CODERS VS COVID-19 | ONLINE HACKATHON

A PROJECT ON COVID-19 OUTBREAK

INTRODUCTION

ABSTRACT *: The catastrophic outbreak of Severe Acute Respiratory Syndrome - Coronavirus (SARS-CoV-2) also known as COVID-2019 has brought the worldwide threat to the living society. The whole world is putting incredible efforts to fight against the spread of this deadly disease in terms of infrastructure, finance, data sources, protective gears, life-risk treatments and several other resources. The artificial intelligence researchers are focusing their expertise knowledge to develop mathematical models for analysing this epidemic situation using nationwide shared data. To contribute towards the well-being of living society, this article proposes to utilise the machine learning and deep learning models with the aim for understanding its everyday exponential behaviour along with the prediction of future reachability of the COVID-2019 across the nations.*

KEYWORDS *: Coronavirus · Machine learning · Deep learning · Prediction*

DESCRIPTION

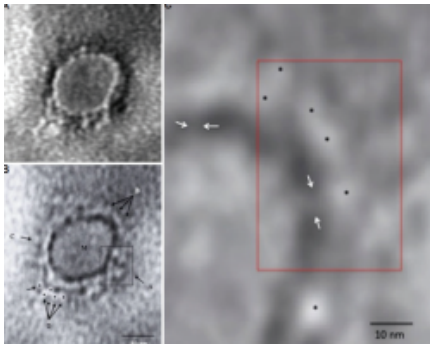

Fig1: Electron microscopy imaging of COVID-19 representing morphological features at varying magnification levels

Coronaviruses are a large family of viruses that can cause severe illness to the human being. The first known severe epidemic is Severe Acute Respiratory Syndrome (SARS) occurred in 2003, whereas the second outbreak of severe illness began in 2012 in Saudi Arabia with the Middle East Respiratory Syndrome (MERS). The current outbreak of illness due to coronavirus is reported in late December 2019. This new virus is very contagious and has quickly spread globally. On January 30, 2020, the World Health Organisation (WHO) declared this outbreak a Public Health Emergency of International Concern (PHEIC) as it had spread to 18 countries. On Feb 11, 2020, WHO named this "COVID-19". On March 11, as the number of COVID-19 cases has increased thirteen times apart from China with more than 118,000 cases in 114 countries and over 4,000 deaths, WHO declared this a pandemic. As the outbreak of the COVID-19 has become a worldwide pandemic, the real-time analyses of epidemiological data are needed to prepare the society with better action plans against the disease. Since the birth of novel COVID19

1.the world is restlessly fighting with its cause. As of April 1, 2020, based on the globally shared live data by the Johns Hopkins

dashboard, worldwide there are 932,605 confirmed cases, out of which 193,177 are recovered and 46,809 lost their lives

2.COVID-19 belongs to the family of the SARS-CoV and MERS-CoV, where it begins with the initial level symptoms of the common cold to severe level of respiratory diseases causing difficulty in breathing, tiredness, fever, and dry cough

3.observed that the identification of the virus can be improved by imaging using immuno-electron microscopy techniques [5]. Figure 1 shows the typical structure of COVID-19 virus, from the throat swab of the first Indian laboratory-confirmed case, captured using sample electron microscopy imaging. Till date, detailed morphology and ultrastructure of this virus remain incompletely understood, and there are no specific vaccines or treatments for COVID-19. However, many ongoing clinical trials are evaluating potential treatments.

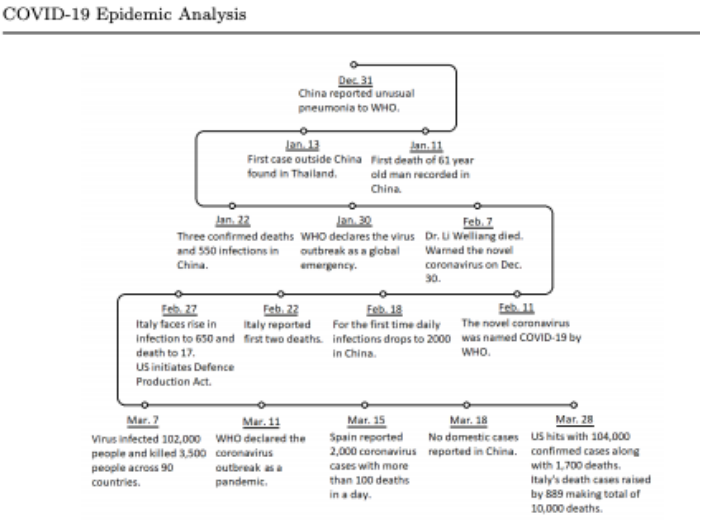

Fig. 2 Timeline of COVID-19 across the nations.

