Innovative Travel Advisor Related Mobile Application

An Engineering Project in Community Service

Phase–II Report

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in partial fulfilment of the requirements for the degree of

Bachelor of Engineering and Technology

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Bonafide Certificate

Certified that this project report titled "**Innovative Travel Advisor related app"** s the bonafide work of "Shyamkrishnan Sudhir [19BAI10032], Akhil S [19BAI10075], Pranav R [19BAI10080], Vailappilly Dharan Harish [19BAI10103], Joys James[19BAS10045], Albin Alex [19BAI10161], Noel Paul Fredy[19BCY10130], Bhuvnesh Sharma[19BCE10213]**"** who carried out the project work under my supervision.

This project report (Phase II) is submitted for the EPICS examination held on 22/04/2022

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Supervisor

Comments & Signature (Reviewer 1)

Comments & Signature (Reviewer 2)

ACKNOWLEDGEMENT

First and foremost, I would like to thank the Lord Almighty for His presence and immense blessings, I am deeply indebted to my parents who have been the greatest support throughout the project work.

I wish to express my heartfelt gratitude to **Dr Anirban Bhowmick (Assistant Professor, SEEE) and Dr Mamta Agarwal (Assistant Professor, SCSE),** the reviewers who channelized our work progress every time.

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I would like to thank all the technical and teaching staff of the School of Computer Science and Engineering Specialization in artificial intelligence and machine learning, who extended directly or indirectly all support.

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1. INTRODUCTION

India recently restarted the fully vaccinated travelers who are travelling on chartered flights. This travel and tourism boost comes in the wake of the latest easing of COVID 19 -related restrictions, as COVID infections are continuing to decline in the country.

The said move of easing travel restrictions on foreign tourists entering the country also coincides with India's domestic tourist and festive season. People can travel to destinations where the covid cases won't be at a peak during the time of travel.

Prediction of the dynamics of new COVID infections during the situation of the COVID-19 pandemic is important for public health planning of effective health care allocation and monitoring of the effects of policy interventions.

We describe a new approach that forecasts the number of incident cases shortly given past occurrences using only a small number of assumptions.

Apprehending the initial dissemination of the virus and scrutinizing the effectiveness of control measures are important in judging the prospects for continued transmission in newer locations. This entails tracking the course of the pandemic to be able to foresee its exposure for a better response.

1.1 MOTIVATION

As the lockdown restrictions are being relaxed, more and more people have started to come out of their houses and started to spend quality time with their friends and family.

The ever-evolving lockdown strategies and restrictions are making it difficult for them to prepare their itineraries. The urge for people to travel after the long lockdown stage can enhance the scope of tourism for states.

1.2 OBJECTIVE

Our goal is to create a user-friendly application that can be used to track the Covid activity in the location of interest and predict the potential cases in that particular region on a given day.

2. EXISTING WORK

Multiple travel apps are available to us, and given the diversity of apps currently available, apps should not be regarded as a uniform category. Some of them are given below:

[1] An LSTM approach was used to check the current situation of COVID-19 cases and to assist the government officials in preparedness, with an RMSE = 45.72. The ARIMA model was used to assign the task of forecasting the spread of COVID-19 infection with an average RMSE = 44.81, followed by AI, ML and hybrid models.

[2] For future research, a more in-depth comprehensive review in other fields, such as AI and DL, is encouraged. Studies addressing the development of novel and hybrid approaches to forecast the pandemic should be scrutinized.

[3] For COVID-19 case prediction, researchers employed six regression analysis-based methods: quadratic, third degree, fourth degree, fifth-degree, sixth degree, and exponential polynomial, with the sixth-degree polynomial regression approach indicating the best model for short-term new case prediction.

[4] Hi-COVIDNet was created using a geographic hierarchy and a neural network with two-level machinery based on data obtained from country-level and continent-level systems. This strategy comprehends the complex relationships between faraway countries and connects their specific infection risk to the target country.

3. TOPICS OF WORK

3.1 System Design / Architecture

3.1.1 Model creation

The following steps were used to create the multiple machine learning model.

Data Collection: The 3 datasets that we have chosen to use for this project in its current state are - Daily total covid +ve cases in Kerala, District wise covid +ve cases in Kerala, History Of Travel/Contact dataset.

The daily total covid +ve cases in Kerala, as well as the district wise covid +ve cases, were taken from https://dashboard.kerala.gov.in/covid/ website. The remaining dataset of History Of Contact was taken from https://github.com/IBM/covid19-india-data, a GitHub project by Mr Mayank Agarwal and other contributors.

Data Pre-processing: The collected data being from different sources had to be made consistent and continuous, this was done by adding the missing data points from various other sources.

To make the data continuous we had to select a time frame for our data, upon closer inspection of the datasets, we were able to find that the time frame from 01-06-2020 to 05-04-2022, was the most suitable and fairly recent with minimum inconsistencies.

After manually going through that datasets and cross-checking the values for any irregularities, we finally created 3 separate datasets[Kerala Date Wise, HOC 1, District Wise] all within the time frame of 01-06-2020 to 05-04-2022, ready for model making.

Model creation : We used the Conv1D that is prebuilt in Tensorflow library followed by GRU, LSTM and finally N-BEATS model. Then the sequential training data are turned into sliding windows. ie, we use the past 7 day's cases to predict the next 7 days. So they are windowed.
eg:

[25,125,43,24,200,250,150] -> [153,85,25,46,67,98,123]

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Then the data is split into train and test data by splitting them at a point. The train windows and train labels are used to train the model and then are evaluated on the test windows and test labels. This method is used for making the LSTM and GRU models as well. N-BEATS model was also built for comparison.

