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Asymptomatic Community Spread Of Coronavirus Disease 2019(COVID-19) Outbreak Prediction Using Logistic Regression

Robin Singh Bhadoria[1], Neha Sharma[2], Manish Kumar Pandey[3], Bishwajeet Pandey[4]

[1,4]Birla Institute of Applied Sciences, Bhimtal, Uttarakhand, India
[2]IPS College of Technology & Management, Gwalior, India
[3]Gurukul Kangri University, Haridwar, India

Abstract—Corona virus disease (COVID-19) pandemic has become a major threat to the entire world. Antidotes and proper medications are still not found and determined to get cure from such virus. The report from World Health Organization (WHO) remits the COVID-19 as severe acute respiratory syndrome (SARS). Such virus is transmitted into human body via a respiratory droplets. Even, major symptoms for coronavirus patience are – tiredness, severe fever and dry cough but in most of the cases such symtoms are not found. This variety of coronavirus symptoms are termed as asymptomatic symptoms. The identification for such disease is very important into human body so that this can be stopped as community spread and reduces the effect of this as global pandemic. This paper provides an extensive study and predicts the outbreak of this disease with the aid of classification techniques of under machine learning. So that, the number of cases related to COVID-19 can be identified and subsequent arrangements have been made from the respective governments and medical doctors for future. Initially, this prediction model is implemented for short-term interval and later, such model based on internet of thing and machine learning, can also be set for estimating into long-term intervals for global as well as Indian perspective. Thelogistic regression and decisiontree techniqueshave been used for such cases predictions for this epidemic.

Index Terms—Coronavirus Dissease 2019 (COVID-19); Decision Trees; Prediction Model; Virus Epidemic; Logistic Regression.

1. INTRODUCTION

Coronavirus disease 2019 (COVID-19) was first recognizedat Wuhan City of Hubei province, Peoples Republic of China.Coronaviruses are zoonotic viruses (means transmitted between animals and people). Symptoms include fever, cough, respiratory symptoms and breath-ingproblems [7]. In severe cases patient may suffer from pneumonia, severe acute respiratory syndrome (SARS), and kidney failures. These viruses are also asymptomatic in nature in which a person can be a carrier for an infection but experience no symptoms. COVID-19 is an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-COV-2).The new virus SARS-COV-2 is very contagious and has quickly spread globally. Ini-tially, the new virus was called 2019-nCoV [2, 3].

COVID-19 outbreak was constituted as a public health emergency of international con-cern (PHEIC) on January 30, 2020. World Health Organization (WHO) declared COVID-19

as a pandemic on March 11, 2020. WHO has developed pandemic phases in the year 1999 and revised in 2005. These phases provide a global framework to countries for response planning to these severe pandemic crises [6].Primary phase starts when cases are accounted for the individuals who visited areas containing the virus, while the subsequent phase reports the cases when a person comes in direct contact with the nearby persons such as family members, relatives, companions, and other people. In third phase, transmission source of the virus becomes undetectable and virus blowouts over the people who did not came into connections with influenced individuals. This situation requests an immediate lockdown to prohibit the direct contact among people and slowing the pace of coronavirus infection. Fourth phase is dangerous because virus infection gets widespread and wild. Until now, a few nations have pass in stage 4 [2]. China is main country that accomplished the fourth stage of the COVID-19 spread [4]. Fig 1 represents the widespread of COVID-19 and increased number of infected cases around the world. According to the report given by the World Health Organization (WHO) based in Geneva (Switzerland), highlighted countries are United States, China, Italy, and Spain.Figure shows growing traits of the quantity of infected, passed out, and recovered cases in the countries depicted in the figure (captured by Johns Hopkins live dashboard) between January to April in 2020.

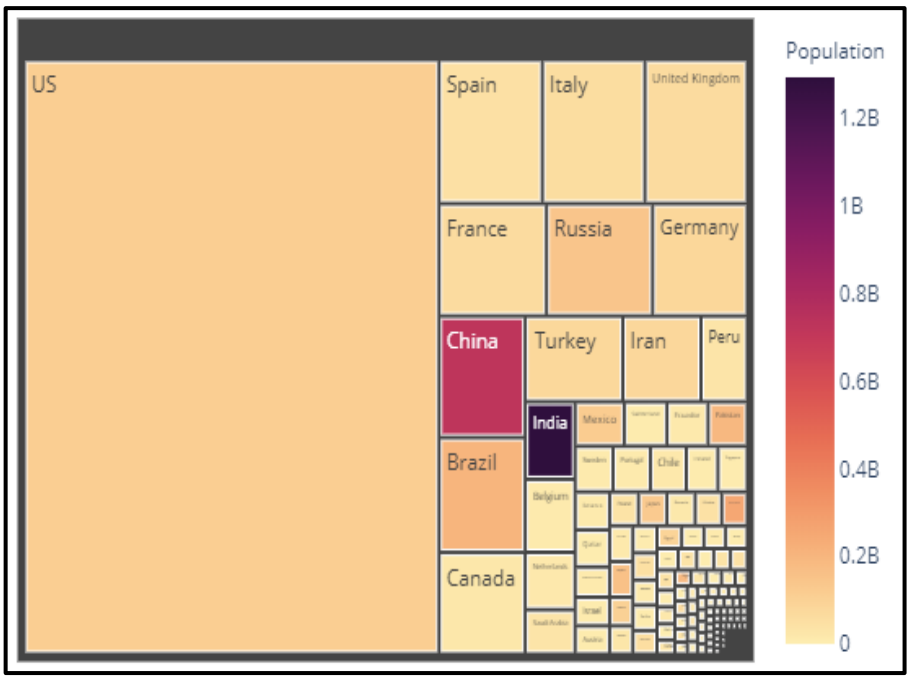

Fig 1: Current share of Worldwide COVID 19 Confirmed Cases

India is a part of worldwide pandemic of coronavirus disease 2019. India currently has become the fourth highest number of confirmed cases in the world. India has the largest number of confirmed cases in Asia [1, 9].

Fig 2 shows that Maharashtra state in India covers the majority of infected people which is nearly 300K (tillJuly 2020). After Maharashtra, the states with most infected people according to density percentage are Tamil Nadu, Delhi, Gujarat, Rajasthan and Uttar Pradesh respectively. As ofJuly 2020, Lakshadweep is the only region which has reported with few cases [12, 14, 15].

