Covid-19 Spread Analysis

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Abstract— **Covid19 has become a potential threat to mankind from past two years. Therefore, it becomes important to have an idea about upcoming conditions and also, to keep track of the situation. It is most important to be educated about the pandemic as well as to be aware of the situation. In this view, attempt has been made to predict the cases for upcoming days employing deep learning, recurrent neural networks based model called long short term memory(LSTM). Live trends of global, India, and Karnataka are visualized using different graphs and charts using visual explanatory data approach. Self-analysis quiz, articles and essential information are included for a deeper impact. All the results are presented in dedicated webpages, integrated on a single web platform. Thus, by conveying the depth of the situation, helping to hinder the spread of the disease.**

Key words— Covid-19, deep learning, LSTM model, awareness.

I. INTRODUCTION

On March 11th 2020, World Health Organization (WHO) declared the 2019 novel coronavirus as global pandemic. Coronavirus, also known as COVID-19 first originated in Wuhan, Hubei province in China around December 2019 and spread out all over the world within few weeks. The resulting spread caused a huge number of deaths and huge losses in the economy all over the world. Thousands of new people are reported to be positive every day from countries across the world. The virus spreads primarily through close person to person physical contacts, by respiratory droplets, or by touching the contaminated surfaces. The most challenging aspect of its spread is that a person can possess the virus for many days without showing symptoms. The COVID-19 pandemic forced many countries to close their borders and enforce a partial or full lock down which had a devastating impact on the world economy which will continue in years to follow. The pandemic still persists and it is very important to monitor the trend. Although vaccines are developed, they reduce the effect of the disease but not stop it from spreading. In this situation it is important to be educated about the pandemic as well as understand the severity of the situation. Analyzing the situation leads to awareness creation. It is important to not panic but instead, it becomes our responsibility to follow the rules and guidelines such as wearing mask, maintaining social distance and regularly disinfecting hands in order to stay safe. So in order to create awareness, this project has been developed. The project consists of a prediction model, which employs deep learning based model (LSTM) to predict the number of cases for upcoming days. The project displays the live covid-19 data of world, India and Karnataka altogether on a single platform. This is done using a visual explanatory data approach: visualization of live data in the form of graphs, charts, dashboards and maps. This visualization is very effective in conveying the severity of the ongoing pandemic and help in the process of awareness inducing responsibility among individuals. The project also provides a quiz based self-analysis to quickly take a test and determine whether to get a covid-19 test done or in general analyze symptoms and get recommendations accordingly. The project also includes essential articles and necessary information to educate about the pandemic such as what are the dos and don'ts, what are the necessary steps to be taken amid pandemic and how to stay safe.

II. LITERATURE SURVEY

[1] Parul Arora, et.al. "Prediction and analysis of COVID-19 positive cases using deep learning models: A descriptive case study of India". This paper uses LSTM and its variants to know beforehand the number of novel coronavirus cases say for next few days and to plan the inventory accordingly.

[2] Vinay Reddy Chimmula, et.al. "Time series forecasting of COVID-19 transmission in Canada using LSTM networks". Modelling of the infections disease, to predict the gravity of COVID-19 in Canada using deep learning approaches. Outcomes suggest regions which followed social distancing directly influenced in less number of cases.

[3] Farah Shahid, et.al. "Predictions for COVID-19 with deep learning models of LSTM, GRU and Bi-LSTM". The study concludes on the basis of results that after parameter tuning, Bi-LSTM performs as best model giving highest accuracy.

[4] Rohitash Chandra, et.al. "Deep learning via LSTM models for COVID-19 infection forecasting in India". The study highlights the challenges of limited data and the spread of infections. Results show that LSTM model gives the best performance.

[5] Samrat K. Dey, et.al. "Analyzing the epidemiological outbreak of COVID-19: A visual exploratory data analysis approach". Presents different cases worldwide to comprehend the specific numbers of cases reported for a specific time period using visualization approach.

[6] Maged N. Kamel Boulos, "Geographical tracking and mapping of coronavirus disease COVID-19/severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) epidemic and associated events around the world: how 21st century GIS technologies are supporting the global fight against outbreaks and epidemics". The paper uses web-based tools,

improved data sharing and real-time information to support critical decision-making.