3.1.2 Application Architecture

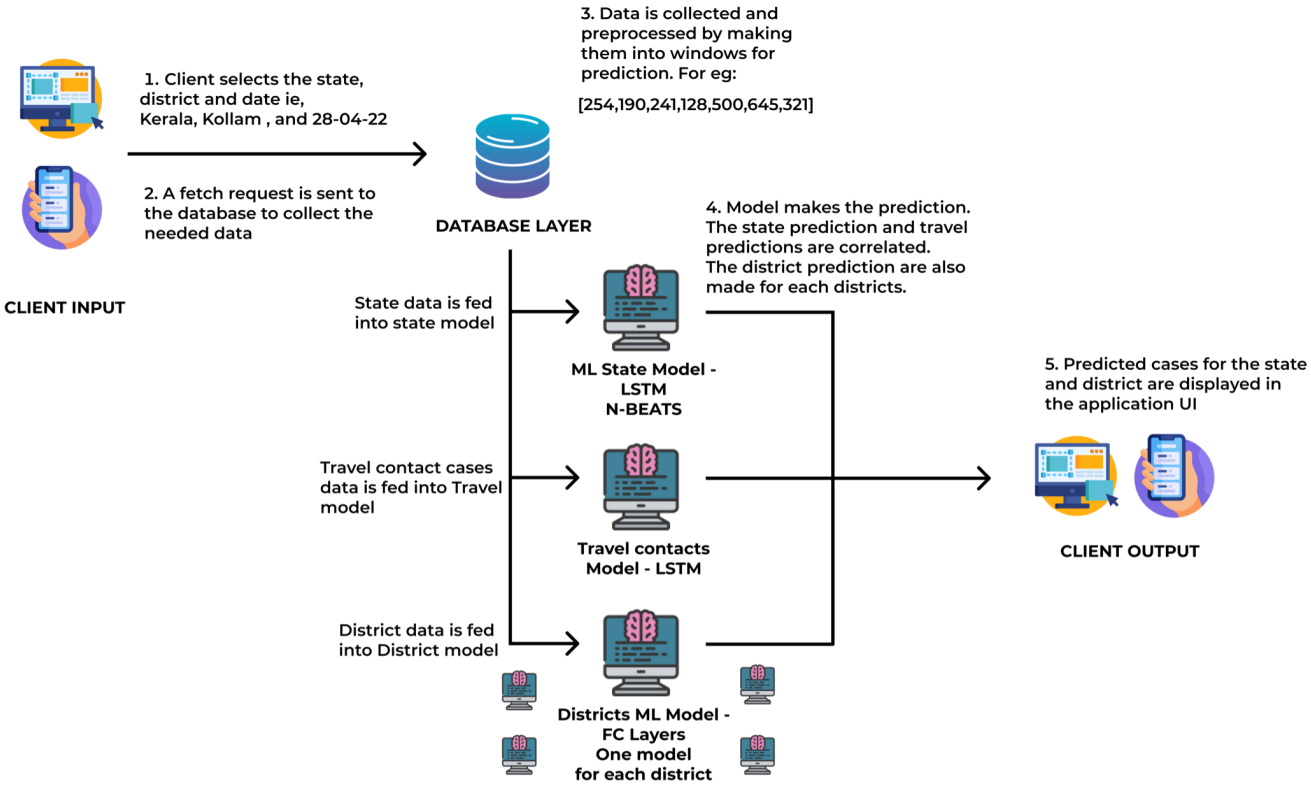


Figure 1: Application architecture diagram

The designing, development and the integration part of the present model into a mobile application was done successfully by using fluter By making use of the material dart package provided by the flutter and creating specific custom functions and widget functions thereby increasing the efficiency of the application using flutter, also making the application multi-platform

The detailed architecture and user flow are shown in the figure above (Figure 1)

3.2 Working Principle

The list of selected algorithms were-

- Conv1D

- GRU
- LSTM
- N-BEATS

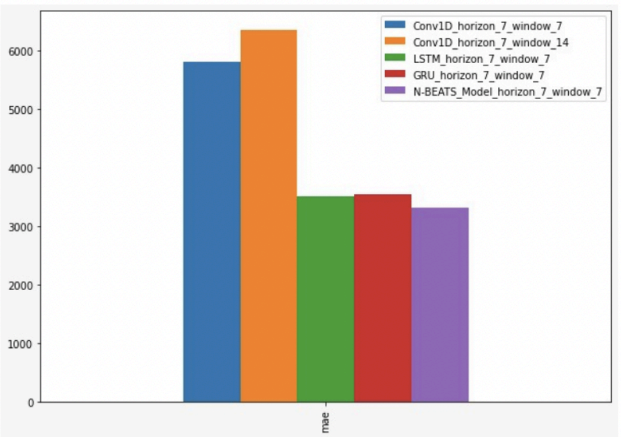
With our selected models we had to know which model was best for each dataset, as the District Wise.xlsx and HOT1.xlsx had smaller numerical values the N-BEATS model will not be as efficient as with larger values. N-BEATS was the best option for the Kerala Date Wise.xlsx dataset due to its generally larger values.

The preprocessed datasets, with the help of NumPy and pandas, are again preprocessed to make it work well with the model. Ie, only the necessary columns are taken and the date column is made as to the index of the data frame.

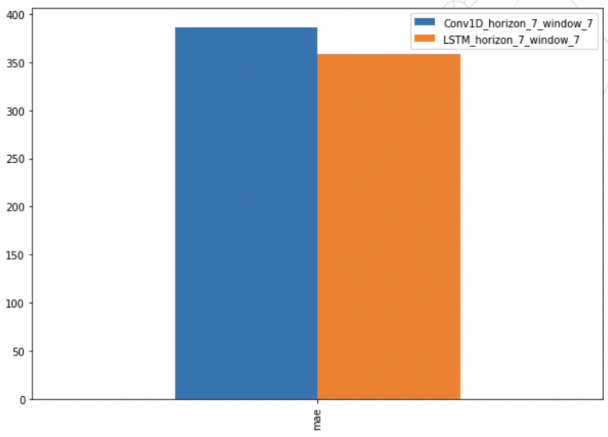
Then the sequential training data are turned into sliding windows. i.e., we use the past 7 day's cases to predict the next 7 days. So they are windowed.

For the N-BEATS algorithm, the custom layers which are built are named NBeatsBlock. Then they are connected using residual links between them.

The backcast from the blocks is used as inputs for subsequent layers. The cumulative forecasts from each of the Blocks are used to predict the future data.



