

Time Series Analysis on COVID-19

Anveshini Dumala

Asst.Professor, Department of IT,

*Vignans Nirula Institute of Technology and Science for Women,
Palakaluru, Guntur, AP, India*

Anusha Papasani

Asst.Professor, Department of IT,

*Vignans Nirula Institute of Technology and Science for Women,
Palakaluru, Guntur, AP, India.*

Abstract- The ongoing corona virus flare-up has activated frenzy circumstance over the globe, provoking travel bans, visa limitations, enormous scope isolates, social removing, and lockdown. The corona virus - COVID-19 - has arrived at practically all nations and has caused boundless fatalities inside as well as outside of territory China. The flare-up has been named a scourge rather than a pandemic: the distinction being that a pestilence is the far reaching event of an infection in one network at a specific time, though a pandemic is the point at which an illness spreads across the globe at a similar pace. Assuming, be that as it may, the pace of contamination and demise expands it could before long be named a pandemic. As the time passes infection is spreading like an out of control fire and expanding the casualty rate. In this paper, an endeavor has been made to feature the seriousness of the infection spreading utilizing the time series analysis.

Keywords: Corona, COVID-19, Flu, Time Series Analysis, ARIMA.

1. INTRODUCTION

In December 2019, a word 'corona' caught a little eye of individuals. The corona is an infection that causes the ailment known as COVID-19 (COrona VIRus Disease-2019), turned into a worldwide pandemic. Its dictionary meaning in anatomy is "part of the body resembling or likened to a crown" as appeared in Figure 1. The one determined legend is that this corona infection was made by researchers and got away from a lab in Wuhan, China. This infection prompts a respiratory disease. It progressively and profoundly influences the lungs. It very well may be transmitted from droplets of bodily liquids-, for example, bodily fluid and spit through sniffing, hacking, and so on. The infection lives for 72 hours on the surfaces of hands, nails, garments, and the physical items that are in contact with the infection influenced individual and so forth. The disease may become extreme that it murders the individual. The infection doesn't wait noticeable all around at sufficiently high levels to be a hazard to a great many people who are not truly close to a contaminated individual. The real problem with this corona virus is that it takes quite a long time like 14-50 days to identify the symptoms if a person is affected by the virus.

At first, no one has a thought of this word corona is going to shake the globe. Prior the corona virus was apparently limited to China. Be that as it may, half a month later, the infection began to spread over the globe like an out of control fire in any event 185 nations as announced. That is the reason, researchers, wellbeing authorities and governments over the world have urged residents to rehearse physical separating, and to abstain from going out except if for fundamental purposes.

As indicated by information arranged by Johns Hopkins University, more than 5.3 million individuals have been tainted, and the episode worldwide loss of life is more than 343,608,. More than two million patients have recouped

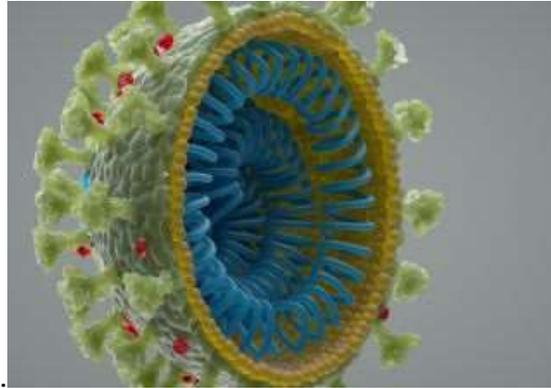


Figure 1: Viruses like the novel coronavirus are shells holding genetic material.

(Image: © Andriy Onufriyenko/Getty Images)

2. MAJOR FLUS IN THE HISTORY

There have been significant events of those in the history;