[7] World Economic Forum, interactive chart shows countries flattening their COVID-19 curves. www.weforum.org/agenda/2020/03/covid19-coronavirus-countries-infection-trajectory/. The website's interactive chart shows countries flattening their COVID-19 curves.

III.   EXISTING SYSTEM

Pandemic's always take a toll on any countries economic and its citizens health and welfare. To overcome this is to break the chain of transmission. To be able to hinder the spread of disease or even completely control the spread. This can be done by understanding the disease itself. How it spreads across the globe and the effect of geographical factors on it. To stop the spread by creating awareness by conveying the severity of the pandemic. To be medically and infrastructural ready to accommodate the new positive cases patients by having an Idea about future situations. Only medical support is not sufficient during such devastating times as psychological problems faced by Covid-19 patients and post recovery also need to be considered. For this information has to be provided about how to react in this situation. All the above-mentioned problems should be solved in a single platform. The existing system does not have all the information available on a single platform and the information by existing systems may lead to ambiguity of actual information since these systems may not have adopted information from authenticated source. The live data may be available but from different sources. Information like steps to be taken amid pandemic, understanding about how the pandemic spreads, from different sources may be opinion oriented and not medically proven. Live data may be available in raw table format rather than visuals. The existing system may not fully thrive to bring awareness. Taking notes from all of these, the attempt is to give complete importance for bringing awareness by various means such as prediction of cases for upcoming days, live data in the form of different visuals, and all of the necessary authenticated data and information in the form of articles on a single web based platform. One important factor that can cause a major hindering of the spread is by bringing awareness among individuals and properly educating them about what is happening, what has to be done and why it has to be done. The situation has to be conveyed in an impactful way so that it aims to bring the awareness. This awareness leads to stop spreading of disease and fight against the pandemic.

IV.   METHODOLOGY

A. Proposed System

As a solution to the considered problem statement, our main aim is to bring awareness about the pandemic by conveying the depth-ness of the situation. In this view, deep learning based LSTM model has been employed to predict the cases for upcoming days thereby helping to have an idea about future conditions. To convey the severity, live statistics of world, India and Karnataka are displayed in the form of visuals, using visual explanatory data approach. The solution also includes useful and informative articles, a self-analysis quiz, necessary information regarding how to act during this pandemic and most importantly how to stay safe during this situation. All the above strategy has been implemented on a single, web based platform.

B. Methodology

The aim is to develop a model for covid-19 spread analysis which includes a prediction model, data visualizations of world, India and Karnataka, self-analysis quiz and articles. To develop this, the project has been sub-divided into 4 divisions: a. For prediction model, b. For data visualizations, c. For articles and quiz and finally d. For integration into a single platform. All the parts are integrated on a web platform that runs on localhost. The design includes a home page, a navigation bar that consists of button options to view prediction model, various visualizations of World, India and Karnataka with buttons of respective names. The article page serves articles, about page contains the essential information and steps to be taken amid pandemic and vaccination page provides link for vaccination registration and provides the self-analysis quiz, vaccination slot page gives details of available vaccination slots. The web platform utilized is flask that runs on localhost with port number 5000. A depiction of methodology is shown in the figure 1 in the form of block diagram.
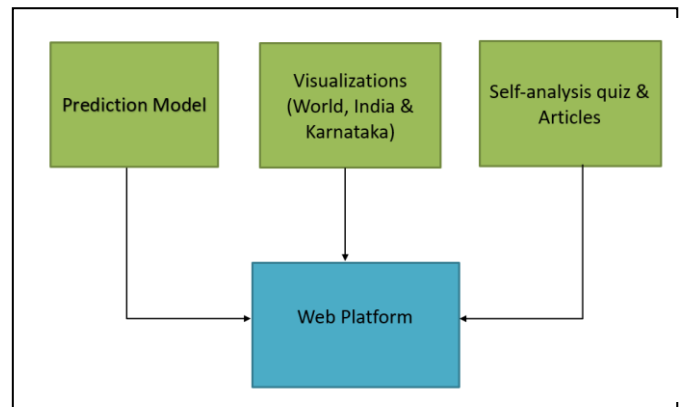

Figure 1: Showing block diagram representation of methodology.

C. Requirements

The software requirements are as follows:

- A high level scripting language - python to implement the prediction model and for integration.
- Markup and styling – Hypertext markup language(HTML), Cascading style sheets(CSS), Bootstrap for webpage design.
- Backend logic of webpages – JavaScript.
- Editors and platforms – Jupyter Notebook and Visual Studio Code for implementation and integration.
- Tensorflow, Keras and dependency libraries for prediction model implementation.