Kerala state case prediction model comparison



Kerala travel contact case prediction model comparison

Graph 1: Comparing Kerala State Case Prediction Model Comparison

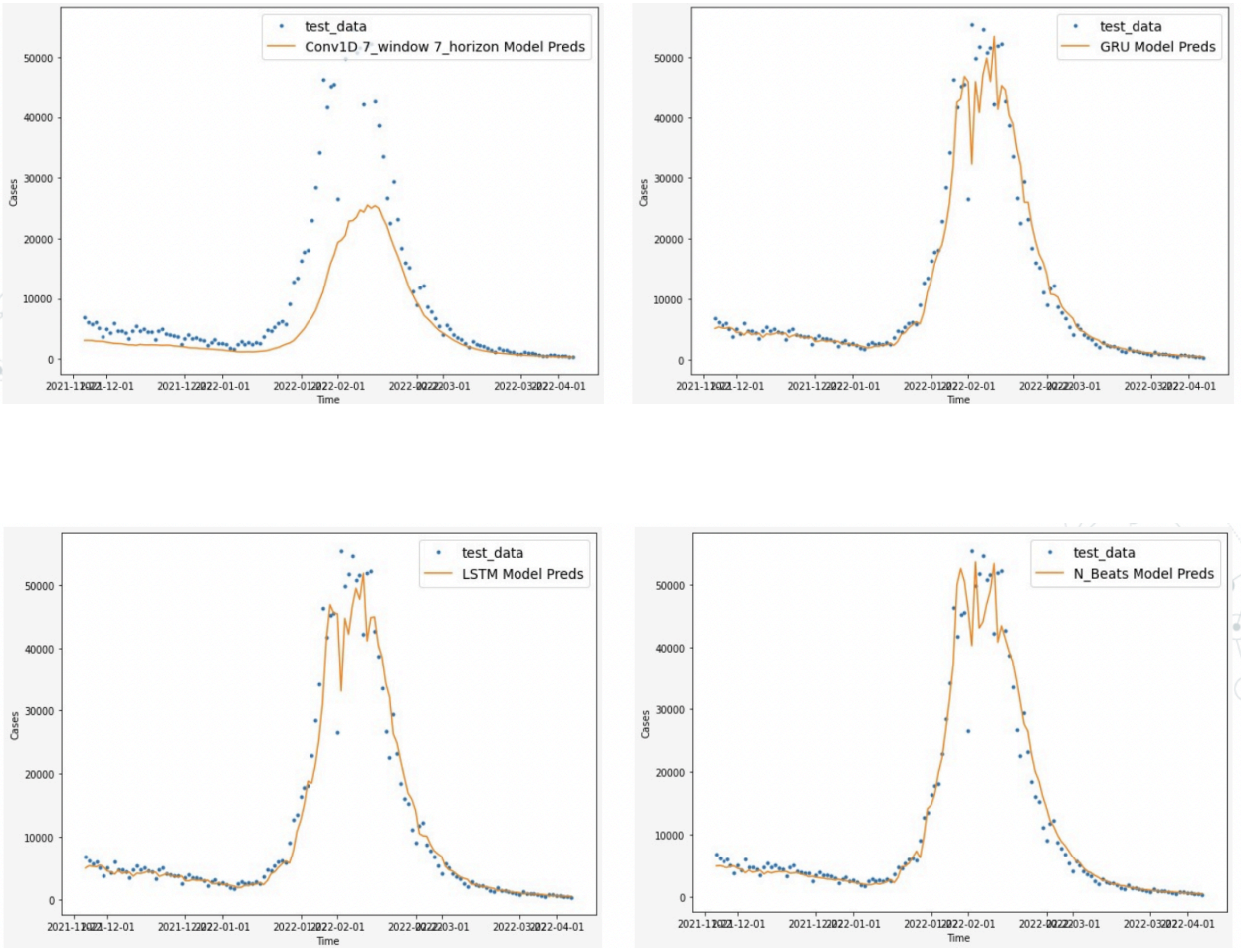
Graph 2: Comparing Kerala Contact Case Prediction Model

3.3 Results and Discussion

Model	MAE	MAPE	MSE	RMSE
Conv1D	5806.57	40.38	133524930.0	6193.21
LSTM	3507.69	29.66	42620892.0	3863.24
N-BEATS	3315.75	29.32	36234536.0	3719.23

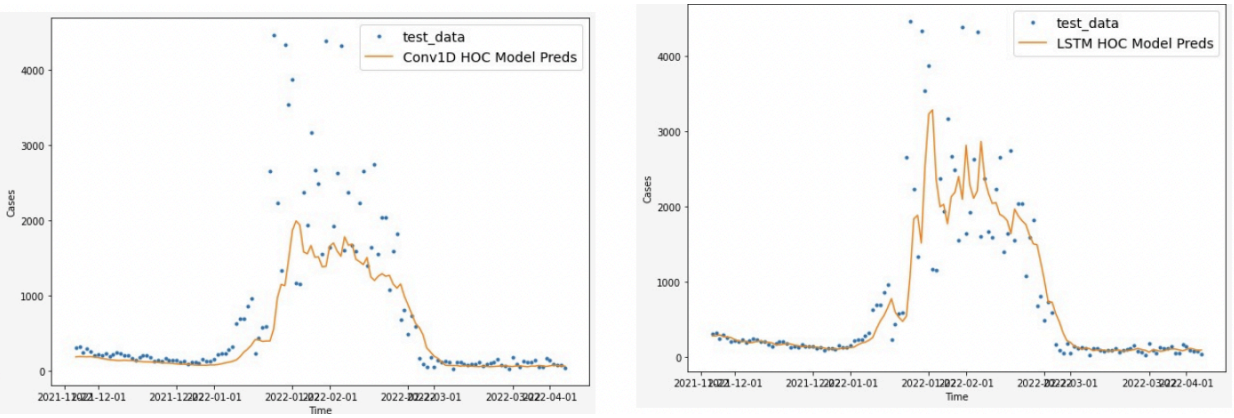
Table 1: Comparing metrics of the three models - Conv1D, LSTM, N-BEATS model

Kerala State Prediction Model Outcomes



Graph 3: Representation of the outcomes of the 4 models: Conv1D, GRU, LSTM and N-BEATS.

