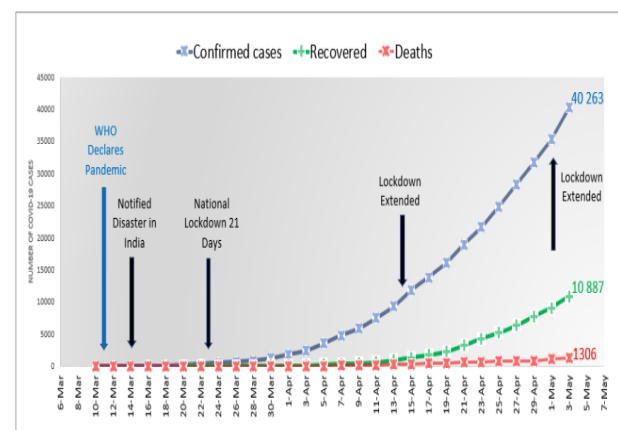


FIGURE 1 Information of COVID -19 in India

The above graph gives the information about lockdown and also the affected rate of COVID – 19. The table 1 shows the statistical report of COVID- 19 in India. These below information have collected from the www.mohfw.gov.in. It contains the details of confirmed cases, cured cases and also the deaths. This paper concentrates on to the analysis of COVID-19 using the combination of memitic algorithm based feature selection and the FFNN based classifier.

**TABLE1** Confirmed cases, Cured cases and Deaths in India (Upto 7th May 2020)

S.N O.	Name of the State/ UT	Total Confirmed Cases (Including 111 Foreign Nationals)	Cured / Discharged / Migrated	Deaths (more than 70% cases due to comorbidities)
1	Andaman and Nicobar Islands	33	32	0
2	Andhrapradesh	1777	729	36
3	Arunachal Pradesh	1	1	0
4	Assam	45	32	1
5	Bihar	542	188	4
6	Chandigarh	59	36	0
7	Chhattisgarh	59	36	0
8	Dadar Nagar Haveli	1	0	0
9	Delhi	5532	1542	65
10	Goa	7	7	0
11	Gujarat	6625	1500	396
12	Haryana	594	260	7
13	Himachal Pradesh	45	38	2
14	Jammu and Kashmir	775	322	8
15	Jharkhand	127	37	3
16	Karnataka	693	354	29
17	Kerala	503	469	4
18	Ladakh	41	17	0
19	Madhyapradesh	3138	1099	185
20	Maharastra	16758	3094	651
21	Manipur	2	2	0
22	Meghalaya	12	10	1
23	Mizoram	1	0	0
24	Odisha	185	61	2
25	Puduchery	9	6	0
26	Punjab	1516	135	27
27	Rajasthan	3317	1596	92
28	Tamilnadu	4829	1516	35
29	Telengana	1107	628	29
30	Tripura	43	2	0
31	Uttarakhand	2988	1130	60
32	West Bengal	1456	364	144

This virus can spread from person to person rather than air. The people catch the COVID-19 from the

virus affected person through the small droplets coming from mouth or nose. The other persons will affect by the COVID -19 in the following: Sometimes, the droplets land on the objects or surfaces that are around the people. The people touch these objects and then touching their eyes, nose or mouth. Otherwise, if they breath the droplets of a person with COVID – 19.