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V. IMPLEMENTATION

A. The prediction model

The design employs deep-learning model – Long Short Term Memory(LSTM) model to predict the number of cases for upcoming days. This also uses the concept of artificial neural networks since the LSTM model is based on the recurrent neural networks which has the capability of short term memory. In fact, this model is the improved version of recurrent neural networks(RNN). A sequence of these along with other functions combined produces looping effect and hence a long term memory. This is particularly useful in time series based stamping. LSTM overcomes problems with RNNs such as gradient vanishing and exploding, complex training and difficulty to process long sequences. Development of logic for implementation of LSTM model w.r.t covid-19 prediction is done in steps. The data required is fetched from application program interface(API) and processed to extract in the required format. Here, the raw data is processed to extract the dates and the number of cases for the respective dates. The data is taken as univariate, and dataset so obtained is divided into training and test data set respectively. Last 14 days is used as training data and rest of the data as test data. The LSTM model is implemented with one input layer, two hidden layers and one output layer. A depiction of these layers is as shown in the figure 2.
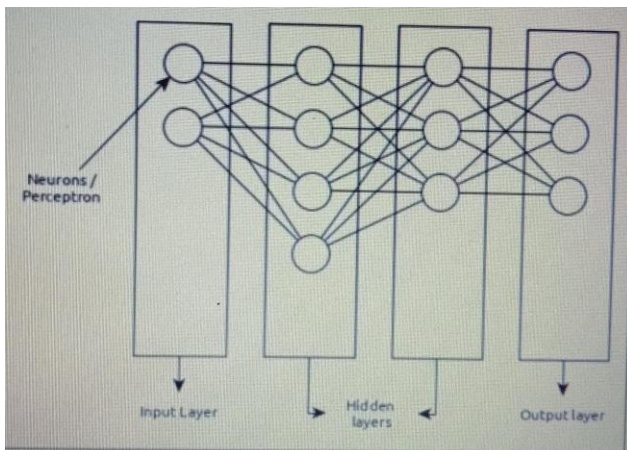

Figure 2: A depiction of layers used in LSTM model.

Hidden layer is located between the input and output of the algorithm, in which the function applies weights to the inputs and directs them through an activation function as the output. In short, the hidden layers perform nonlinear transformations of the inputs entered into the network. An activation function in a neural network defines how the weighted sum of the input is transformed into an output from a node or nodes in a layer of the network. The activation function used is rectified linear unit commonly known as relu. The LSTM layers are implemented using tensorflow environment and keras modules, and programming with python using jupyter notebook as editor. The prediction is obtained in the form of graph with days versus number of cases, typically predicting the number of cases for the next seven days. This graph is converted into an image format and presented into webpage.

B. The visualizations

An approach of visual explanatory data analysis(VEDA) is used to bring about various visualizations w.r.t live covid-19 data. World data is developed to visualize in the form of map, cards and table w.r.t number of active, death and recovered cases country wise. An animation is designed and developed to visualize the trends of world. Pie chart is utilized for visualizing distribution of active, death and recovery cases. Similarly, State wise data of India is designed in the form of map. Line charts and bar-graphs are used to display the analysis of Indian data i.e, top states with highest active cases, top states with less cases, active death and recovery cases. Also, Karnataka statistics has been designed to display in bar-graph, and table.

C. Articles and quiz

The articles page aims in bringing all the informative and authenticated articles under a single page. This includes the information such as analysis of the disease, information regarding symptoms, etc. The quiz is adopted from the center for disease control where recommendations are generated based on the answers given through quiz. The About page contains essential and standard practices to be carried amid pandemic including dos and don'ts, importance of social distancing and wearing mask. An additional vaccination page provides link for vaccination registration.

D. Integration

All of the three parts has to be assembled on a single platform. Flask framework has been utilized for this purpose. This essentially consists of multiple webpages, designed using HTML, CSS, JavaScript and Bootstrap. The prediction results are converted in the form of image and displayed in a dedicated webpage. Similarly, visualizations for World, India and Karnataka have dedicated webpages. Other webpages include articles, important standard practices, quiz and vaccination links.