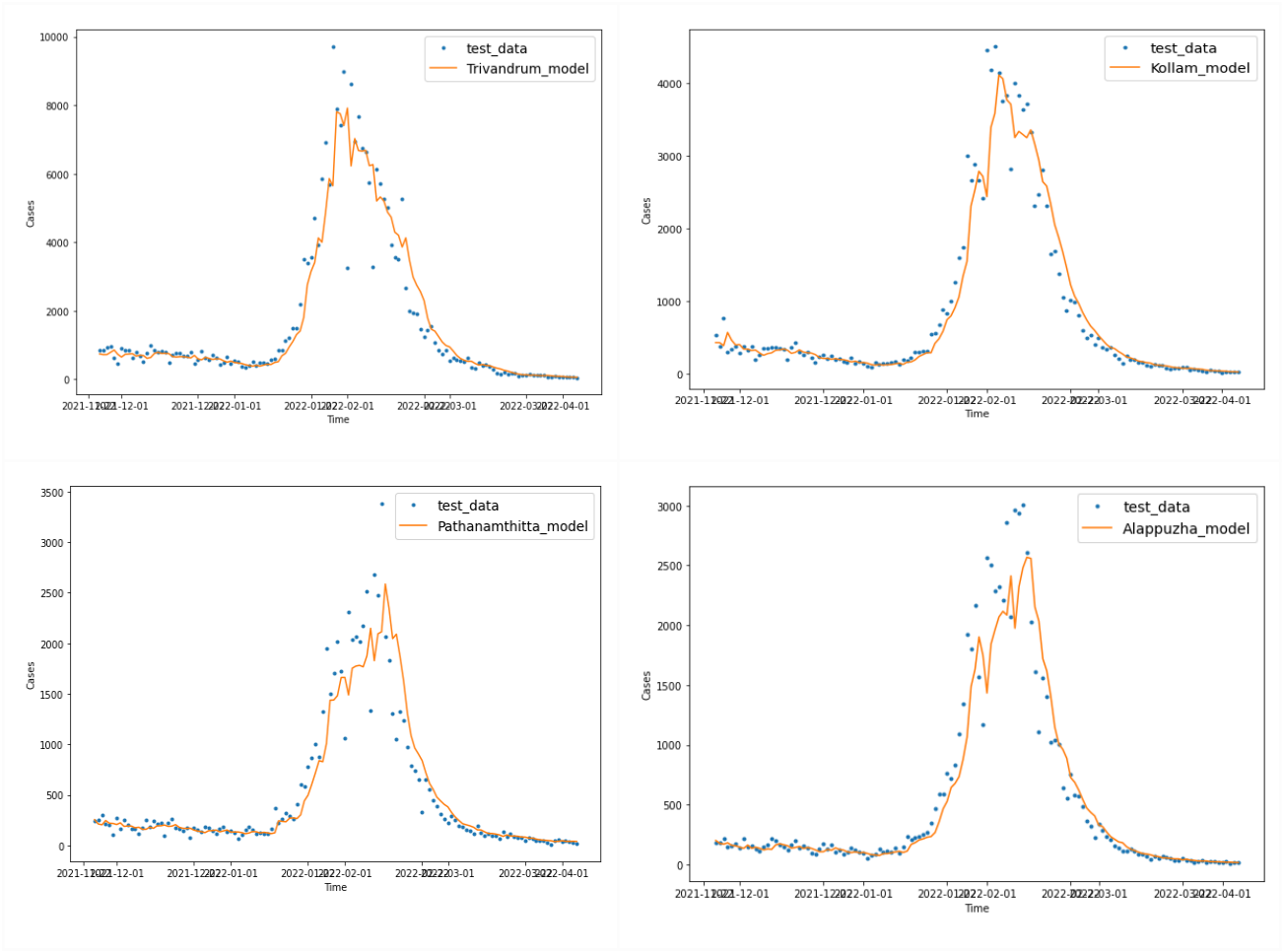
History of contact/Travel Prediction Model outcomes

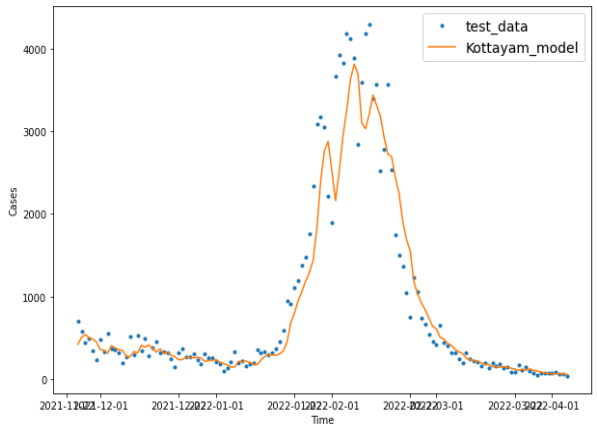


Graph 4: *Representation of the outcomes of the Covid1D HOC model and LSTM HOC model*

District Wise Prediction Model outcomes

Graph 5: Graphical outcomes of the Fully Connected Dense Layer Model used on the 14 districts in Kerala.