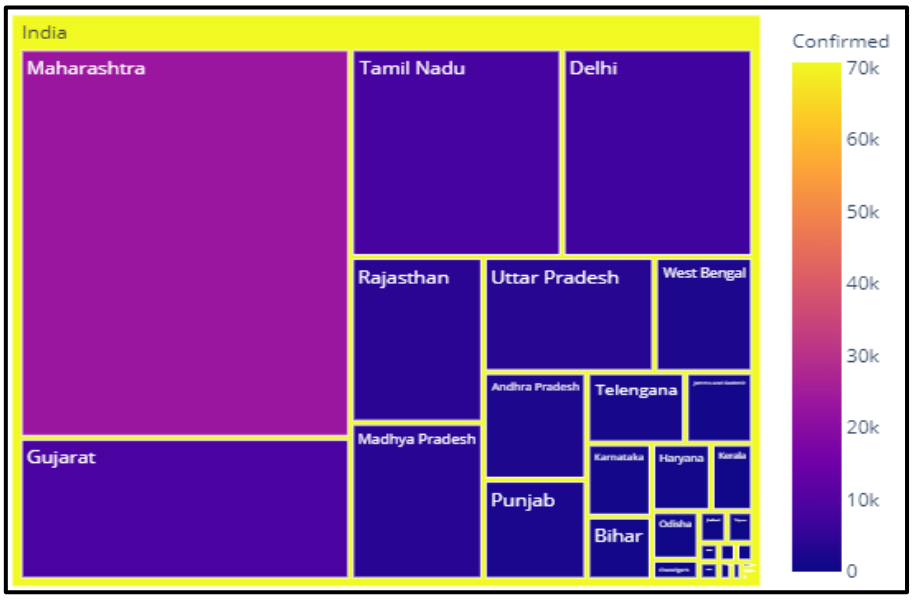

Fig 2: Density-wise separation of COVID-19 in India

As on date 20 July 2020, total number of confirmed cases, active cases, recovered cases, deaths are 10,85,493; 5,20,115; 6,47,978; 27,400 respectively [17].

In the last twenty years several viral epidemics have posed serious issues to public health. Viral diseases such as severe acute respiratory syndrome coronavirus (SARS-COV) in 2002, HIN1 influenza in 2009, Middle East respiratory syndrome coronavirus (MERS-CoV) in 2012 have been recorded. On 30 January 2019 Coronavirus first confirmed case was reported [3, 11].

Compared to earlier viral diseases, COVID-19 is happening in more digitalized and linked world. The amount of information produced in today's world is much more than the earlier times. Information is easily accessible to people and awareness is spread in a constructive way [8]. People are informed about latest updates about coronavirus which help them to protect themselves in a better way. Several computational models based on artificial intelligence technology have been designed for anticipating further spread of coronavirus disease. These models helped people to monitor fast evolving situation of the occurred pandemic.But these information driven methodologies based on AI are ground breaking [16]. For training AI models, data of the COVID-19 has been made publicly available which poses a threat to data privacy. Second problem with AI are lack of historical data and problems with using "Big Data".

Inspite of the fact that a lot of considerable amount of information about COVID-19 is incomplete,temporary directions on lab biosafety was presented by theWHO.The persistence of COVID-19 on lifeless shells and approaches to manage it. It is found that the time of persistence is nine days for COVID-19 virus [15]. Also a few antiseptics, for example0.1% Na$HClO_3$, 0.5% H_2O_2, or 62%–71% C_2H_5OH can be exceptionally proficient in managing the coronavirus infection. A review on the practices of infections. Some datasets were researched, and the acquired outcomes show the dynamic scientific display. It was fundamental to anticipate behaviour of infections. The job of media inclusion on general society was assessed [2]. It demonstrated that deceptive and one-sided mediainclusion could negatively affect people's emotionalwellness. The acquired outcomes demonstrate that the anticipated model had a rea-

sonable execution to anticipate confirmedcases. Li and Feng analyzed that the pattern of the coronavirusoutburst was evaluated at China. Itsoutcomes display that quick and activesystemsmust be helpful to lower and compel the present emergency. Theimpact ofmovement limitations to lessen the coronavirus outburst. The acquired outcomes showed that movementlimitations are profoundly successful in decreasing the blowout of nCoV (new coronavirus).

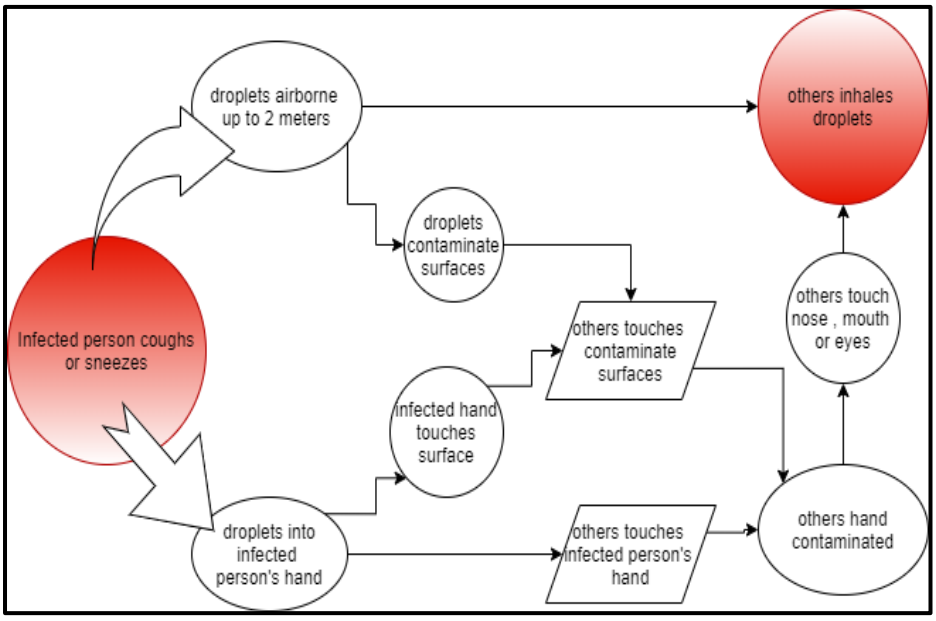

Fig 3: Asymptomatic Transmission Scale Block for COVID-19 Infection

In the information intensive universe of 2020, universal information and advanced surveillance devices can do many works. China is allegedly utilizing pervasive sensor information and health check-up applications to check the illness blowouts. As per the New York Times report there is a little clue of how the information is validated and reprocessed for observation determinations. The report said that an Alibaba-upheld administration, Ali pay Health Code, run application that bolsters choices for whom ought to bein isolation for COVID-19. Additionally, itappears to impart data to the police department. The European nation recorded the biggest number of COVID-19 cases in Italy [22].The neighbourhood information security authority was encouraged, on 2 March 2020. It gives an announcement to explain the states of legitimate information use for relief and control determinations. In the announcement it is mentioned that the consultant cautioned in contradiction of the security encroaching assortment and handling of information.