## 2 RELATED WORKS

The information related to the COVID-19 and the symptoms are collected from Ministry of Health and Family Welfare website [1]. Olga Krestinskaya et.al. proposed the Analog back propagation learning circuits for various learning architectures of different neural networks [2]. This book gives detail information about the corona virus infection, challenges associated with the treatment and the prevention against the novel Corona virus [3]. This paper have proposed the calculation for death and cured cases of COVID-19 using the median cure and median death time of the individual cases. This prevention is used to diagnosis of COVID-19 data set [4]. This paper gives the information related to the vaccines about the COVID-19 [5]. Panel PeiHu et.al. proposed the wolf optimizer algorithm for the feature selection. This algorithm has produced the high efficiency when compared to other algorithms [6]. This paper proposed the various behaviours of CT-image of the COVID-19. Here future fusion and ranking method is used to analysis the behaviours of COVID-19 CT-images. The efficiency is calculated using the measure of accuracy, sensitivity and specificity [7]. This paper proposed the machine learning and deep learning models to find out the everyday behaviours of COVID-19 for the purpose of prediction. It also gives the future reachability of COVID-19 by using the prediction [8]. This paper gives the analysis related to the epidemic in Tunisia using population dynamics with SEIR model [9]. Liu et.al. proposed the method based on the super-pixel and Convolutional Neural Networks (CNN) for the image segmentation of COVID- 19 image. [10]. Hesamian proposed many deep learning models for image segmentation [11] to produce the better result. Isra Al-Turaiki et.al. uses the Naïve Bayes classifier and J48 classification algorithms to build the models for MERS-CoV infections. These algorithms have produced the accuracy between 53.6% and 71.58% [13]. Artificial Intelligence has

addressed many medical problems. So, A. S. Albahri et.al uses the Artificial Intelligence based Machine learning algorithms to detect and diagnosis the novel coronavirus-19. These ML based algorithms have produced the better results in COVID-19 diagnosis [14]. L. J. Muhammet. al. uses many algorithms in Machine Learning to predict the Covid-19 present in the human bodies. Here it uses the machine algorithms of Random forest classification, k-Nearest Neighbour, logistic regression, Decision tree to predict the Covid-19 and the confusion matrix is used to calculate the accuracy of these methods. It produced the 99.85% of accuracy [15]. MortezaNikooghdamet. al. Uses the group based ensemble methods to improve the accuracy of the prediction when compared to classifier. This model executed using Rapid miner and python 3.7 tool [16]. Aman Khakharia et.al.uses Auto-Regressive Moving Average (ARMA) for the prediction of COVID-19. This algorithm was tested against Linear Regressor, Bayesian classifier and Boosting classifier continuously for 5 days using Covid-19 data set. In this analysis, ARMA have been produced the better accuracy of 99.93%. Here python and Google Colaboratory environment is used for the experimentation. Input dataset is collected from the ourworldindata.org [17]. Srivatsan et.al. uses the algorithms such as support vector machine, Random forest classifier for the prediction of medical dataset. This dataset consists of 27 different variables related to the Covid-19. Here, the correlation based heat map is used to calculate the ISP score for the prediction. The confusion matrix is used to find the accuracy, precision, sensitivity and F-score for the medical dataset. It produced the precision of 99.8%, F-score of 99.29%, accuracy of 99.7%, and sensitivity of 98.8% [18]. AkibMohiUd Din Khanday et.al using the machine learning algorithms to detect the Covid-19 with clinical data set. Here it uses the feature engineering methods like term frequency; term document frequency, report length and bag of words are used to generate the features for classification algorithms. These features are supplied into the ensemble machine learning algorithms for the detection of Covid-19. In which, logistic regression and Multinomial Naïve Bayes have produced the better accuracy when compared to machine learning algorithms [19]. Ibrahim Arpacı et.al have concluded CR meta classifier produced better accuracy for the

predicting positive and negative of the covid-19. This method was compared with another five classifiers such as BayesNet, Logistic, IBk, PART, and J48 [20].

### 3 COVID-19 DATASET DESCRIPTIONS

The major symptoms of COVID-19 are fever, tiredness, and dry cough. Some patients may have aches and pains, nasal congestion, runny nose, sore throat or diarrhea. The above said symptoms or start with mild and increase gradually. More concentration should take on the people of older age, who have the problem of high blood pressure, heart problems or diabetes [1]. The following table 2 shows the sample COVID-19 dataset contains 6 factors and one class for prediction.