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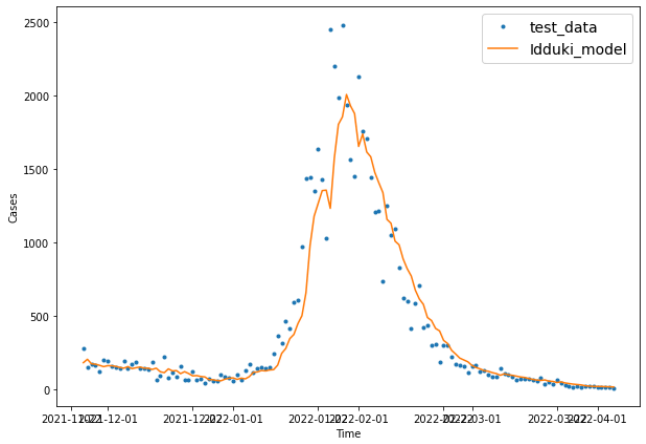
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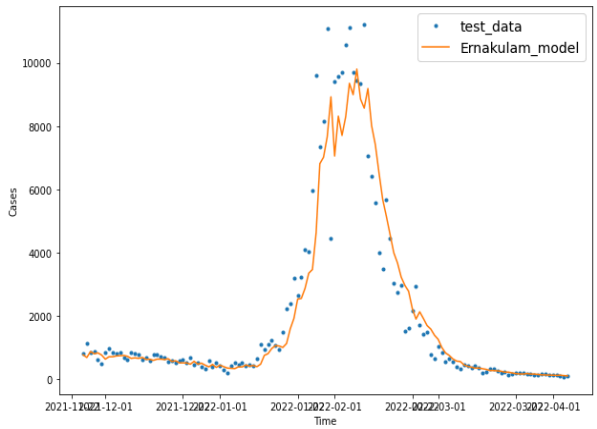
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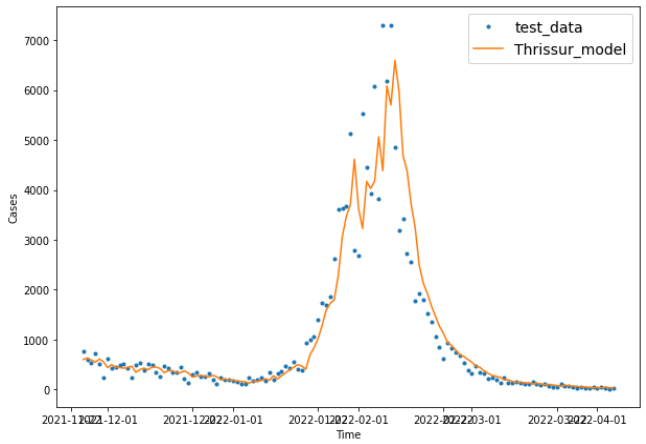
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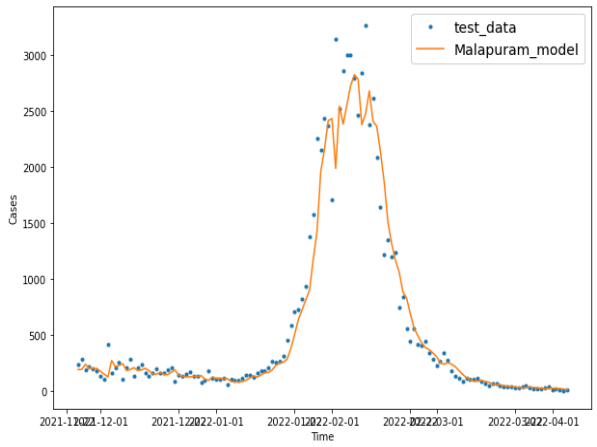