The major contribution of this paper can be counted as:

- Provide extensive studypredicts the outbreak of asymptomatic coronavirus disease with the aid of classification techniques of under machine learning.
- Presented with the model that can be used for estimating into long-term as well as short-termintervals for global as well as Indian perspective.
- The logistic regression and decision tree techniques have been used for such cases predictions for this epidemic.
- The classification and regression tree also determined the 57.30% of the total cases found at globe level for specific countries and predicts the model estimation statistics for future growth rate.

2. BACKGROUND AND RELATED WORK

In 1995, Kennedy and Eberhart presented the PSO as a questionable quest strategy for enhancement purposes. The calculation was enlivened by mass undertaking of birds observing for diet. A gathering of fowls coincidentally searched for food in a space. There is just one bit of food in the hunt space [5].

Every arrangement in PSO is known as a molecule, which is equal toa fowl in the bird's mass undertaking procedure [21]. Every molecule has a worth that is determined by a competency work. Molecule increments in the pursuit space as it moves towards the objective. Everymolecule has a speed that manages the movement of the molecule. Every molecule keeps on moving in the difficult space by following the ideal particles in the present state [10]. The PSO strategy is established in Reynolds' work, which is an early re-enactment of the social conduct of feathered creatures. The mass of particles in nature speaks to aggregate insight. All individuals move in ideal amicability with one another, chase together in the event which has to be pursued.Molecule properties in this calculation of asymptomatic coronavirus disease may include [3]:

- Each molecule autonomously searches for the ideal point.
- Each molecule moves at a similar speed at each progression.
- Each molecule recollects its best situation in the space.
- The particles cooperate to advise each other of the spots they are searching for.
- Each molecule is in contact with its neighbouring particles.
- Every molecule knows about the particles that are in the area.
- Every molecule is known about the best molecule in its neighbourhood.

The Particle Swarm Optimisation (PSO) usage steps can be summed up as: the initial step sets up and assesses the essential populace for asymptomatic transmission in the community. The subsequent advance decides the best close to home recollections and the best aggregate recollections. The third step refreshes the speed and position. On the off chance if the conditions for halting are not met, the cycle will go to the subsequent advance [19]. The PSO calculation is a populace-based calculation. This property makes it less inclined to be caught in a neighbourhood least. This calculation works as per potential standards, not on clear principles. Along these lines, PSO is an irregular improvement calculation that can look for unknown and complex regions. This makes PSO more adaptable and tough than customary strategies.

2.1. Manipulating factor co-related to Asymptomatic COVID-19 Cases

It is appealed that the starting point of infection is in Wuhan, China.It influences the further created nations (USA, Brazil,India, Britain, Spain, Italy, and so on.) [12, 23]. These nations are presently in phase4 of the spread and confrontingprogressive amounts of contaminations. On account of China, it is seen that exponential development of the infected and confirmed cases arrives at the immersion period. This trails from the way that the quantities of powerless individuals, which are presented to infection, are drastically diminished. It was made conceivable because of the diminished communalconnection among individuals by isolating the contaminated people. Isolation and lockdown were started by the Chinese administration and management, in this manner lessening the chance of additional spread. The symptoms for all variety of COVID-19 as “Most Common, Less Common and Serious” level have been shown in fig 4.

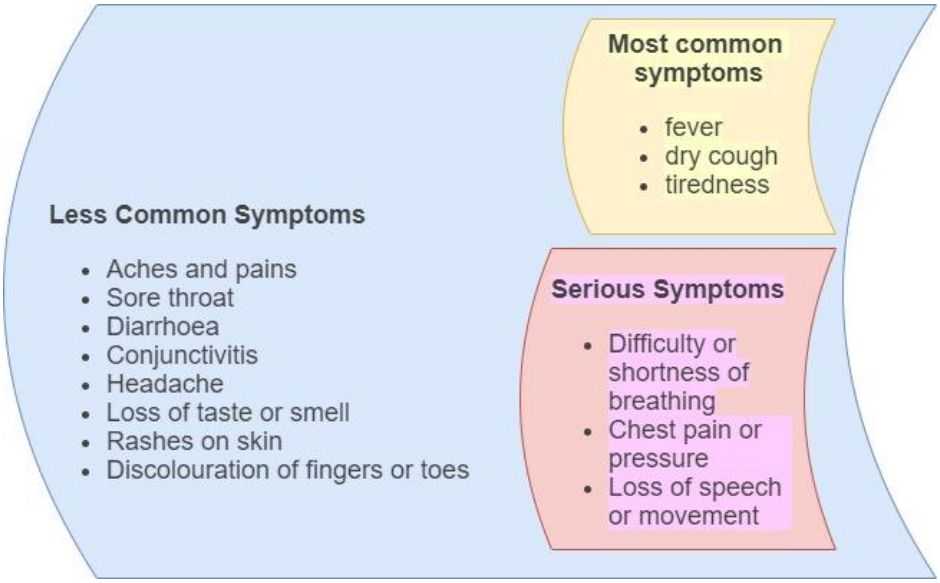

Fig 4: Most Common, Less Common and Serious Symptoms for COVID-19

Since the most recent decade, advanced ML techniques are assuming basic jobs in significant wellbeing part issues including sickness counteraction. It also presents overall wellbeing crisis and looking for mechanical help to handle COVID-2019 [20].
In [28], ARIMAmodel to foresee the blowout of COVID-2019 and explores the effort shows the visual representation of correlations in data that change over time and ARIMA gauge chart for the pestilence frequency and pervasiveness. Deb et al. suggested a period arrangement strategy to dissect frequency design and the evaluated generation number of coronavirus cases. They completed factual investigation to investigate the patterns of the outburst to feature the current epidemiological phase of a district so different arrangements can be distinguished to reportcoronavirus pandemic in various nations. According to the current circumstance, it is basic to comprehend the initialblowout examples of the contamination to design and regulate the successful wellbeing actions. Towards this path anticipated a logical prototypical model of basic SARS-CoV2 infection by utilizing diverse datasets to examine the coronavirus cases inside and exterior Wuhan. With this, they investigated the conceivable spread of malady outburstexterior side of Wuhan [2, 25].