VI. RESULTS AND DISSCUSSION

The result of integration of individual pages looks as shown in the figure2. The homepage design consists of a navigation bar with homepage images. The navigation bar consists of links to other webpages as shown in the figure. The prediction page consists of graph predicting the number of cases for upcoming seven days. The graph is in the form of image and the image is uploaded into webpage. In the figure 3 shows the prediction model for India. The world and countries links on navigation bar navigates to respective pages where visualizations of global data are represented in the form of bar graph animation, table and maps as shown in the figure 5 and 6. The global data is represented in the form of pie chart and cards as well. Options for customization of data display is also made available.

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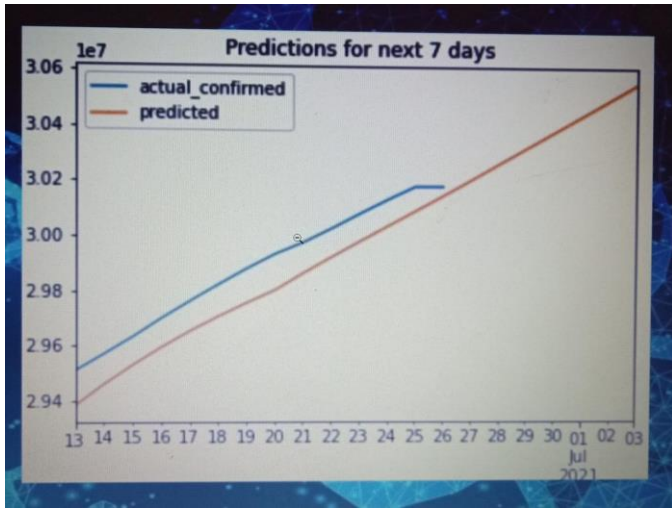**NCCDS - 2021 Conference Proceedings**

Figure 3: Prediction for the next seven days

Figure 3 shows the prediction for next 7 days with orange curve as the predicted number of cases and blue curve as the actual number of cases. The x axis represents the time stamping and the y axis represents the confirmed cases with scale of crores. As and when the newer data is available for training, the prediction curve changes continuously. On an average, the difference stays within 10-20 percent when compared with actual data.

	actual_confirmed	predicted
2021-04-07	12928574.0	1.291576e+07
2021-04-08	13060542.0	1.302213e+07
2021-04-09	13205926.0	1.313408e+07
2021-04-10	13358805.0	1.325050e+07
2021-04-11	13527717.0	1.337134e+07
2021-04-12	13689453.0	1.349520e+07
2021-04-13	13873825.0	1.362406e+07
2021-04-14	14074564.0	1.375498e+07
2021-04-15	14291917.0	1.388905e+07
2021-04-16	14526609.0	1.402855e+07
2021-04-17	14788003.0	1.417321e+07
2021-04-18	15061805.0	1.432312e+07
2021-04-19	15320972.0	1.447839e+07
2021-04-20	15616130.0	1.463947e+07

Figure 4: The table shows the comparison between the actual confirmed cases with the predicted cases by LSTM model used during the month of April.
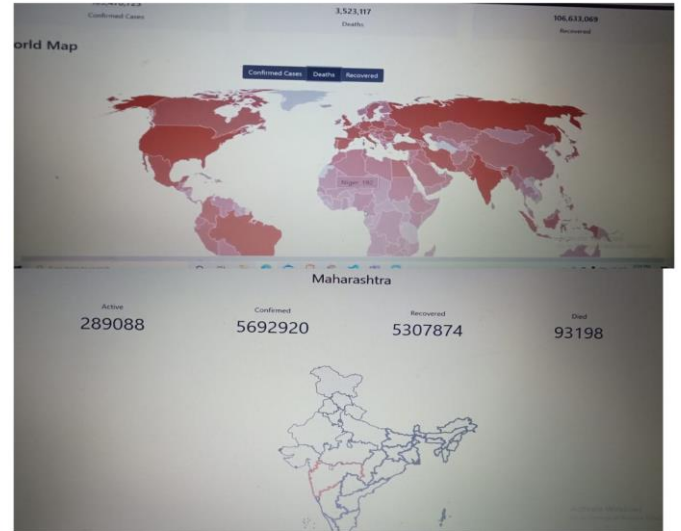