- The 6th cholera (1910-1911) - It started in India, in this way spread to the North Africa, Middle East, Russia and Eastern Europe. It took lives of 8 lakh individuals.
- The Third cholera (1852) - It started in India and spread across mainlands asserting more than 10 lakh lives across the world.
- The Hong Kong influenza (1968) - This season's cold virus was a worldwide flare-up of the flu infection, which began in the Asian landmass. The pandemic was brought about by the infection's H3N2 subtype suspected to have developed from a past flu episode in 1957. The infection murdered 1 million individuals.
- Influenza (1889-1890) - The rendition of the flu infection was the H3N8 subtype, started in the Russia and along these lines spread over the Northern Hemisphere. The malady guaranteed 10 lakh lives.
- The Asian influenza (1957) - This was an avian flu flare-up that spread and late ceased to exist after an immunization was presented.
- The Antonine plague (AD 165) – This is otherwise called the Plague of Galen hit of Roman Empire, murdering 50 lakh individuals. It was doubted that has been either measles or smallpox brought back by crowds coming back to Rome from the Far East.
- The Plague of the Justinian (541-542): A flare-up of bubonic plague, the pandemic hit the Byzantine Empire and numerous urban areas of the Mediterranean Sea.
- The HIV/AIDS (2005-2012): AIDS is an auto-invulnerable malady, brought about by the Human Immuno Virus (HIV) that was first distinguished in the Republic of Congo in 1976 yet didn't turn into a pandemic until it topped somewhere in the range of 2005 and 2012 generally influencing the African landmass. The explicitly transmitted infection has slaughtered more than 350 lakh individuals in those times.
- The Spanish influenza (1918): This is the deadliest influenza episodes ever; it tainted around 500 million individuals, and executed more than 50 million individuals. The pandemic was one of the two flare-ups brought about by the H1N1 infection. Allegedly, the spread was exacerbated because of meager cleanliness.
- The Black Death (1346-1353): This took more than 200 million individuals, remodeling socioeconomics of the world. History specialists accept the infection began in the Asia and traversed the world.

Based on current statistics, COVID-19 is affected to more than 3.5 million people in 212 countries and territories around the world, more than 249,083 deaths and 1,166,021 Recovered cases are recorded. Since, China is

the epicenter of the universal supply chain, the blowout of the virus has affected businesses undeniably across the world. It is said that a vaccine is under the experimentation with no actual clue when it comes into reality.

3. TIME SERIES ANALYSIS (TSA)

A time series is a sequence of data points indexed with respect to time. Generally, TSA analyzes time series data to excavate the significant statistics and other hidden features of the data. It predicts the future values according to the previously observed values. It is broadly used for active data, like increase in COVID-19 positive cases w.r.t time as shown in Figure 2, stock price, economic rise or downfall, weather, hourly number of pages views for a website, retail sales, daily air temperature in a city, monthly average number of reported complaints, annual population data in the country etc. Time series analysis knows the trends in the data and forecasts, understands the behavior of data in the future based on previous data. A sequential set of data points measured over time $x(k)$, where $k=1,2,3,4\dots$ is a variable that represents the elapsed time.

A time series comprehend the information about general tendency in data, seasonal effects, occasional events, and so on. ARIMA (Auto Regressive Integrated Moving Average) modeling is one of the best modeling techniques for time series analysis. It is expressed as ARIMA (p, d, and q). Here, p is auto regression, d is the degree of trend difference and q is the order of moving average. We practiced an ARIMA model on the COVID -19 time series data. This ARIMA model is then tested for variance in normality and stationary.



Figure 2: The Time vs. prevalence of COVID-19

Types of Time series analysis

- ✓ Trend-It's a general (long term, non-periodic) tendency of a time series.
- ✓ Seasonal-The periodic fluctuation caused by regular influences.
- ✓ Cyclical-The medium term fluctuations caused by cyclically occurred on basis of non-periodic influences.
- ✓ Irregular-Random Variation caused by unpredictable influences.

This paper uses the figures from the World Health Organization (WHO) [1] and combines the Johns Hopkins University coronavirus dataset [2] [3] [4]. Google COLAB and simple python libraries are used for TSA.

4. RESULTS AND ANALYSIS

The latest (from 22-1-2020 to 21-5-2020) dataset taken from the Johns Hopkins University coronavirus dataset has 20574 records with the 7 features Observation Date, Province/State, Country/Region, Last Update, Confirmed, Deaths and Recovered as shown in Figure 3.

Observation Date	Province/State	Country/Region	Last Update	Confirmed	Deaths	Recovered
5/21/2020		Afghanistan	5/22/2020 2:36	8676	193	938
5/21/2020		Albania	5/22/2020 2:36	969	31	771
5/21/2020		Algeria	5/22/2020 2:36	7728	575	4062
5/21/2020		Andorra	5/22/2020 2:36	762	51	639
5/21/2020		Angola	5/22/2020 2:36	58	3	17
5/21/2020		Antigua and Barbuda	5/22/2020 2:36	25	3	19
5/21/2020		Argentina	5/22/2020 2:36	9931	416	3032
5/21/2020		Armenia	5/22/2020 2:36	5606	70	2581
5/21/2020		Austria	5/22/2020 2:36	16404	633	14951
5/21/2020		Azerbaijan	5/22/2020 2:36	3749	44	2340
5/21/2020		Bahamas	5/22/2020 2:36	97	11	44
5/21/2020		Bahrain	5/22/2020 2:36	8174	12	3873
5/21/2020		Bangladesh	5/22/2020 2:36	28511	408	5602
5/21/2020		Barbados	5/22/2020 2:36	90	7	70
5/21/2020		Belarus	5/22/2020 2:36	33371	185	12057
5/21/2020		Belgium	5/22/2020 2:36	56235	9186	14988
5/21/2020		Belize	5/22/2020 2:36	18	2	16
5/21/2020		Benin	5/22/2020 2:36	135	3	61