3. RESEARCH METHODOLOGY FOR ASYMPTOMATIC SPREAD OF CORONAVIRUS DISEASE

3.1. Designing Principle for Internet of Things (IoT)

The beginning of year 2020 has given so much exciation in the history of medicine and science where technologies based on Internet of Things and Machine Learning can support the society for better leving [24]. It is a typical rule that lie beneath all managed internet of things and AI calculations used forprojecting this model.The ML calculations are portrayed asexamining an objective capacity (f) that finest maps participation factors (N) to a yield mutable (Y):

$$Y = f(N)$$

It is a basic and fundamental examination that might predict forecasts later on (Y) given initially and new instances for information factors (N). We do not have a clue that what exactly the capacity (f) looks or its structure. On the off chance that we have done previously, we will utilize it legitimately and we wouldn't have to take it from information utilizing ML algo-

rithms [3].

The very important and highly recognized kind of AI and ML is to gain proficiency with the plotting $Y = f(N)$ to use expectations of Y and reinitializeN. It is called as predictive modelling or prescient examination and its objective is for make the very precise predictions likely [27].

3.2. Logistic Regression

Logistic regression is an additional procedure acquired in AI and ML, from the categoryfor measurements. This is a go-to strategy for dual classification complications (issues with two group values) [26]. Logistic regression resembles direct reversion in the objective which has to discover the qualities for the quantities that computeheavinessof each input coefficient. In contrast to linear regression, the expectation for outcome is changed utilizing a non-direct capacity which is called as logistic function. This function seems as though a big S and would change any incentive into the choice ofzero to one. It is helpful on the grounds whena standard is applied to the yield of the calculated capacity to snap and esteems to 0 and 1 (for example in the event that under 0.5, at that point yield 1) and predict a class value [10].

The logistic relapse model accepts that the log-chances of a perception y can be denoted like a linear method of the N input factors **i**:

$$\log \frac{W(i)}{1 - W(i)} = \sum_{j=0}^{N} b_j i_j$$

Next, we will add the term of constant b_o by initializing $i_o = 1$. This produces the resultN+1 parameter. The L.H. S. of above expression is namedas the logit for W (that is why we called it as logistic regression).Here,We can similarlyreverse the logit expression to come to on a new equation for W(i):

$$W(i) = \frac{\exp z}{1 + \exp z},$$

$$z = t = \sum_{j=0}^{N} b_j i_j$$

The R.H.S.for the given above expression is called as the sigmoid for z, which uses to plots the feasible line in the range (0, 1), and it is about near the origin linearly. A beneficial fact onP (t) is the P' (t) = P(t) (1 – P(t)).

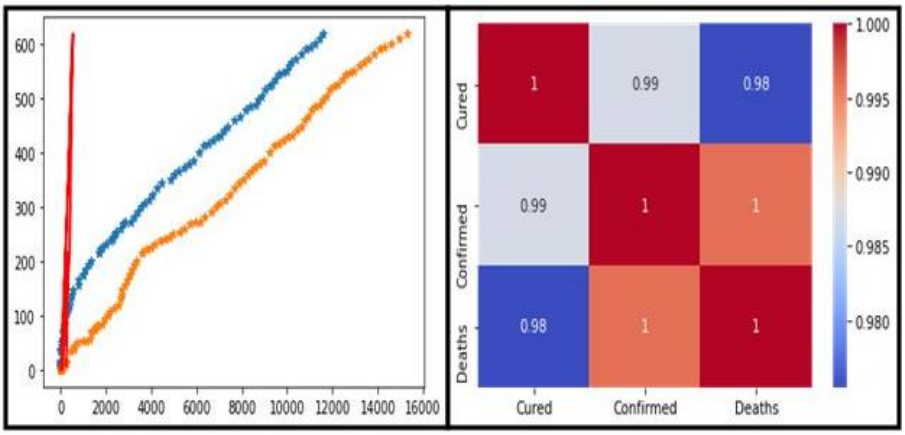

Fig 5: Multivariate Logistic Regression & its generated HeatMap

Fig 5 is generated after doing analysis on the COVID19 data of the state Madhya Pradesh (India). The data consists of four dependent variables Confirmed, IndianNational, ConfirmedForeignNational, Cured, Confirmed and Death is the independent variable [16, 26].

3.3. Classification and Regression Tree

Decision Trees are a significant sort of calculation for prescient demonstrating AI. The representation of the decision tree model is a twofold tree. Every Node speaks to a single information variable (x) and a split point on that factor (expecting the variable is Integer). This is termed as classification tree [23, 26].

Regression Tree

The regression tree is type of decision tree in which leaf nodes of the tree contain a yield variable (y) which is utilized to predict an expectation. Expectations are made by strolling the parts of the tree until showing up at a leaf Node and yield the group value at that leaf node. Trees are quick to learn and quick for making forecasts. They are additionally regularly precise for an expansive scope of issues and don't require any uncommon groundwork for your data [24, 27].

Below are the major characteristic selection actions:

Information Gain: This characteristic gives us the parting values as far as the measure of data required to additionally maintain the tree. Information gain limits the data expected to characterize the information focuses into particular parcels and mirrors the least impurity or "randomness" in these allotments.

$$\mathrm{Info}(D) = -\sum_{i=1}^{m} p_i \log_2(p_i)$$

$$\mathrm{Info}_A(D) = \sum_{j=1}^{v} \frac{|D_j|}{|D|} \times \mathrm{Info}(D_j)$$

p_i is known as probability arbitrary list in dataset D related to group Ci and is calculated bythe equation $\sum_{j=1}^{v} \frac{|D_j|}{|D|} \times \mathrm{Info}(D_j)$ is basically the average value of the data needed to classify the group/class of aninformation point in D. A logarithmic method tobase value of 2 is used, because in majority of cases, data is encrypted in binary values or bits. Info(D) is mainly called as the randomness of the dataset D.