COVID-19 TRANSMISSION STAGES :

As per the WHO reports , the pandemic situation is classified into four stages. The first stage begins with the cases reported for the people who travelled in already affected regions, whereas in the second stage, cases are reported locally among family, friends and others who came into contact with the person arriving from the affected regions. At this point the affected people are traceable. Later, the third stage makes the situation even worse as the transmission source becomes untraceable and spreads across the individuals who neither have any travel history nor came into contact with the affected person. This situation demands immediate lockdown across the nation to reduce the social contacts among individuals and control the rate of transmission. Figure 2, presents the outbreak of COVID-19 across the nations with the high number of confirmed cases such as US, Italy, Spain, and China based on the WHO reports , whereas figure 3 illustrates the rising characteristic of the number of confirmed, death, and recovered cases in these nations between the period January 22, 2020, to April 1, 2020. The worst of all, stage 4 beings when the transmission becomes endemic and uncontrollable. Figure 4 presents the complete stages of the COVID-19 epidemic. Until now, several countries have entered stage 4. China is the first nation that experienced the stage 4 of the COVID-19 transmission. Though, it is claimed that the origin of the virus is Wuhan, China [6]; it affects the other developed countries (USA, Italy, Spain, Britain, etc.). These countries are now in stage 4 of the transmission and facing more number of infections and deaths compared to China. In the case of China, it is observed that exponential growth of the confirmed cases reaches the saturation stage where the number of cases stopped growing. This follows from the fact that the number of susceptible people, which are exposed to virus, are dramatically reduced. This was made possible due to the reduced social contact among people by segregating the infected individuals in quarantine and a complete lockdown period was initiated by the Chinese government, thereby reducing the possibility of further spread. Machine learning

algorithms play an important role in epidemic analysis and forecasting [. In the presence of massive epidemic data, the machine learning techniques help to find the epidemic patterns so that the early action can be planned to stop the spread of the virus. In this research, machine learning and deep learning models are used to observe everyday behaviour along with the prediction of future reachability of the COVID-2019 across the nation by utilizing the real-time information

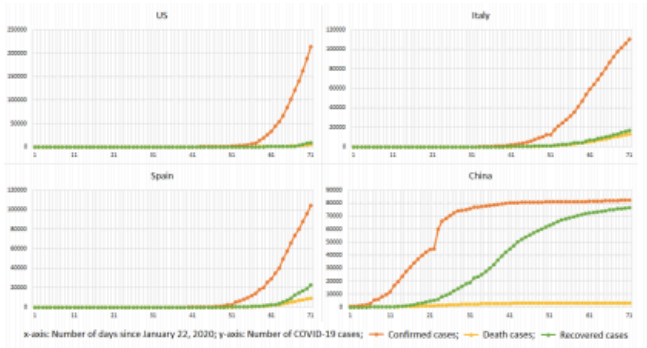

Fig. 3 Epidemic status of the COVID-19 across nations having the highest number of confirmed cases since January 22, 2020.

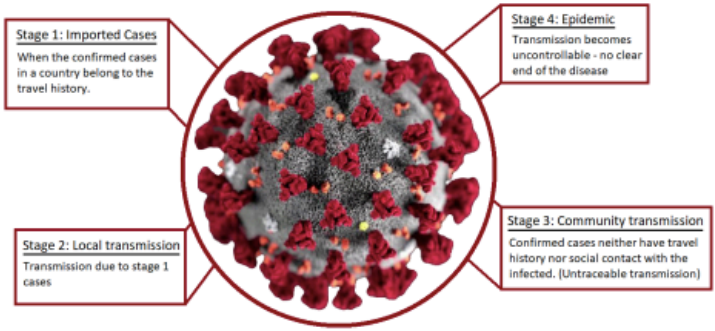

Fig. 4 COVID-19: complete transmission stages.

DATASET DESCRIPTION :

The day to day prevalence data of COVID-2019 from January 22, 2020, to April 1, 2020. The dataset consists of daily case reports and daily time series summary tables. In the present study, we have taken time-series summary tables in CSV format having three tables for confirmed, death and recovered cases of COVID-2019 with six attributes i.e. province/state, country/region, last update, confirmed, death and recovered cases, where the update frequency of the dataset is once in a day . Figure 5 presents the COVID-19 confirmed, recovered, and death cases distribution across the world since the time data was recorded. It is easy to observe the exponential growth of the spread which needs to be controlled.

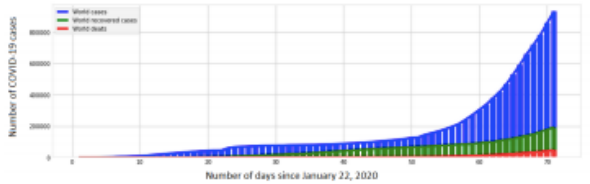

Fig. 5 Distribution of COVID-19 cases across the globe.

EPIDEMIC ANALYSIS :

The COVID-19 spread has brought the world under the brink of loss of human lives due to which it is of utmost importance to analyze the transmission growth at the earliest and forecast the forthcoming possibilities of the transmission. With this objective, state-of-the-art mathematical models are adopted based on machine learning such as support vector regression (SVR) and polynomial regression (PR) , and deep learning regression models such as a standard deep neural network (DNN) and recurrent neural networks (RNN) using long short-term memory (LSTM) cells . Machine learning and deep learning approaches are implemented using the python library "sklearn" and "keras" respectively, to predict the total number of confirmed, recovered, and death cases worldwide. The prediction will allow undertaking the necessary decisions based on transmission growth such as increasing the lockdown period, executing the sanitation procedure, providing the everyday resources, etc.

CONCLUSION :

The world is under the grasp of SARS-CoV2 (COVID-19) virus. Early prediction of the transmission can help to take necessary actions. This article proposed to utilize the machine learning and deep learning models for epidemic analysis using data from Johns Hopkins dashboard. The results show that polynomial regression (PR) yielded a minimum root mean square error The world is under the grasp of SARS-CoV2 (COVID-19) virus. Early prediction of the transmission can help to take necessary actions. This article proposed to utilize the machine learning and deep learning models for epidemic analysis using data from Johns Hopkins dashboard. The results show that polynomial regression (PR) yielded a minimum root mean square error

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