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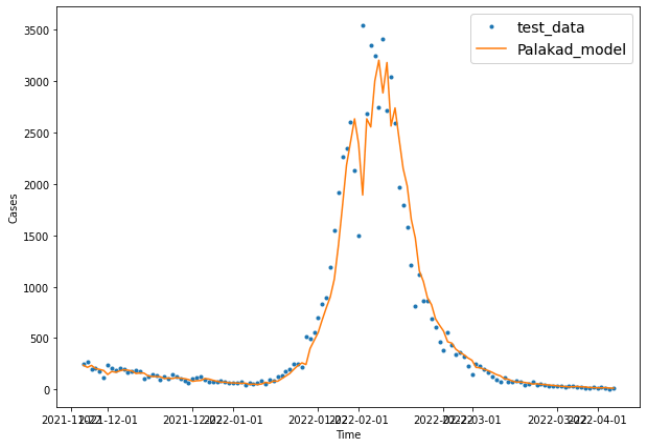
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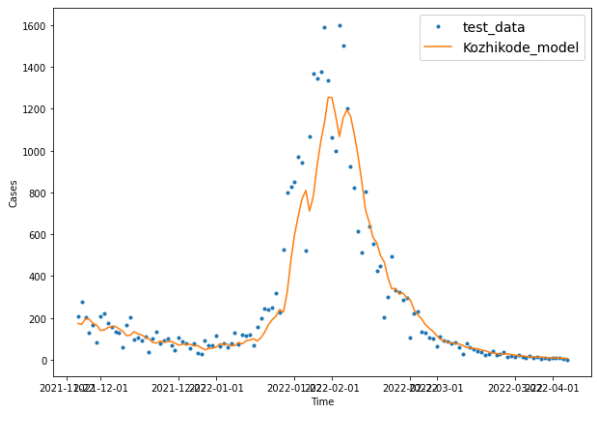
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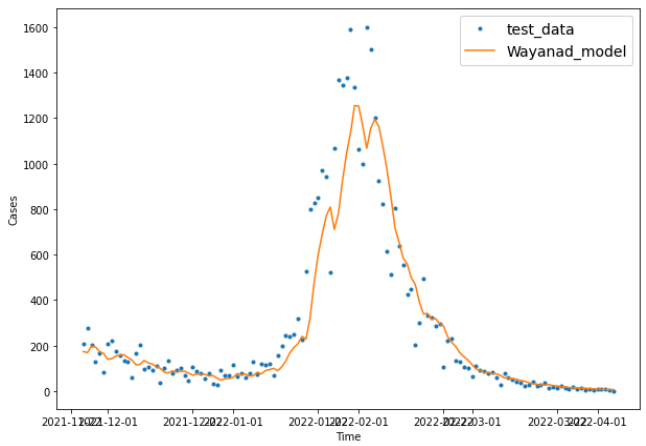
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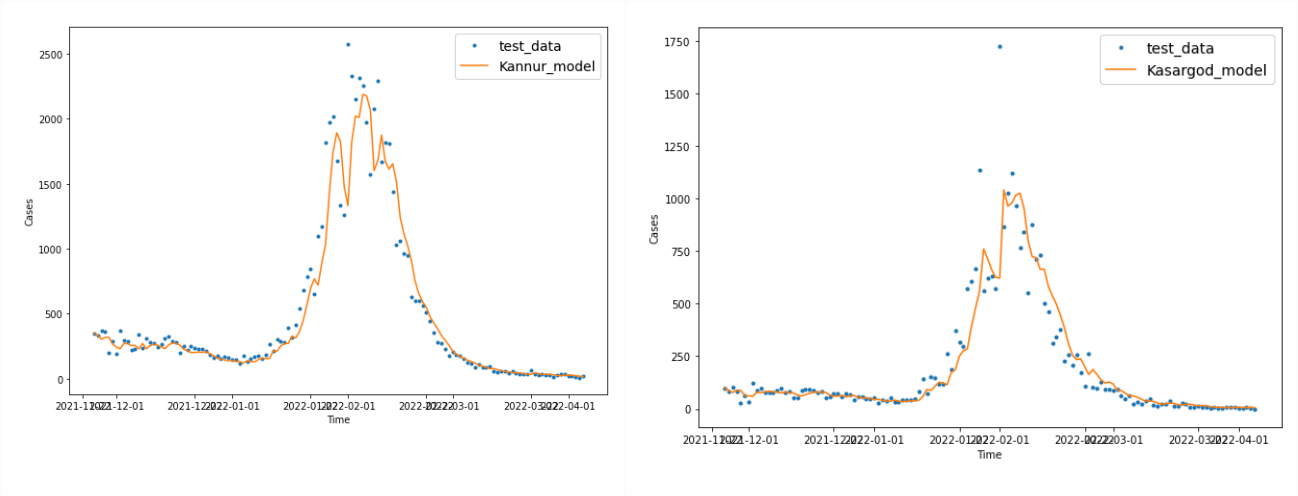
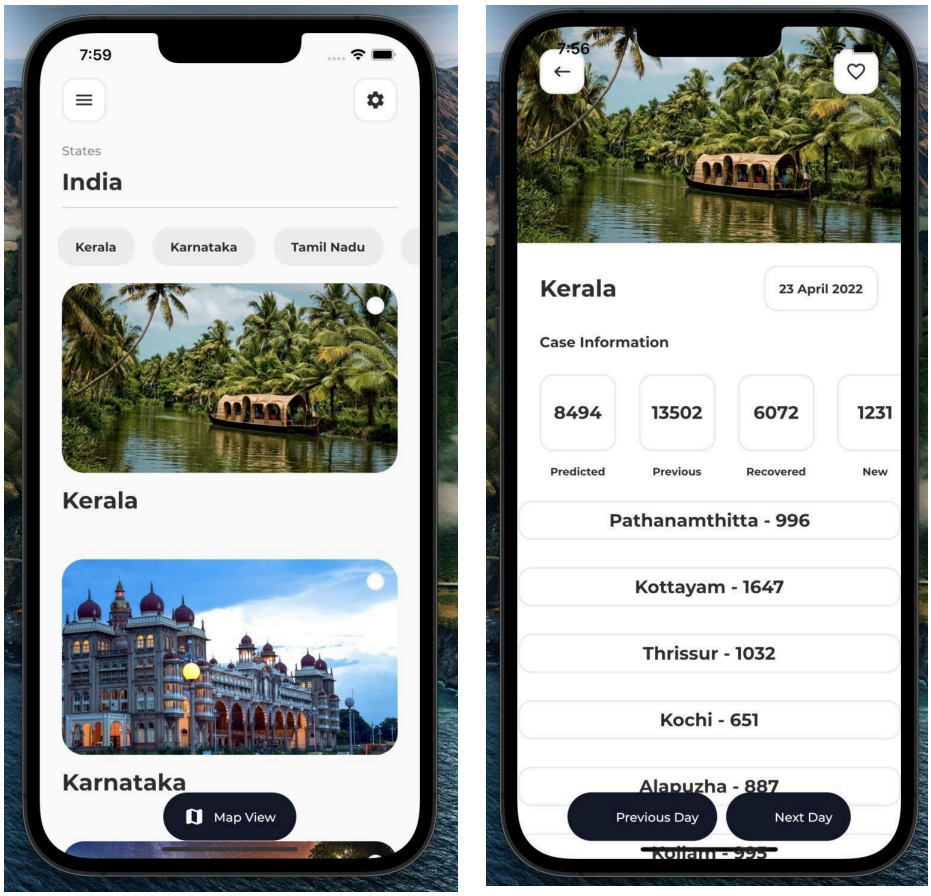
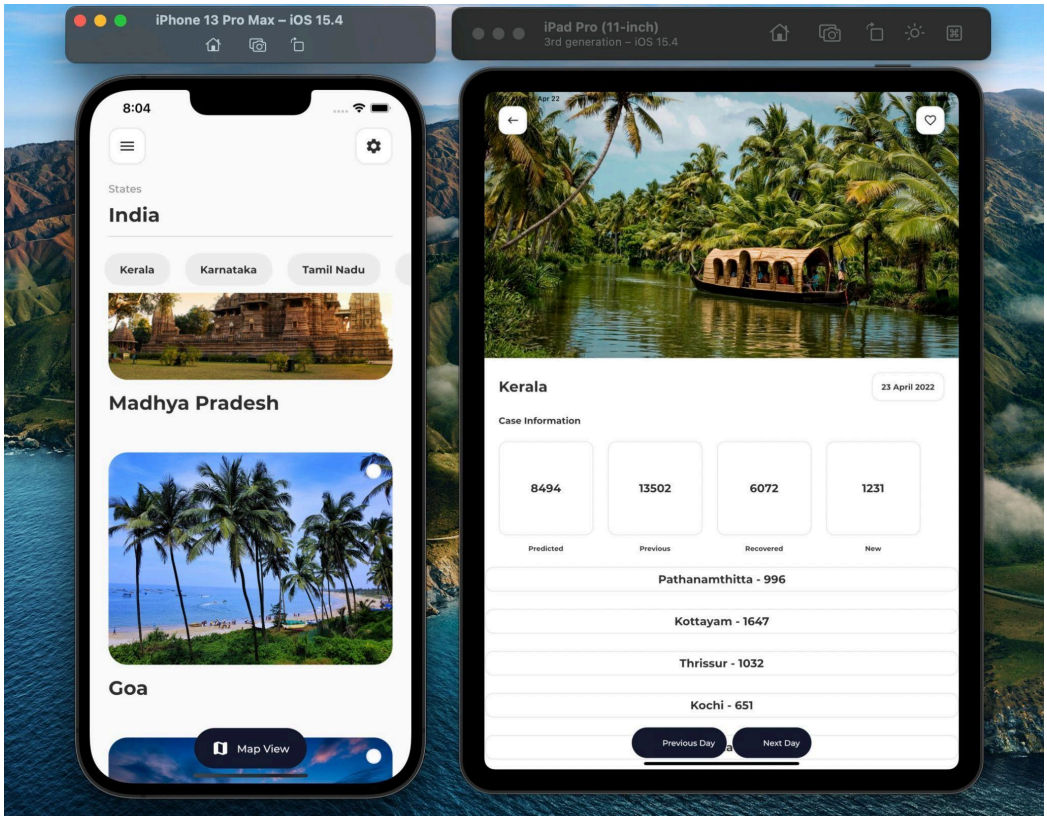