Figure 3: The Latest COVID-19 Dataset

Distributions plot for Active Cases of COVID-19 from 22-1-2020 to 21-5-2020 is displayed in the figure 4.

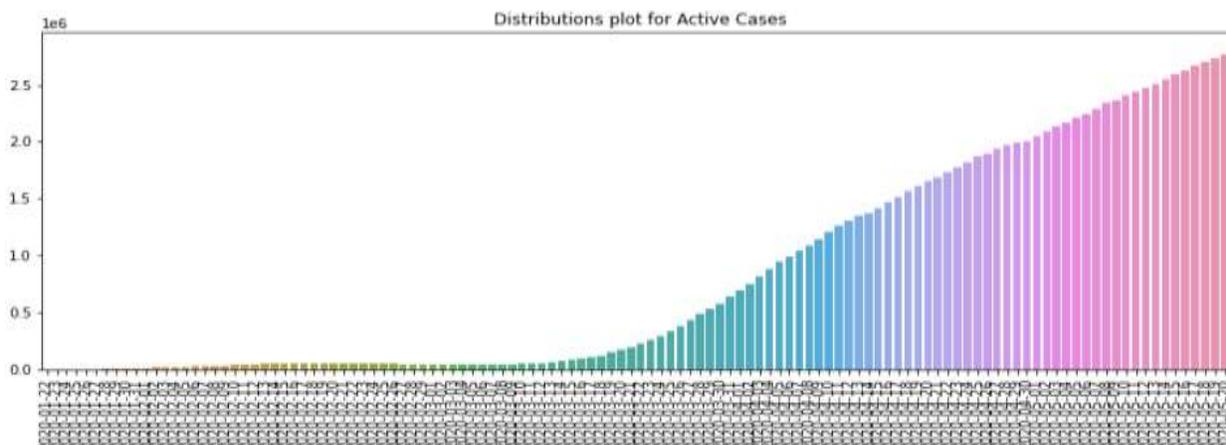


Figure 4: Distributions plot for Active cases of COVID-19

Total number of Confirmed cases around the world is 5401586.0. Total number of Recovered cases around the world is 2244852.0. Total number of Death cases around the world is 343804.0. Total number of Active cases around the world is 2810650.0. Total number of closed cases around the world is 2812930.0.

The Distributions plot for Closed (Confirmed-(Recovered + Deaths)) cases of COVID-19 is shown in Figure 5.