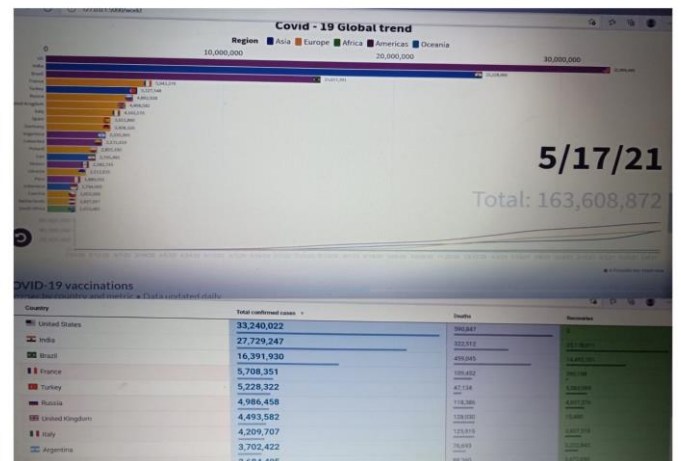Figure 5: Showing map visualizations of World and India.

Figure 6: Showing covid-19 global trend and table.

Figure 7: Showing trends of India in the form of bar graph and line chart.

The figure 7 show visualizations of India data in the form of line charts and bar graphs. The bar graphs show the comparison of various states with most number of cases and various states with least number of cases. Also, the map visualization of India is achieved. The Karnataka button in the navigation bar navigates to Karnataka statistics. This data is visualized in the form of bar graph, cards, and table as shown in the figure 8. All of the visualizations fetch live data using

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application programming interfaces which are publicly available.

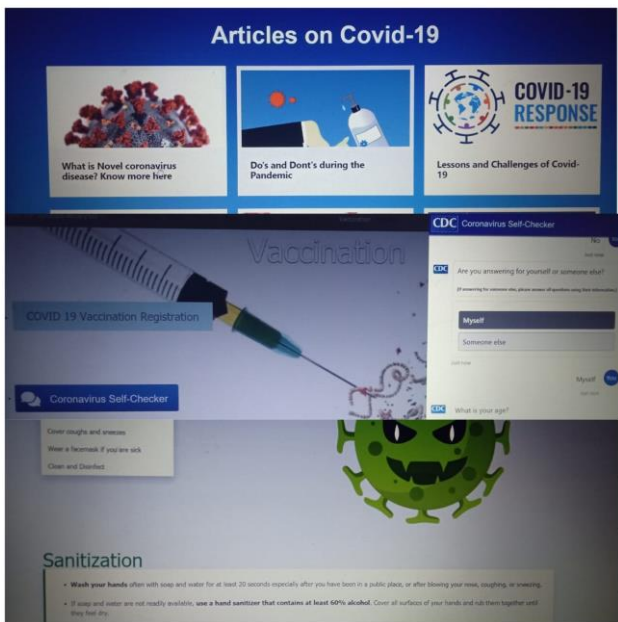Figure 8: Showing Karnataka trends.

Figure 9: Showing articles, quiz and information on what has to be done during covid-19.
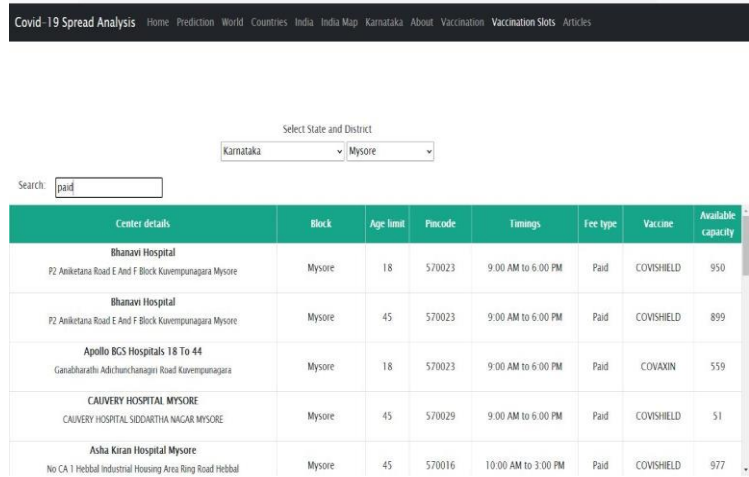

Figure 10: Vaccination slots availability

The vaccination page consists of link for vaccination registration and has option to take a self-analysis test provided by the centers for disease control and prevention. The result of the quiz is a recommendation whether to get a covid-19 test done or not or the symptoms is matching with any other flu. The Vaccination slot page gives the vaccine slot availability details which is fetched from public API as shown in figure 10. The articles page provides information on covid-19 such as what is covid-19, how does it spread, and what are its symptoms. The about page provides information on how to stay safe during the pandemic, what are the steps to be taken in the pandemic, how to act in case of emergency. The design of articles page, about page and vaccination page are as shown in the figure 9. All the individual pages are combined using the flask framework and run on localhost, thus obtaining results on a single platform.