Application Interface





3.4 Individual Contribution by members

Joys James - 19BAS10045

The work of collecting the necessary dataset was given to Joys James[19BAS10045]. When we tried to find data on positive covid cases in the state of Kerala and its districts, we ran into a few problems.

First, the data we needed had to be continuous, and it had to include data from each district of the state to increase accuracy. We tried several websites, but there was no continuous data or, to put it another way, it didn't have the most recent data we needed. Next, we needed to find the history of contact/travel data, which was difficult to come by.

Then we came across a project on Github that utilized AI-assisted document and image extraction techniques to automate the extraction of such data from state-level daily health bulletins in structured (SQL) form.

Bhuvnesh Sharma - 19BCE10213

The data collected by Joys had to be thoroughly cleaned as it had lots of inconsistencies and missing data points.

To process that data we decided to select the time frame of our dataset, as we selected the dates from 01-06-2020 till 05-04-2022.

From the datasets that we had collected, there was only data from 17-08-2020, Bhuvnesh Sharma[19BCE10213] was given the task of finding all the data for the remaining days for the dataset on History Of Travel/Contact. Similarly, fix all the data inconsistencies.

Noel Paul Fredy - 19BCY10130

The handling of the other two data sets, daily covid +ve cases in Kerala and the daily covid +ve cases for each of the 14 districts of Kerala was done by Noel Paul Fredy[19BCY10130].

He had to find all the inconsistencies and irregular data points and replace them with the actual values. As the daily covid +ve cases in Kerala were recorded in the https://dashboard.kerala.gov.in/covid/ website it was much easier to clean the data.

Vaillapilly Dharan Harish - 19BAI10103 and Akhil S - 19BAI10075

Through the extensive research conducted by Akhil S.[19BAI10075], We got different insights initially starting with 1D CNNs which didn't provide much accuracy, so then shifted to LSTM which was providing better results, GRU performed similarly to LSTM.

On further research by Vailappilly Dharan Harish[19BAI10103], we found that for seasonal data, the N-BEATS algorithm performs much better with situations having larger numbers and upon researching more about the N-BEATS algorithm, we found that it's the best possible option for Kerala Date Wise dataset. For the district and history of travel/contact dataset, we have used LSTM as they have significantly smaller values than the Kerala Date Wise dataset.

Pranav R - 19BAI10080

The model creation was handled by Pranav R [19BAI10080]. The primary framework used to make the models is Tensorflow and was trained using the google collab cloud platform. For the entire state prediction model, Conv1D, LSTM, GRU and N-BEATS model architectures were made to make a comparative study. For the travel contact dataset, LSTM and Conv1D models were built and for the districts, a set of fully connected models were built.

Some of the libraries used for preprocessing the dataset were - Pandas and Numpy. Matplotlib.

pyplot was used for visualization. For models such as Conv1D, LSTM and GRU, the layers come prebuilt in the TensorFlow library.

For the state of the art N-BEATS model, custom layers were built. NBeatsBlock layers were built as they are the building blocks of the multi-residual neural network. These blocks were linked using the residual connections. Each block returns two outputs - backcast and forecast.

The backcast from the blocks is passed to subsequent blocks after passing it through a residual link(subtract link) and the forecast, after passing through another residual link(adding a link) was added together to make the predictions. The N-BEATS model gave the best performance among all the trained models.

For the prediction of each district, a function was made to automate the process of making the training and test data, creating and training the model as well as evaluating and plotting the graphs for the same.

Shyamkrishnan Sudhir - 19BAI10032 and Albin Alex - 19BAI10161

A collaborative effort of Shyamkrishnan Sudhir [19BAI10032] and Albin Alex [19BAI10161] was done to Design, Develop, Integrate and Apply the most accurate machine learning model into a mobile application through Flutter and further up-gradation of the application can be made possible by using Tensorflow Lite which makes it possible to make models on mobile, microcontrollers and other edge devices.

The data from real-time datasets is fetched and stored in the database. The database and the server-side cloud also communicate in a similar response for request manner. In contrast, the data communication between the client-side and the server-side is maintained by our responsive REST APIs. Thus, it makes the full system unique, helpful, secured, and user-friendly with all the features entitled to the users in an optimized way.

Flutter made it easy with the help of specifically made custom functions and custom widget functions in dart making the application more efficient and there my consuming less memory and very less latency thereby making the application multi-platform which works excellently in all smartphones, iPads allowing the collected results from the machine learning model to be displayed more easily and understandably.

The particulate was converted into an ML model into a file and then integrated into a flutter.

Used VSCode IDE to run the dart file using an emulator for iOS devices such as iPhone 13 and iPads. We have included a seamless user experience wherein the users can make use of the custom widgets and navigate to the particular date and location of their visit and effectively search the predicted no of cases. Through further research, we have kept an open-source iteration wherein we can include more features in the coming future.

4. CONCLUSION

Our project is currently being applied on a small scale, in one state and its districts the scope of the project can go beyond a single state and be used for the remaining states and their respective districts. Given sufficient data, resources and time we can expand this project to further reaches.

The basic drawback of any infectious disease prediction model is the complexity of how data are collected. These Infectious disease reports have long been plagued with many challenges. It is important to acknowledge that our model relies on the detection of infections through testing and reporting. In reality, the journey from infection to tabulation has many obstacles along the way.

In our current connected world, the spread of rumour-mongering news is common due to a surge in the use of the internet and social media.

The models have to be validated using multiple datasets. In the future ahead, we will have to incorporate and explore the impact of other clinical features and laboratory results that were identified as significant in the previous studies.