TABLE 2 Dataset Descriptions

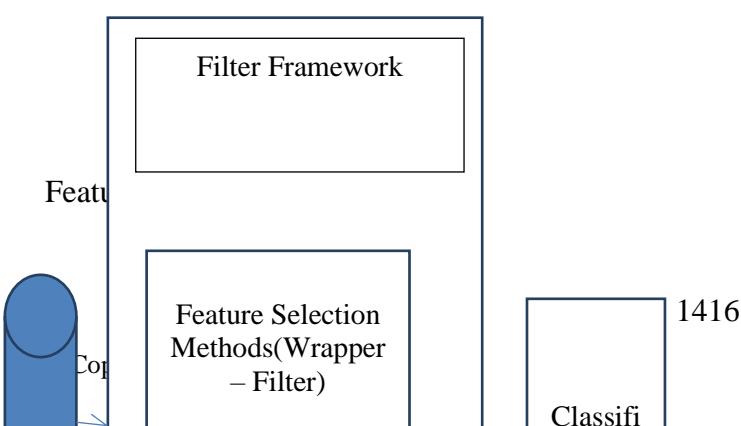
Age	Fever	Dry cough	Running Nose	High Blood Pressure	Heart Problem	CLASS
25	1	1	0	0	0	0
34	1	0	1	0	1	1
28	1	1	0	1	1	1
75	1	0	0	1	1	1
23	1	1	1	0	0	0
54	0	1	0	0	1	1
65	1	1	1	1	0	1
76	1	0	1	0	1	0
34	1	1	0	0	0	0
28	1	1	1	0	0	1
27	1	0	1	0	0	1
24	0	1	0	0	0	0
21	1	1	1	0	0	1
28	1	0	1	0	0	1
14	1	1	0	0	0	1
12	1	1	1	0	0	1
26	1	1	1	0	1	1
30	1	1	0	0	0	0
74	0	0	1	1	1	0
32	1	1	1	0	0	1
33	1	1	1	0	0	1
35	1	0	0	0	1	0
38	1	1	1	0	1	1
25	0	1	1	0	0	0
28	1	0	1	0	0	1
29	1	1	0	0	0	1
20	0	0	1	0	0	0

45	1	1	1	0	0	1
47	1	1	0	0	0	1
54	1	1	1	0	1	1
53	1	0	1	0	1	0
43	0	1	0	1	0	0
44	1	1	1	1	0	1
40	1	1	1	1	0	1
74	1	0	0	1	1	0
32	1	1	1	0	0	1
34	0	1	1	0	0	0
75	1	1	0	0	0	1
79	1	0	1	1	0	1
45	1	1	1	0	0	1
67	1	1	0	1	1	1
68	1	1	1	0	1	1
79	0	1	1	1	1	0
64	1	0	0	1	0	1
58	1	1	1	1	0	1
57	1	1	1	1	0	1
63	1	1	0	1	1	1

**4 PROPOSED METHODOLOGY**

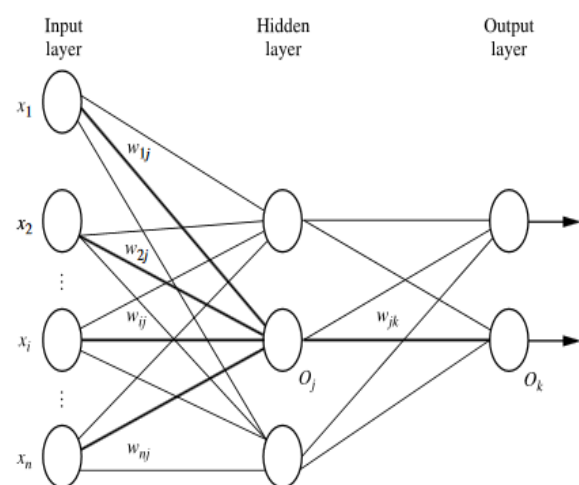
**4.1 Wrapper Filter Approach using Memitic Algorithm and FFNN based Classifier**

Memitic algorithm is an extension of Genetic algorithm is used to improve the efficiency of evolutionary based population approach. This memitic algorithm gives the good balance between the local search and also with the global search. Here, univariate feature Ranking algorithm is used to select the features in the form of adding or deleting the features from features set [12]. Figure 2 shows the architecture of filter framework. This Filter framework contains the wrapper – filter for feature selection is combined with feature evolutionary method of Memitic algorithm. Here, the feature are having the high impact is added and the features with the low impact value is deleted from the features set.