We can calculate the information gain as follows:

$$\mathrm{Gain}(A) = \mathrm{Info}(D) - \mathrm{Info}_A(D)$$

Gain Ratio: The information gain calculations are prejudiced on the way to testit with as many outputs as possible. Hence, it prioritizes choosing attributes which is huge in number of values. Gain ratio is an additional attempt to re-improve this kind of problem [17].

$$\mathrm{SplitInfo}_A(D) = -\sum_{j=1}^{v} \frac{|D_j|}{|D|} \times \log_2\left(\frac{|D_j|}{|D|}\right)$$

$$\mathrm{GainRatio}(A) = \frac{\mathrm{Gain}(A)}{\mathrm{SplitInfo}(A)}$$

Gini Index: The Gini index is given by the following expression:

$$\mathrm{Gini}(D) = 1 - \sum_{i=1}^{m} {p_i}^2$$

where p_i denotes the probability for which a tuple in dataset D goes to group Ci and is reported with the ratio $\frac{|D_j|}{|D|}$.The total addition value is iterated over m number of classes. The Gini index contemplates a dual fold split (binary) for every attribute value. In Fig 6 decision tree is used to illustrate the classification of red, orange, and green zones.

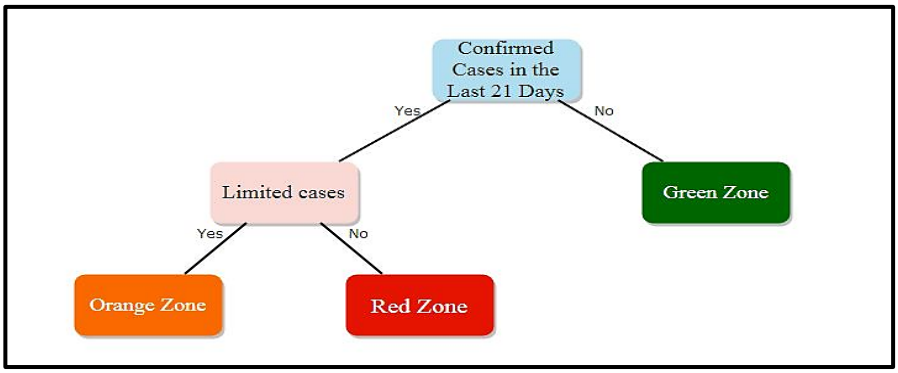

Fig 6: COVID19 Zones Classification Using Decision Tree

4. RESULTS AND ANALYSIS

The mainly written tasks reports deep level evaluation, i.e. infected and non-infected exactness. Few of them reports recovery level population exactness, but ground truth is not totally available yet [6, 23].

Table 1: COVID 19 cases all over the world

Country/region	**Confirmed**	**Recovered**	**Deaths**	**Active**	
US	1347881		232733	80682	1034466
Spain	227436		137139	26744	63553
UK	224332		1015	32141	191176
Russia	221344		39801	2009	179534
Italy	219814		106587	30739	82488
France	177547		56835	26646	94066
Germany	172576		145617	7661	19298
Brazil	169594		67384	11653	90557
Turkey	139771		95780	3841	40150
Iran	109286		87422	6685	15179
China	84011		79198	4637	176
Canada	71264		33007	5115	33142

India	70768	22549	2294	45925
Peru	68822	22406	1961	44455
Belgium	53449	13697	8707	31045
Saudi Arabia	41014	12737	255	28022
Mexico	36327	23100	3573	9654
Pakistan	32081	8555	706	22820
Switzerland	30344	26800	1845	1699
Netherlands	42987	149	5475	37363

4.1. Data Extraction

Shown in table 1, it uses given table values to scan through dataset. It shows for total confirmed cases till may 2020 [18]. For comparing and predicting level of covid-19 pandemic we have other values like recovered, deaths and total active cases in a country. Further it also scans and gives results of prediction of covid-19 pandemic in India. The dataset for this implementation has been taken from Kaggle Inc. source mentioned at (https://www.kaggle.com/daaset/106028f4f69234cb77024ae05041a7ceb3644ccb8de4efba1eefece4848593d4)

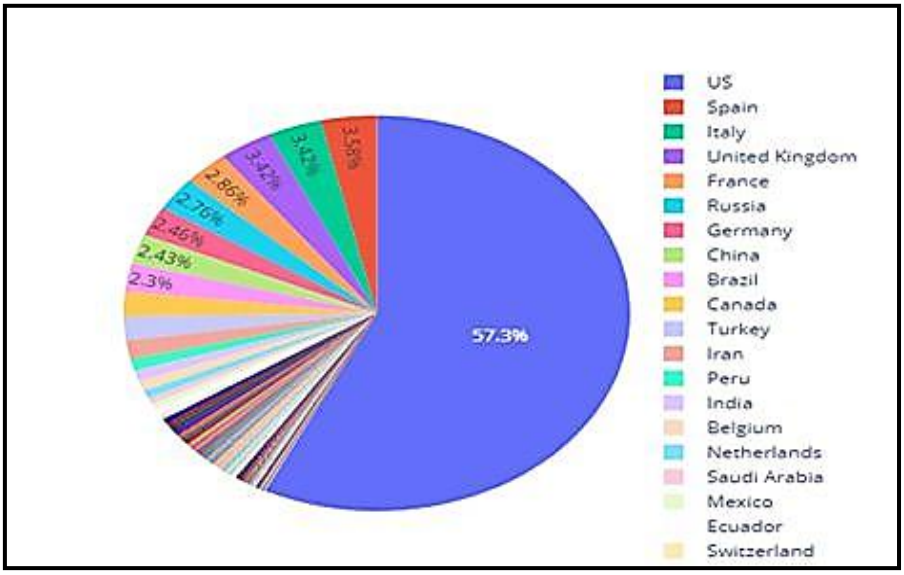

Fig 7: Percentage Wise Distribution of Total Cases in Per Country

After loading data, it goes for label and co-relation table of given dataset with the help of pandas and NumPy as shown in Fig 7. It has been found that 57.30% of the total cases in globe are found in United States and after that the order is India (6.76%),Russia (5.46%), Spain (3.58%), Italy (3.42%), United Kingdom (3.42%), and France (2.86%).