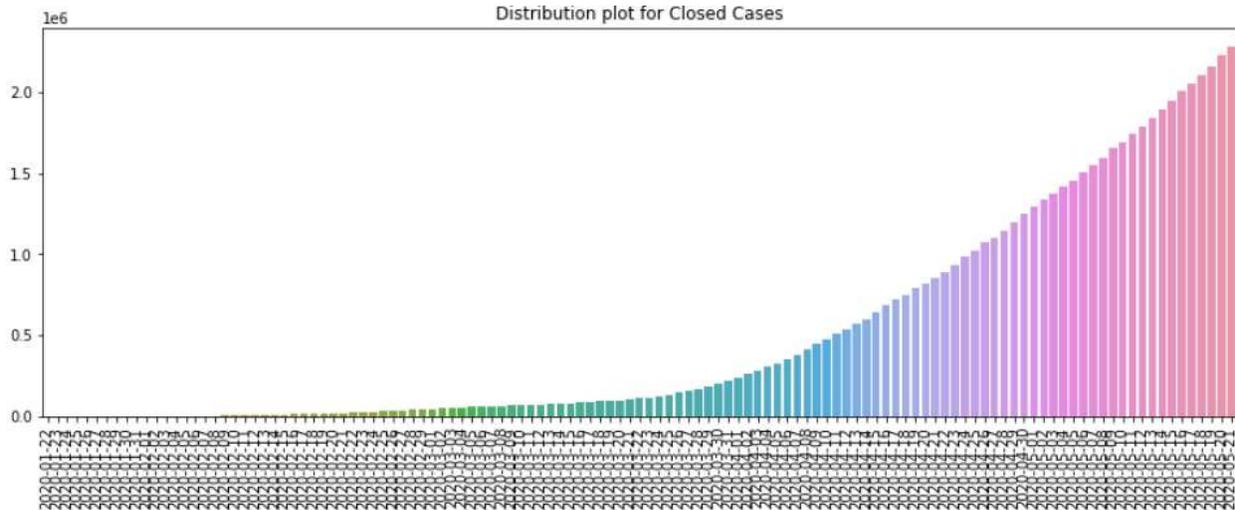


Figure 5: Distributions plot for Closed (Confirmed-Recovered and Deaths) cases of COVID-19

Week by week there is a drastic intensification in the number of positive COVID-19 cases. The line graph for Confirmed, Recovered and Deaths of COVID-19 cases in weekly progress is presented in Figure 6.

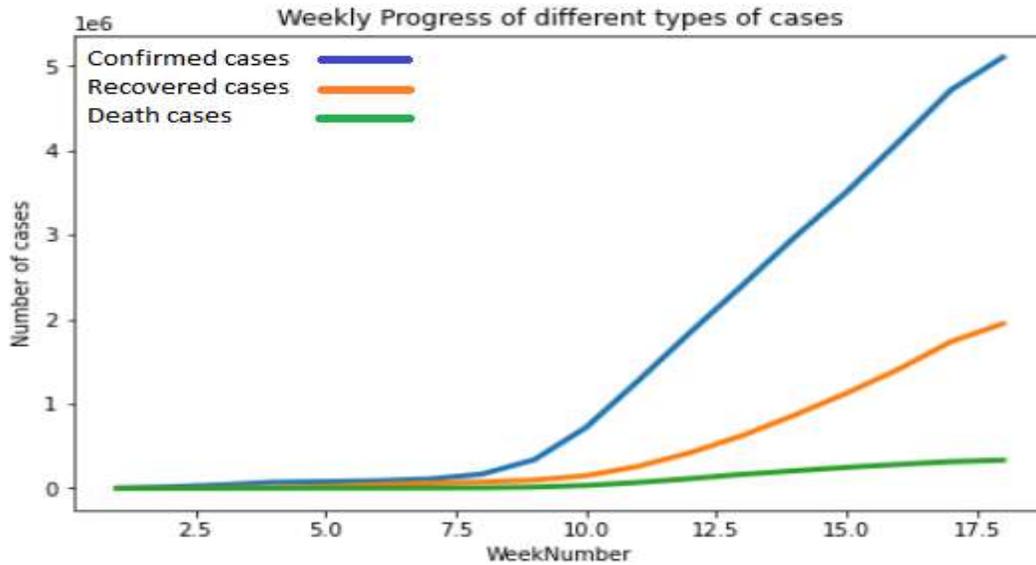


Figure 6: Line graph for Confirmed, Recovered and Deaths of COVID-19 cases in weekly progress

In particular, the Figure 7 depicts the Bar graphs for Confirmed and Deaths of COVID-19 in weekly progress.

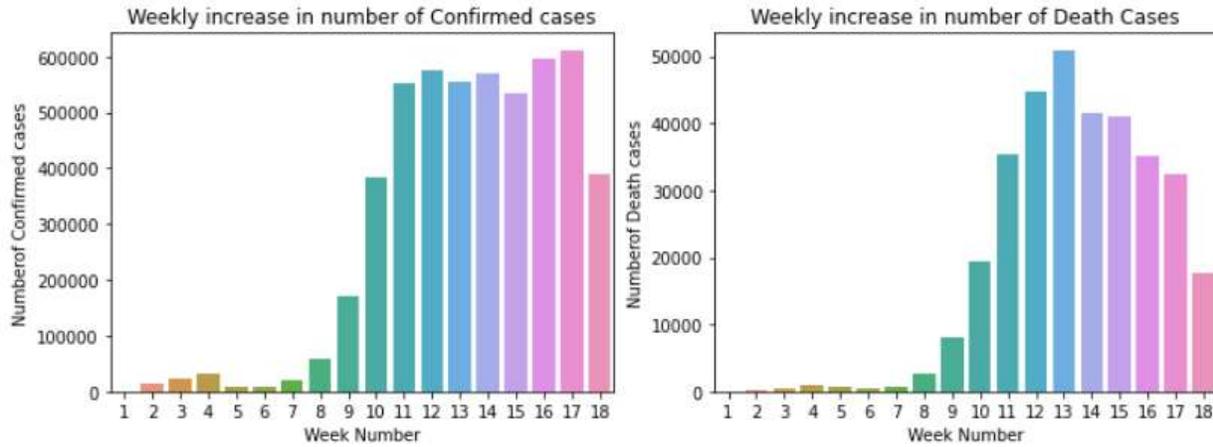


Figure 7: Bar graphs for Confirmed and Deaths of COVID-19 cases in weekly progress