In this project the result is obtained by using the prediction model-LSTM which helps to understand the need for social distancing and significance of rules by which the upcoming cases can be reduced significantly. When comparing the model used in this project with that of IIT-K, they have used SIR model whereas we have used LSTM model. SIR model is used for long term time series prediction where LSTM for short term time series prediction and at the time of choosing the prediction model the accuracy was 95% i.e., for first wave. In SIR the predicted curve will be within its max and min curves whereas in LSTM the predicted value matches the actual with 2-3 days as its tolerance.

VII. CONCLUSION

In this pandemic, we are facing threat to the human life. This prediction model is only for understanding the seriousness of the situation and not for any medical purpose. When we compare our predictions with that of predictions projected by IIT-K, they have used SIR model whereas we have used LSTM model. Their prediction is one time and spread across a definite period whereas our model fetches live data and makes predictions for next 7 days. As it fetches live data, which is currently in increasing trend, there is a difference in the actual to predicted data. If this prediction model is made much more accurate, then the government can look into when the severity of restrictions need to be imposed and when

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relaxation needs to be given. Noting that the basic rules needs to be followed all the time until the end of pandemic. The visualizations help analyzing and monitoring the live trend and has a greater impact in conveying the spread since it is visualized. Self-analysis quiz helps to quickly monitor the chances of having covid-19 by analyzing symptoms. Articles aim to provide essential and authenticated information. This is helpful in being informed as well as to be aware of the situation. Information about do's and don'ts, precautions to be taken and understanding the spread of pandemic has also been included which aims to educate about the pandemic.

VIII.   REFERENCES

[1] Parul Arora, Himanshu Kumar and Bijaya Ketan Panigrahi, "Prediction and analysis of COVID-19 positive cases using deep learning models: A descriptive case study of India." June 17th 2020, US National Library of Medicine, National Institutes of Health.

[2] Samrat K. Dey, Md. Mahbubur Rahman, Umme R. Siddiqi, Arpita Howlader, "Analyzing the epidemiological outbreak of COVID-19: A visual exploratory data analysis approach." 03 March 2020, Wildly online library.

[3] Maged N. Kamel Boulos & Estella M. Geraghty, "Geographical tracking and mapping of coronavirus disease COVID-19/severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) epidemic and associated events around the world: how 21st century GIS technologies are supporting the global fight against outbreaks and epidemics." 11 March 2020, International Journal of Health Geographics.

[4] World Economic Forum, "This interactive chart shows countries flattening their COVID-19 curves", www.weforum.org/agenda/2020/03/covid19-coronavirus-countries-infection-trajectory/.

[5] AAAS, "The effect of travel restrictions on the spread of the 2019 novel coronavirus (COVID-19) outbreak." https://science.sciencemag.org/content/368/6489/395/tab-figures-data.

[6] IIT-K, "SIR - Covid-19 Prediction Model". https://covid19-forecast.org/

[7] Kaggle "COVID-19 Open Research Dataset Challenge (CORD-19)", www.kaggle.com/allen-institute-for-ai/CORD-19-research-challenge.

[8] Centers for disease control and prevention, "People with Certain Medical Conditions", https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html.

[9] Science wire, "Nearly Half the People Who Have Died of COVID-19 in India Are Younger Than 60" ,https://science.thewire.in/health/india-covid-19-mortality-comorbidities-age-health-ministry/

[10] Karnataka government, "Karnataka Covid-19 Dashboard", https://covid19.karnataka.gov.in/covid-dashboard/dashboard.html

[11] Government of India," #IndiaFightsCorona COVID-19", www.mygov.in/covid-19.

[12] Wikipedia, "Coronavirus pandemic in India", en.wikipedia.org/wiki/2020_coronavirus_pandemic_in_India