4.2. Study Characteristics:

As shown in Fig. 8, it shows the beginning and how the corona virus hits the top 10 worst affected countries with time. The most affected country with major variation in its graph is US.

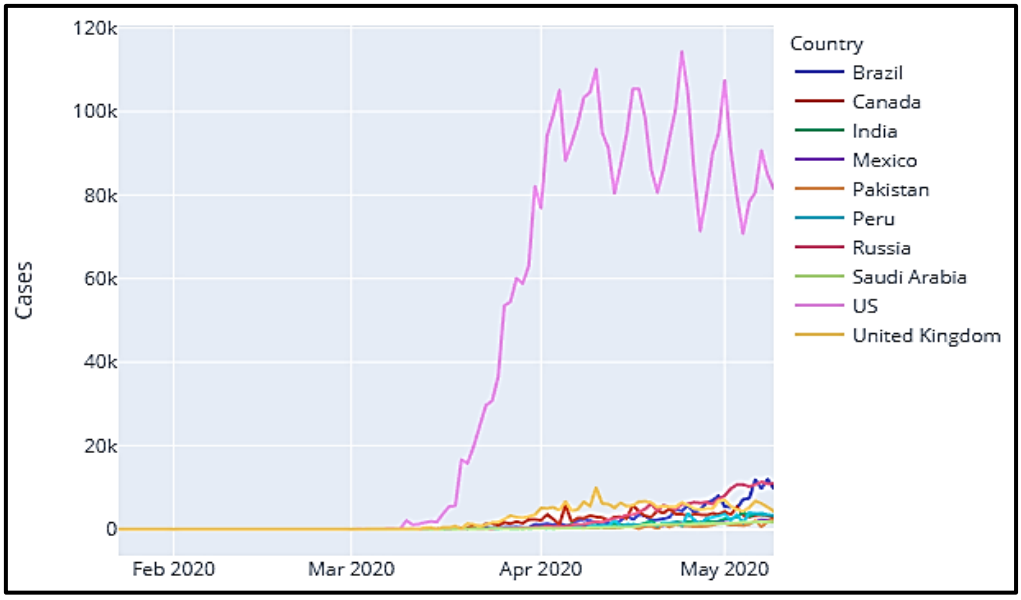

Fig 8: Top 10 worst affected countries and growth with time

As we can see in fig 9, it reports that the very first case is found in China and with the highest no. of cases (529) by 23 January 2020. It is shown in figure that US has the maximum increasing rate.

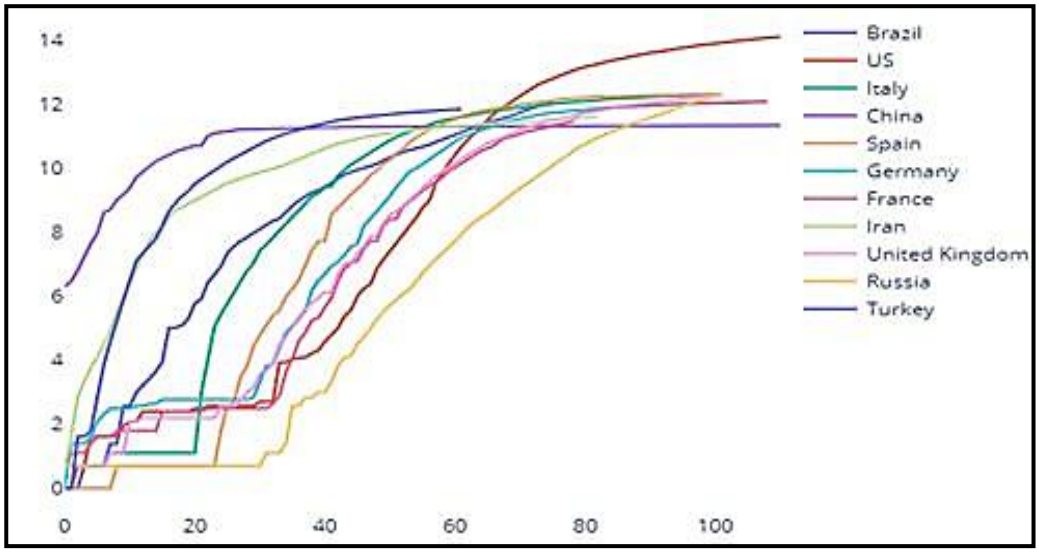

Fig 9: Growth of cases in nations since the first case appear

As shown in Fig. 10, in the past one month, several US states were scheduled to close, if the condition comes under control, there will be a reopening. As of April 22, 2020, there are 6 European countries that have some form of reopening in place.

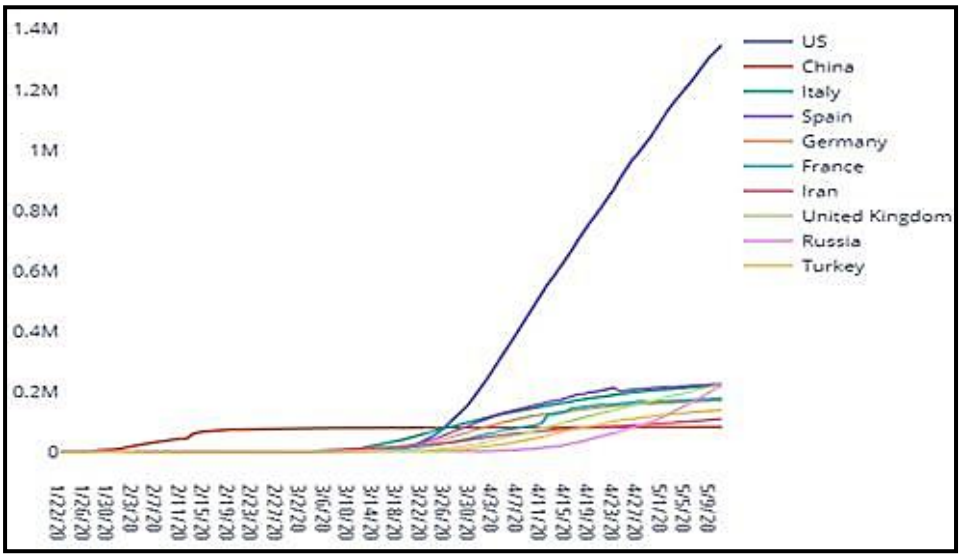

Fig. 10: total confirmed cases and growth by countries

Here shown in Fig. 11, we can see the growth in total cases all over world. It is reported that after 15 march, there is a big change in growth of cases and thus graph is showing a sudden rise in total cases which is above 50,00,000 for global cases. So here it reports the increasing rate of confirmed cases, recovered cases and deaths.