According to the research, Average increase in the number of Confirmed cases every day is 42164.0. The average rise in the number of Recovered cases every day is 16105.0. Average increase in number of Death cases every day is 2751.0. Figure 8 demonstrates the Confirmed, Recovered and Death of COVID-19 cases in a daily progress in Line graphs.

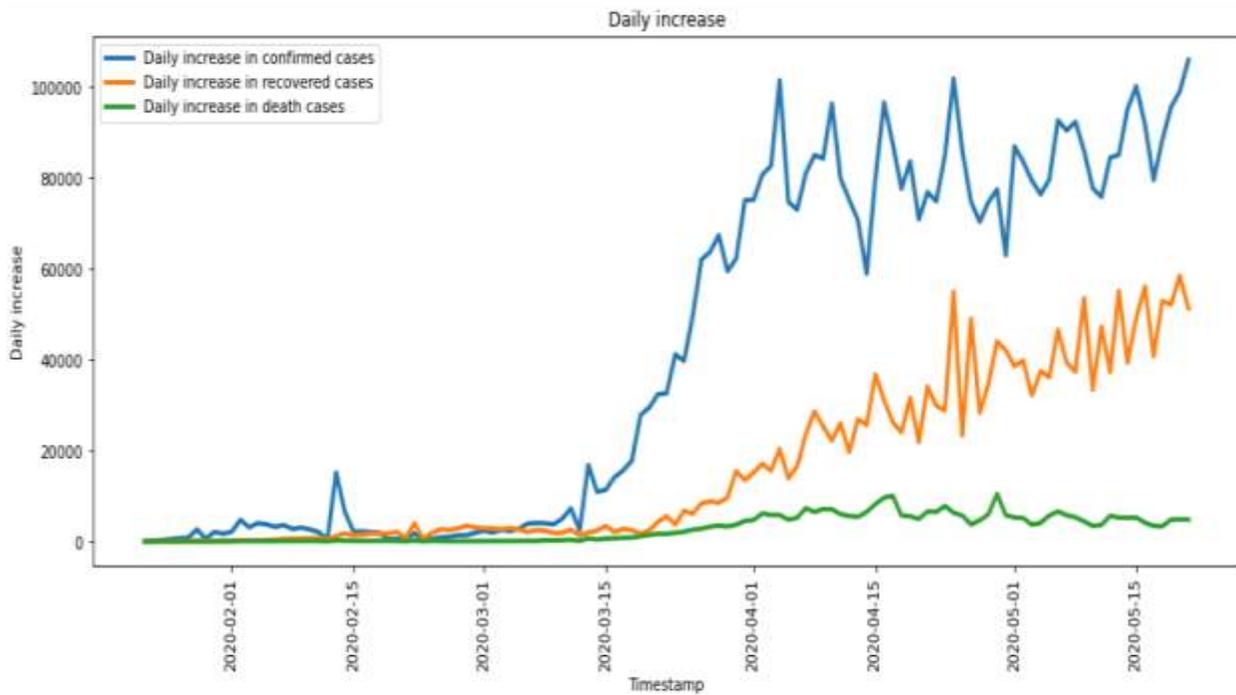


Figure 8: Line graphs for the Confirmed, Recovered and Deaths cases of COVID-19 in daily progress.