5. REFERENCES

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Sentence

The urge for people to travel after the long lockdown stage can enhance the scope of tourism for states. 1.2 OBJECTIVE Our goal is to create a user-friendly application that can be used to track the Covid activity in the location of interest and predict the potential cases in that particular region on a given day. EXISTING WORK There are multiple travel apps that are available to us, and given the diversity of apps currently available, apps should obviously not be regarded as a uniform category. Some of them are given below: [1] An LSTM approach was used to check the current situation of COVID-19 cases and to assist the government officials in preparedness, with an RMSE = 45.72. The ARIMA model was used to assign the task of forecasting the spread of COVID-19 infection with an average RMSE = 44.81, followed by AI, ML and hybrid models. [2] For future research, a more indepth comprehensive review in other fields, such as AI and DL, is encouraged. 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N-BEATS model was also built for comparison. 3.1.2 Application Architecture The designing, development and the integration part of the present model into an mobile application was done successfully by using fluter By making use of the material dart package provided by flutter and creating specific custom functions and widget functions thereby increasing the efficiency of the application using flutter, also making the application multi platform The detailed architecture and user flow is shown in the figure above (Figure 1) 3.2 Working Principle The list of selected algorithms were- Conv1D GRU LSTM N-BEATS With our selected models we had to know which model was best for each dataset, as the District Wise.xlsx and HOT1.xlsx had smaller numerical values the N-BEATS model will not be as efficient as with larger values. N-BEATS was the best option for the Kerala Date Wise.xlsx dataset due to its generally larger values. The preprocessed datasets, with the help of numpy and pandas, are again preprocessed to make it work well with the model. Ie, only the necessary columns are taken and the date column is made as the index of the dataframe. Then the sequential training data are turned into sliding windows. ie, we use the past 7 day’s cases to predict the next 7 days. So they are windowed. For the N-BEATS algorithm , the custom layers which are built are named NBeatsBlock. Then they are connected together using residual links between them. The backcast from the blocks are used as inputs for subsequent layers. The cumulative forecasts from each of the Blocks are used to predict the future data. 3.3 Results and Discussion 3.4 Individual Contribution by members Joys James - 19BAS10045 The work of collecting the necessary dataset was given to Joys James[19BAS10045].When we tried to find data on positive covid cases in the state of kerala and its districts, we ran into a few problems. First, the data we needed had to be continuous, and it had to include data from each district of the state to increase accuracy. We tried several websites, but there was no continuous data or, to put it another way, it didn't have the most recent data we needed. Next, we needed to find the history of contact/travel data, which was difficult to come by. Then we came across a project on github that utilized AI-assisted document and image extraction techniques to

automate the extraction of such data from state-level daily health bulletins in structured (SQL) form. Bhuvnesh Sharma - 19BCE10213 The data collected by Joys had to be thoroughly cleaned as it had lots of inconsistencies and missing data points. In order to process that data we decided to select the time frame of our dataset, as we selected the dates from 01-06-2020 till 05-04-2022. From the datasets that we had collected, there was only data from 17-08-2020, Bhuvnesh Sharma[19BCE10213] was given the task of finding all the data for the remaining days for the dataset on History Of Travel/Contact. Similarly fix all the data inconsistencies. Noel Paul Fredy - 19BCY10130 The handling of the other two data-sets, daily covid +ve cases in kerala and the daily covid +ve cases for each of the 14 districts of kerala were done by Noel Paul Fredy[19BCY10130]. He had to find all the inconsistencies and irregular data points and replace them with the actual values. As the daily covid +ve cases in kerala were recorded in the
https://dashboard.kerala.gov.in/covid/ website it was much easier to clean the data. Vaillapilly Dharan Harish - 19BAI10103 and Akhil S - 19BAI10075 Through the extensive research conducted by Akhil S.[19BAI10075], We got different insights initially starting with 1D CNNs which didn't provide much accuracy, so then shifted to LSTM which was providing better results, GRU performed similar to LSTM. On further research by Vailappilly Dharan Harish[19BAI10103], we found that for seasonal data ,the N-BEATS algorithm performs much better with situations having larger numbers and upon researching more about N-BEATS algorithm, we found that it's the best possible option for Kerala Date Wise dataset. For the district and history of travel/contact dataset we have used LSTM as they have significantly smaller values than the Kerala Date Wise dataset. Pranav R - 19BAI10080 The model creation was handled by Pranav R [19BAI10080]. The primary framework used to make the models is Tensorflow and was trained using google colab cloud platform. For the entire state prediction model, Conv1D, LSTM, GRU and N-BEATS model architectures were made to make a comparative study. For the travel contact dataset, LSTM and Conv1D models were built and for the districts, a set of fully connected models were built. Some of the libraries used for preprocessing the dataset were - Pandas and Numpy. Matplotlib.pyplot was used for visualization. For models such as Conv1D, LSTM and GRU, the layers come prebuilt in the tensorflow library. For the state of the art N-BEATS model, custom layers were built. NBeatsBlock layers were built as they are the building blocks of the multi-residual neural network. These blocks were linked using the residual connections. Each block returns two outputs - backcast and forecast. The backcast from the blocks are passed to subsequent blocks after passing it through a residual link(subtract link) and the forecast, after passing through another residual link(adding link) was added together to make the predictions. The N-BEATS model gave the best performance among all the trained models. For the prediction of each district, a function was made to automate the process of making the training and test data, creating and training the model as well as evaluating and plotting the graphs for the same. Shyamkrishnan Sudhir - 19BAI10032 and Albin Alex - 19BAI10161 A collaborative effort of Shyamkrishnan Sudhir [19BAI10032] and Albin Alex [19BAI10161] was done to Design, Develop, Integrate and Apply the most accurate machine learning model into a mobile application through Flutter and further upgradation of the application can be made possible by using Tensorflow Lite which makes it possible to make models on mobile, microcontrollers and other edge devices. The data from real-time datasets is fetched and stored in the database. The database and the server-side cloud also communicate in a similar response for request manner. In contrast, the data communication between the client-side and the server-side is maintained by our responsive REST API's. Thus, it makes the full system unique, helpful, secured, and user-friendly with all the features entitled to the users in an optimized way. Flutter made it easy with the help of specifically made custom functions and custom widget function in dart made the application more efficient and there my consuming less memory and very less latency there by making the application multi-platform which works excellently in all smartphones, iPads allowing the collected results from the machine learning model to be displayed in a more easier and understandable way. The particulate was converted into an ML model into a tflite file and then integrated into flutter. Used VSCode IDE to run the dart file using an emulator for iOS devices such as iPhone 13 and iPads. We have included a seamless user experience wherein the users can make use of the custom widgets and navigate into the particular date and location of their visit and effectively search the predicted no of cases. Through further research we have kept an open source iteration wherein we can include more features in the coming future. CONCLUSION Our project is currently being applied on a small scale, in one state and its districts the scope of the project can go beyond a single state and be used for the remaining states and their respective districts. Given sufficient data, resources and time we can expand this project to further reaches. The basic drawback of any infectious disease prediction model is the complexity in how data are collected. These Infectious disease reports have long been plagued with many challenges. It is important to acknowledge that our model relies on detection of infections through testing and reporting. In reality, the journey from infection to tabulation has many obstacles along the way. In our current connected world, the spread of rumor-mongering news is common due to a surge in the use of the internet and social media. The models have to be validated using multiple datasets. In the future ahead, we will have to incorporate and explore the impact of other clinical features and laboratory results that were identified as significant in the previous studies.

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