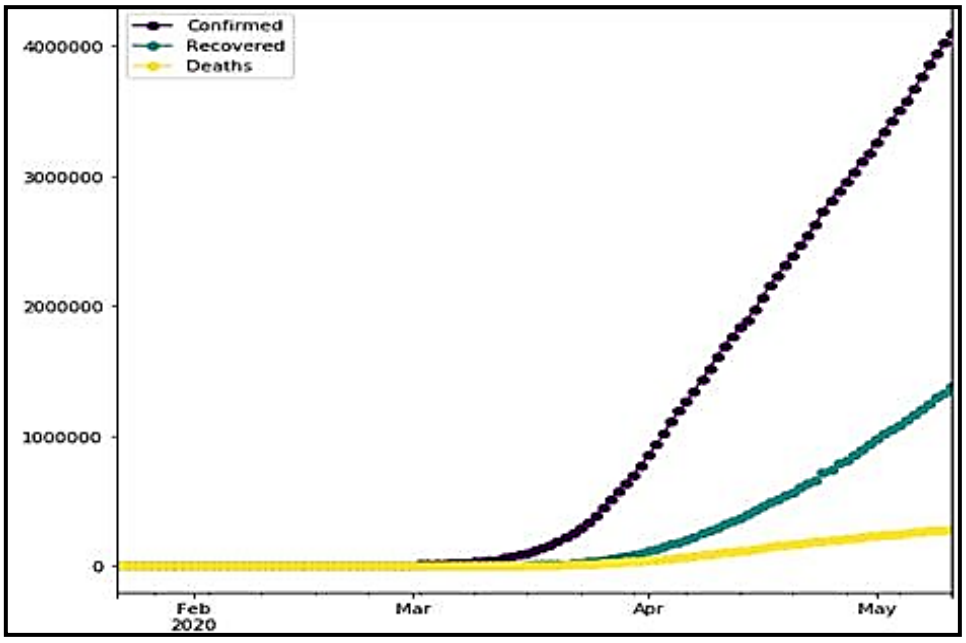

Fig. 11 Per Day statistics of world with cases

4.3. Data Collection

As shown in Fig. 12, it reports with co-relational value of 0.977. On Y-axis, it goes for logarithmic data scale from 30 January 2020 to 5 May, 2020. Blue line indicates the growth of cases and red line indicates number of deaths. After founding all the related data and predicted values, it has been observed that in the next two weeks there will be a big growth in number of cases and increasing rate of deaths as well.

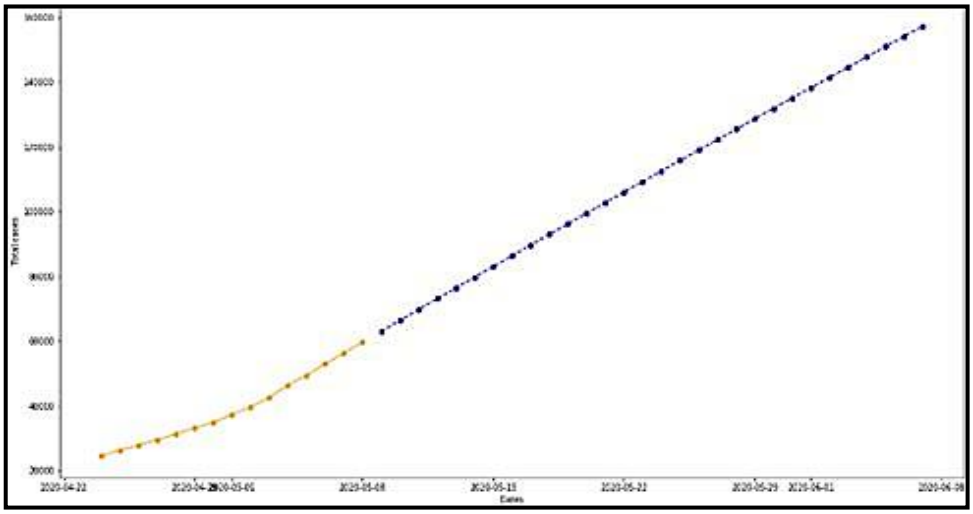

Fig 12: Predicted values for next upcoming days in India

4.4. Model Presentation Estimation

From Table 2, it has been observed that Maharastra is the most infected state of India with the positive test rate of 0.08. After Maharastra , the state with respectively maximum positive rate are Uttar Pradesh (0.03), Tamil Nadu (0.02), Rajasthan (0.02), and Andhra Pradesh (0.01). It is reported that the state with most infected rate with maximum number of negative test rate is Andhra Pradesh (0.99) [19].

	Negative	**Positive**	**Total Tested**	**Positive Test Rate**	**Negative Test Rate**
State					
Maharastra	140587	11506	151085	0.08	0.93
Tamil Nadu	135698	2757	139490	0.02	0.97
Rajasthan	104705	2720	113934	0.02	0.92
Andhra Pradesh	106878	1525	108403	0.01	0.99
Uttar Pradesh	82356	2487	85729	0.03	0.96

Table 2: Test Rate forPositive and Negative Cases

5. CONCLUSION

This paper provides an extensive study on prediction and estimation for asymptomatic number of coronavirus 2019 (COVID-19) cases using machine learning techniques. The study shows both positive and negative rate percentagefor different provinces especially in India as

well as for different countries in the world. This paper also depicts the possible growth of corona virusesin upcoming days at India and Global perspective.The early predictions will help local and state government to moderate their doctors, and health workers to assure the better services to their country citizens. The study also reported with model estimation statistics with total number of test conducted along with positive and negative aspects till May2020. This model guaranteed the nearest value prediction for possible number of case into short-interval time and this model can also be accepted for long-interval time at global level. The classification tree also determined the 57.30% of the total cases in globe are found in United States and after that the order is India (6.76%),Russia (5.46%), Spain (3.58%), Italy (3.42%), United Kingdom (3.42%), and France (2.86%).