**FIGURE 2** Filter Framework

COVID- 19 data set is analyzed using FFNN – Feed Forward Neural Networks. Actually, the Neural Networks having three layers are : Input Layers, Hidden Layers and the Output Layers [2]. Here, it uses the one input layer, any number of hidden layers and one output layer. The following figure 3 shows the structure of the FFNN. In which,  $x_1, x_2, \dots, x_n$  is a input layer, weight is represented by using the  $w_{1j}, w_{2j}, \dots, w_{nj}$ , the input and output of the hidden layer is  $I_j, O_j$  and  $I_k, O_k$  is the output layer.



**FIGURE 3** Structure of the Neural Network

The input of the hidden layer is calculated using,

$$I_j = \sum_i w_{ij} O_i + \theta_j \quad (1)$$

Where -  $\theta_j$  is the bias or threshold value. The output of the hidden layer is computed by using,

$$O_i = \frac{1}{1+e^{-I_j}} \quad (2)$$

The error of the output layer and the hidden layer is performed by using:

$$Err_j = O_j(1 - O_j)(T_j - O_j) \quad (3)$$

Where,  $T_j$  is the target value. This value is always considered as 1. The error of the hidden layer is:

$$Err_j = O_j(1 - O_j) \sum_k Err_k w_{jk} \quad (4)$$

If the error is greater than 0.5 then the particular weight is updated to increase the performance of FFNN. The following equation is used to update the weight:

$$\Delta w_{ij} = (l) Err_j O_i \quad (5)$$

$$w_{ij} = w_{ij} + \Delta w_{ij} \quad (6)$$

Where,  $l$  is the learning rate and this value is in between 0.0 to 1.0.

### 5 RESULTS AND DISCUSSION

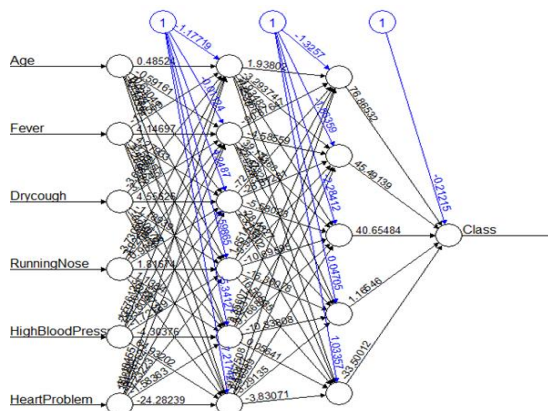
This COVID – 19 dataset is analyzed using 6 input layers, one output or class layer and the hidden layer is chosen by the user at that time of calculation. The following table gives overall performance of Neural Network classifier. It contains the Number of hidden layer, Rate of the error and the number of steps performed by this algorithm to reach the target value. Here the bias or threshold value is as 0.01. This table shows that, the error rate of the NN is increased when the number of hidden layer is increased. Here, the hidden layer (6,5) gives the better performance and low error rate. But, the computation steps needed to calculate the final output is high.

**TABLE 3** Hidden Layer Vs Error Rate

Number of Hidden Layers	Error Rate	Number of Steps taken
2	2.1328	159
3	1.6123	359
4	1.6237	465
5	1.6633	246
6	0.8757	246
2,1	2.6589	218

3,2	3.3315	9
4,3	3.3332	10
5,4	0.8206	290
6,5	0.0016	1201

The following figure shows the Neural Networks model for COVID-19 data set. The input layer consists of Age, Fever, Dry cough, Running nose, High blood pressure and the Heart problem.