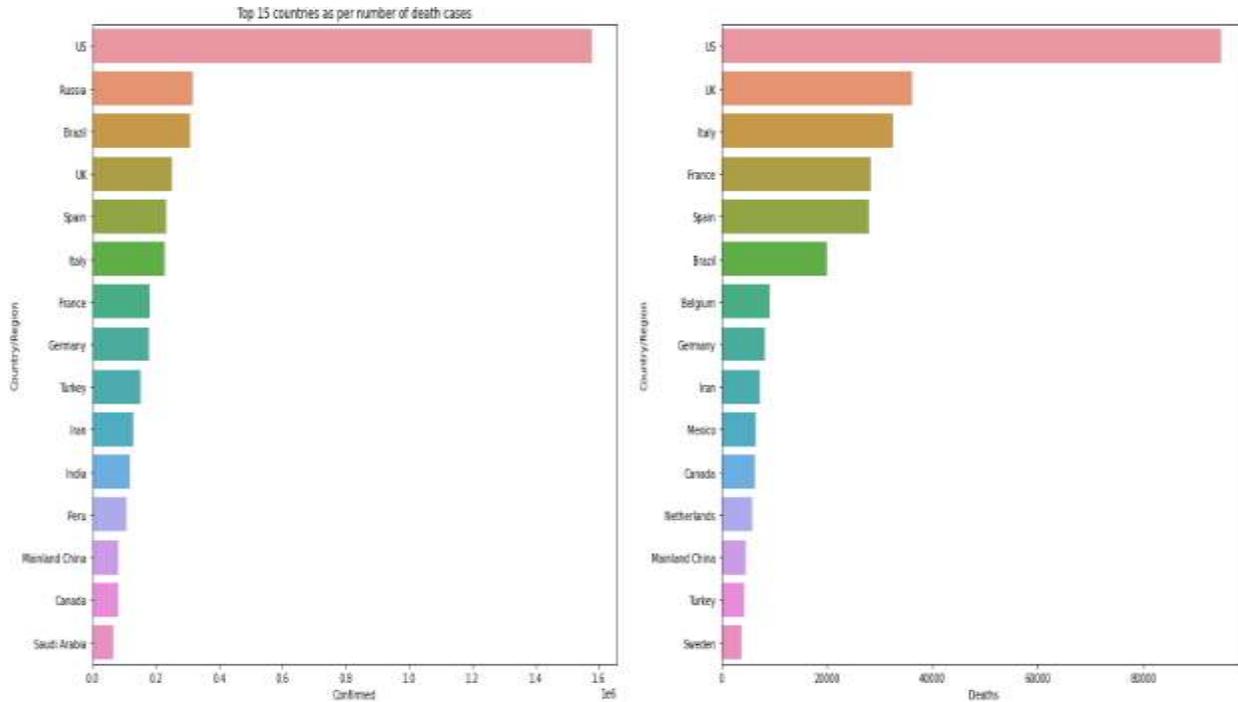


Figure 9: Comparative Bar graphs for Confirmed and Death of COVID-19 cases in highly affected top 20 countries

The regression models have the great benefit to apprehend the important associations between the prediction variable of concern and the predictor variables. Real-time applications have a very huge dimensional time series data. Figure 10 shows the prediction of the increase in the number of COVID-19 cases by 30th, May, 2020 by using Linear Regression and Support Vector Machine (SVM).

	Dates	LR	SVR
0	2020-05-22	3571669	6111266
1	2020-05-23	3609578	6364009
2	2020-05-24	3647487	6625175
3	2020-05-25	3685396	6894974
4	2020-05-26	3723305	7173618
5	2020-05-27	3761214	7461323
6	2020-05-28	3799124	7758308
7	2020-05-29	3837033	8064795
8	2020-05-30	3874942	8381011
9	2020-05-31	3912851	8707186

Figure 10: Prediction of the number of COVID-19 cases by 31st, MAY, 2020.

5. CONCLUSION

At first individuals thought COVID-19 is a pandemic. Later the individuals and governments understood that it is pandemic. The expanding numbers are alarming. The COVID-19 positive cases are expanding inconceivably step by step. According to the model estimate, the affirmed cases are required to significantly increment in the coming days. The time series analysis indicates an exponential upgrade in the tainted cases. It is forecast that the COVID-19 cases may increment to 8.7 million before the finish of May 2020. With the extremely severe upkeep of social separation, development of the high insusceptibility in the body and self-isolation cut the numbers down. These expectation models aid the individuals, government and clinical workforce to set up for the forthcoming circumstances and have more preparation in social insurance frameworks in the coming days.

REFERENCES

- [1] World Health Organization, Coronavirus disease (COVID-19) outbreak. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019> (accessed on May 4, 2020).
- [2] Johns Hopkins University Center for Systems Science and Engineering, Coronavirus (COVID-19) Cases. <https://github.com/CSSEGISandData/COVIDQ3> (accessed on May 04, 2020).
- [3] <https://data.world/covid-19-data-resource-hub/covid-19-case-counts>
- [4] www.kaggle.com