REFERENCES

[1] C. J.Wang, C.Y., Ng&R.H. Brook. Response to COVID-19 in Taiwan: big data analytics, new technology, and proactive testing. JAMA, 323(14), pp. 1341-1342, 2020.
[2] J.T. Wu, K. Leung &G.M. Leung. Nowcasting and forecasting the potential domestic and international spread of the 2019-nCoV outbreak originating in Wuhan, China: a modelling study. The Lancet, 395(10225), pp. 689-697, 2020.
[3] N.E. Wheeler. Tracing outbreaks with machine learning. Nature Reviews Microbiology, 17(5), 269, 2019.
[4] M. Bates. Tracking disease: Digital epidemiology offers new promise in predicting outbreaks. IEEE pulse, 8(1), pp.18-22, 2017.
[5] P.R. Ward. Improving access to, use of, and outcomes from public health programs: the importance of building and maintaining trust with patients/clients. Frontiers in public health, 5, 22, 2017.
[6] S. V. Scarpino&G. Petri. On the predictability of infectious disease outbreaks. Nature communications, 10(1), pp.1-8, 2019.
[7] World Health Organization, 2020. Coronavirus disease 2019 (COVID19): situation report, 67.
[8] G. Purcaro, C.A. Rees, W.F. Wieland-Alter, M.J. Schneider, X. Wang, P.H. Stefanuto, P.F. Wright, R.I. Enelow and J.E. Hill. Volatile fingerprinting of human respiratory viruses from cell culture. Journal of breath research, 12(2), p.026015, 2018.
[9] E.O. Nsoesie, J.S. Brownstein, N. Ramakrishnan and M.V. Marathe. A systematic review of studies on forecasting the dynamics of influenza outbreaks. Influenza and other respiratory viruses, 8(3), pp.309-316, 2014.
[10] Q.H. Ye, L.X. Qin, M. Forgues, P. He, J.W. Kim, A.C. Peng, R. Simon, Y. Li, A.I. Robles, Y. Chen and Z.C. Ma. Predicting hepatitis B virus–positive metastatic hepatocellular carcinomas using gene expression profiling and supervised machine learning. Nature medicine, 9(4), pp.416-423, 2003.
[11] R. Bavaresco, J. Barbosa, H. Vianna, P. Büttenbender &L. Dias. Design and evaluation of a context-aware model based on psychophysiology. Computer Methods and Programs in Biomedicine, 189, 105299, 2020.
[12] K. Roosa, Y. Lee, R. Luo, A. Kirpich, R. Rothenberg, J.M. Hyman&G. Chowell. Real-time forecasts of the COVID-19 epidemic in China from February 5th to February 24th. Infectious Disease Modelling, 5, pp. 256-263, 2020.
[13] A. Tomar, &N. Gupta. Prediction for the spread of COVID-19 in India and effectiveness of preventive measures. Science of The Total Environment, 138762, 2020.
[14] T. Zhang, Q. Wu, & Z. Zhang. Probable pangolin origin of SARS-CoV-2 associated with the COVID-19 outbreak. Current Biology., 2020

[15] S. Mandal, T. Bhatnagar, N. Arinaminpathy, A. Agarwal, A. Chowdhury, M. Murhekar&S. Sarkar. Prudent public health intervention strategies to control the coronavirus disease 2019 transmission in India: A mathematical model-based approach. The Indian journal of medical research, 151(2-3), 190, 2020.
[16] K. Sarkar, S. Khajanchi &J.J. Nieto. Modeling and forecasting the COVID-19 pandemic in India. Chaos, Solitons & Fractals, 110049, 2020.
[17] M. D. P.Kavadi, R. Patan, M. Ramachandran&A. H. Gandomi. Partial Derivative Nonlinear Global Pandemic Machine Learning Prediction Of Covid 19. Chaos, Solitons & Fractals, 110056, 2020.
[18] R. Salgotra, M. Gandomi&A. H. Gandomi. Time Series Analysis and Forecast of the COVID-19 Pandemic in India using Genetic Programming. Chaos, Solitons & Fractals, 109945, 2020.
[19] S. Roy, G.S. Bhunia &P.K. Shit. Spatial prediction of COVID-19 epidemic using ARIMA techniques in India. Modeling Earth Systems and Environment, 1-7, 2020.
[20] B. Paital, K. Das, &S. K.Parida. Inter nation social lockdown versus medical care against COVID-19, a mild environmental insight with special reference to India. Science of The Total Environment, 138914, 2020
[21] S.S. Ali, I.I. Ganapathi and S. Prakash. Fingerprint Shell with impregnable features. Journal of Intelligent & Fuzzy Systems, 36(5), pp.4091-4104, 2019.
[22] K. Kanagarathinam&K. Sekar. Estimation of Reproduction Number (Ro) and Early Prediction of 2019 Novel Coronavirus Disease (COVID-19) Outbreak in India Using Statistical Computing Approach. Epidemiology and Health, e2020028, 2020.
[23] D. Rafiq, S.A. Suhail &M. A.Bazaz. Evaluation and prediction of COVID-19 in India: A case study of worst hit states. Chaos, Solitons & Fractals, 110014, 2020.
[24] P. Chyne, P. Chatterjee, S. Sanyal &D. Kandar. Anomaly Detection in IoT Frameworks Using Machine Learning. In Applied Approach to Privacy and Security for the Internet of Things, pp. 88-112, 2020.
[25] B. Vellingiri, K. Jayaramayya, M. Iyer, A. Narayanasamy, V. Govindasamy, B. Giridharan&K. Rajagopalan. COVID-19: A promising cure for the global panic. Science of The Total Environment, 138277, 2020.
[26] S. Gupta, M. Mittal & A. Padha. Predictive analytics of sensor data based on supervised machine learning algorithms. In 2017 IEEE International Conference on Next Generation Computing and Information Systems (ICNGCIS), pp. 171-176, 2017.
[27] N. Thakur&C. Y. Han. An Improved Approach for Complex Activity Recognition in Smart Homes. In International Conference on Software and Systems Reuse, pp. 220-231, 2019.
[28] D. Benvenuto, M. Giovanetti, L. Vassallo, S. Angeletti &M. Ciccozzi. Application of the ARIMA model on the COVID-2019 epidemic dataset. Data in brief, 105340, 2020.