**FIGURE 4**Neural Network Model for COVID -19 Dataset

The input layer value is passed into the hidden layer. These values are shown in the following table. Here two hidden layer is considered for the process, that is hidden layer 1 contains 6 nodes and hidden layer 2 contains the 5 nodes.

**Table4.** Values of the NN Model

Values from First Layer to First Hidden Layer	
Age.to.1layhid1	4.85E-01
Fever.to.1layhid1	-1.46E+00
Drycough.to.1layhid1	-3.61E+00
RunningNose.to.1layhid1	-3.73E+00
HighBloodPressure.to.1layhid1	-1.58E+00
HeartProblem.to.1layhid1	-1.12E+01
Intercept.to.1layhid2	-1.12E-02
Age.to.1layhid2	-5.92E-01
Fever.to.1layhid2	4.15E+00
Drycough.to.1layhid2	3.58E+00
RunningNose.to.1layhid2	3.93E+00
HighBloodPressure.to.1layhid2	2.39E+01
HeartProblem.to.1layhid2	1.39E+01
Intercept.to.1layhid3	4.25E+00
Age.to.1layhid3	-6.30E-01
Fever.to.1layhid3	4.28E+00
Drycough.to.1layhid3	4.56E+00

RunningNose.to.1layhid3	9.33E-01
HighBloodPressure.to.1layhid3	-5.38E+01
HeartProblem.to.1layhid3	-6.46E+01
Intercept.to.1layhid4	5.99E-01
Age.to.1layhid4	2.94E-02
Fever.to.1layhid4	-3.56E+00
Drycough.to.1layhid4	-1.79E+00
RunningNose.to.1layhid4	1.82E+00
HighBloodPressure.to.1layhid4	-1.72E+00
HeartProblem.to.1layhid4	-2.32E-01
Intercept.to.1layhid5	-5.34E+00
Age.to.1layhid5	1.14E-01
Fever.to.1layhid5	1.50E+00
Drycough.to.1layhid5	-2.11E+00
RunningNose.to.1layhid5	1.14E+00
HighBloodPressure.to.1layhid5	-4.30E+00
HeartProblem.to.1layhid5	-1.58E+00
Intercept.to.1layhid6	7.22E+00
Age.to.1layhid6	-3.03E-01
Fever.to.1layhid6	2.27E+00
Drycough.to.1layhid6	-2.84E-02
RunningNose.to.1layhid6	3.58E+01
HighBloodPressure.to.1layhid6	6.49E+01
HeartProblem.to.1layhid6	-2.43E+01
<b>Values from First Hidden Layer to Second Hidden Layer</b>	
Intercept.to.2layhid1	-1.33E+00
1layhid1.to.2layhid1	1.94E+00
1layhid2.to.2layhid1	-9.09E+01
1layhid3.to.2layhid1	-7.23E+01
1layhid4.to.2layhid1	1.65E+00
1layhid5.to.2layhid1	3.36E+00
1layhid6.to.2layhid1	-9.77E+01
Intercept.to.2layhid2	-1.86E+00
1layhid1.to.2layhid2	-3.29E+00
1layhid2.to.2layhid2	-4.59E+00
1layhid3.to.2layhid2	-2.89E+01
1layhid4.to.2layhid2	-9.94E+00
1layhid5.to.2layhid2	8.62E+00
1layhid6.to.2layhid2	7.43E+00
Intercept.to.2layhid3	-2.28E+00
1layhid1.to.2layhid3	-3.93E+00
1layhid2.to.2layhid3	3.91E+01
1layhid3.to.2layhid3	-5.58E+00

1layhid4.to.2layhid3	-1.07E+01
1layhid5.to.2layhid3	9.77E+00
1layhid6.to.2layhid3	2.97E+00
Intercept.to.2layhid4	4.70E-02
1layhid1.to.2layhid4	-1.23E+00
1layhid2.to.2layhid4	-2.35E+01
1layhid3.to.2layhid4	-2.84E+01
1layhid4.to.2layhid4	-1.64E+01
1layhid5.to.2layhid4	-1.08E+01
1layhid6.to.2layhid4	3.29E+00
Intercept.to.2layhid5	1.03E+00
1layhid1.to.2layhid5	1.45E+00
1layhid2.to.2layhid5	2.29E+01
1layhid3.to.2layhid5	2.31E+01
1layhid4.to.2layhid5	1.66E+01
1layhid5.to.2layhid5	5.64E-02
1layhid6.to.2layhid5	-3.83E+00
Intercept.to.Class	-2.121489e-01
<b>Values from Second Hidden Layer to Class</b>	
2layhid1.to.Class	7.69E+01
2layhid2.to.Class	4.55E+01
2layhid3.to.Class	4.07E+01
2layhid4.to.Class	1.17E+00
2layhid5.to.Class	-3.35E+01

The following figure shows the performance of Neural Networks at that time of increasing the hidden layer. It shown that the hidden layer is increased; the error rate of NN is decreased. It shows the improvement in NN performance. Figure 4 shows the error rate of Neural Networks with 2- Hidden Layers of (m, n). This figure 5 contains the hidden layer of (2, 1) (3, 2) (4, 3) (5, 4) and (6, 5). In which, the hidden layer of (6, 5) having the less error rate, when compared to the remaining hidden layers.

**FIGURE 5** Error Rate Vs 2-Hidden Layer

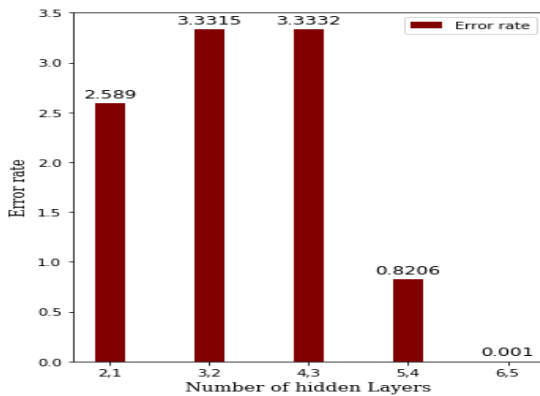
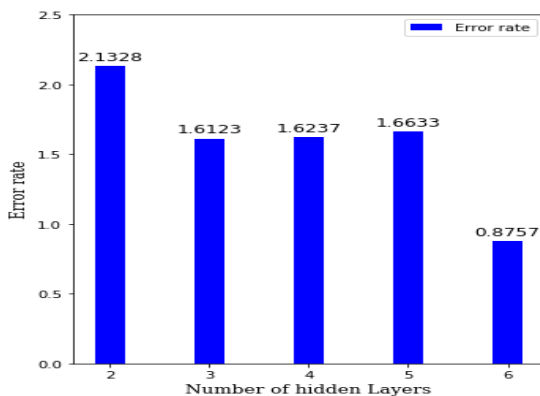


FIGURE 6 Error Rate Vs 1-Hidden Layer



This figure 6 contains the hidden layer of (2) (3) (4) (5) and (6). When compared to the single hidden layer, the hidden layer of (m, n) is having the less error rate.

## 6 CONCLUSIONS AND FUTURE ENHANCEMENT

Corona Virus (COVID-19) is the most infectious spreading disease in this world. This Virus spread among the people easily through the droplet of the corona virus affected person. To avoid these spreading, people has to maintain the social distance between them. Most of the persons are lost their valuable life and entire world lost their economic condition. This paper gives the analysis of the COVID-19 dataset using FFNN algorithm with 6, 5 hidden layers. This analysis conclude that, the major symptoms of the COVID -19 is fever, Dry cough, Running Nose and sometimes it will leads death because of High blood pressure and Heart problem. This proposed algorithm produces the 0.0016 error rate with high efficiency. In future, the machine learning approaches will be used for better analysis and the prediction.

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