COVID-19: A BOON TO E-BUSINESS

Final Report
WIL Project 50

By,
Amogha Amaresh s3789160
AnilKumar Lingaraj Biradar s3798024
Arvinda Sanjeevi s3755232
Harshitha Reddy KS s3797186
Shivani Rajesh Deshmukh s3805479

Table of Contents

Abstract

In terms of social expectations and the way we live and operate, the COVID-19 pandemic was a remarkable global occurrence that affected the lives of billions of people worldwide, resulting in what was widely referred to as the new standard. Apart from the exceptional effect on society and industry, the pandemic created a set of unusual circumstances linked to society and business. The heightened panic induced by the pandemic increased the risk. This report analyses the COVID-19 pandemic from a business perspective and highlights the solutions to e-business with the help of machine learning techniques. Interactive ShinyApps enables us to gain access to the most accurate visualization. We have built a ShinnyApp which provides a complete detailed analysis for the country selected. The shiny app is built for the interactive visualization.

Introduction

In 2019, the first outbreak of the COVID-19 pandemic started happening and gradually and eventually infected other nations around the globe, resulting in mass quarantine of the citizens around the world and as COVID-19 spread globally it also led to a significant threat to the e-business. In this report, we are predicting how the number of cases affects business and e-commerce. We are building this report based on the machine learning models and the graphs which are gained for the results. Shiny app will help us with graphs of various other countries.

Business questions

1. **How likely will this trend in the increase in consumer population is going to persists due to pandemic?**

In a short period of time, COVID-19 has overwhelmed the lives and the livelihoods of people across the globe. Businesses are forced to rethinking on how to improve people's likelihood by enhancing business experience. This has direct implications on the increase/decrease in the new coronavirus cases. The SIR model will help us to predict the saturation of infection so that Business can address the business requirements.

- Businesses in the countries where infections have reached the peak can expect a gradual decrease in the growth of consumers.
- Businesses in the countries where infections are yet to reach the peak with imposed lockdown restrictions should expect an increase in consumer growth.

The pandemic has an immediate impact on the business and is noticing the greatest recession of all times. This trend will increase the consumer population by providing new policies, new ways of working, and new consumer behaviours which will give rise to incomes and employment as well.

2. **What are the proactive ideas and solutions that are to be adopted by E-business that adds more value while retaining the past consumer population by abiding by the COVID-19 rules restrictions?**

The stated objective is for all nations to monitor the pandemic by slowing it down. Strategic global priorities are as follows:

- Mobilize all industries and societies to ensure that, through hand grooming, respiratory etiquette, and individual-level physical distancing, every sector of government and community takes control of and engages in the response and in preventing cases.
- Monitor intermittent cases and clusters and escape population dissemination by quickly recognizing and isolating all cases, ensuring proper treatment, monitoring, quarantining, and encouraging them to contact.
- Suppress community spread by context-specific steps to deter and manage diseases, physical distancing steps at the population level, and appropriate and proportionate restrictions on non-essential domestic and global travel.
- Reduce mortality by delivering sufficient clinical coverage, maintaining vital health and social services, and securing public servants and vulnerable communities for those impacted by COVID-19. [1]

Scrape old reviews to track consumer -service activity. Understand the change in consumer needs by identifying the critical changes in consumer behaviour. Ensure adequate online customer experience by communicating constraints on capacity and product availability at the time of the shop. Introduce promotions and offers, incorporating both consumer-traffic trends and key competitor pricing and promotional activities. Launch and test new consumer propositions in agile ways E.g.: by leveraging presale, or third-party partners to get early reads on-demand by experimenting. Some of the national strategies will also help respond the pandemic, like coordination and planning for health, international affairs, economy, education, transport, travel and tourism, water, and sanitation to provide management of COVID-19 response. [2]

3. What strategies can be implemented on the existing services or introduce new services based on the fluctuation in the consumer population?

In order to reduce impacts, organizations should've designed pandemic-specific policies and protocols around workplace messaging, telecommunications, and personal leave. Shift the company online:
In this latest paradigm change, there are 2 essential parts:

- People working at home.
- People who are online.

Make use of the contact list and CRM (Customer Relationship Management). You can also keep your company afloat whether your market is down, or you can't afford sponsored advertisements. For current customers or leads, scrub your CRM, and run email campaigns to re-engage those consumers.
Using the email list in the two forms below:

- Select the most despite the impressive and have exclusive deals or illustrate empathy.
- Meet current leads who haven't yet purchased from you with exclusive deals.

Platforms aimed at reaching new consumers by promoting

- Who are they?
- Where they operate (LinkedIn).
- Their concerns.
- What they're in the market for.
- What they search on Google, etc.

Fitness: Fitness coaches will have customized 1-on-1 instruction or a challenge for 20 days and diet coaching sessions.
Law: Internet consultations may be offered by legal practitioners.
Health: Remote video reviews and consultations can be made by hospitals and physicians.
Architecture: Online video consultations and quotations (the client can take the measurements) can be provided by construction contractors.
Education: Online classes can be created by coaches, teachers, and tutors, etc. [2][3]

4. Calls to be made on the workforce by E-businesses to maximum profits.

Reducing the susceptibility of employees to the COVID-19 virus in the workplace.
Steps to restrict physical contact are being taken by many nations. The first emphasis was on interpersonal encounters in the workplace and the everyday commute, as vast numbers of individuals are frequently gathered by workplaces and public transport and therefore raise their chance of contracting and transmitting the COVID-19 virus. Government choices to decrease the occupational exposure of employees to the COVID-19 virus

- Relaxing current rules or implementing new telecommuting solutions.
- Providing small and medium-sized businesses (SMEs) with financial and non-financial resources to help them develop teleworking skills and efficient teleworking routines efficiently.
- Encouraging groups of businesses to inform their participants of the benefits of telework and to help.

Providing sick workers and their families with employment backup.
Paid sick leave is a critical opportunity for workers and their families to counter the effects on the economy of the COVID-19 crisis. For employees who are unable to function since they have been diagnosed with COVID-19 or must self-isolate, it can have some employment continuity. Paid sick leave also helps to slow the spread of the virus by ensuring that sick workers can manage to be at home until they are no longer susceptible. Proposed policies for sick workers and their families to strengthen income security.

- Extending protection of paid sick leave to non-standard employees, including self-employed people.
- Extending and aligning the term of paid sick leave or waiving processing time for quarantine and medical suggestions.
- Adapting reporting standards, e.g. by waiving the need for medical certificates, to access paid sick leave.[4]

Methodology

Data Retrieving

The data is loaded using the R package covid19.analytics, this package is used to fetch the time series worldwide data of confirmed cases, Recovered cases and Deaths reported for Covid-19 provided by the Johns Hopkins University Center for Systems Science and Engineering (JHU CSSE) using the GitHub data repository, <https://github.com/CSSEGISandData/COVID-19>.

Data Description

- The data set contains Covid-19 cumulative confirmed cases for 253 countries from the date: 2020-01-22 to 2020-10-18. The given data set has 262 attributes with 266 observations.
- Among the 262 attributes, the initial 4 attributes are Province.State, Country.Region, Lat, Long which provides the information about the State, Country, Latitude and Longitude of corresponding country.
- The remaining 258 attributes include the covid-19 cases from the date 2020-01-22 to 2020-10-18.
- The first 5 observations with first week of confirmed cases details are as shown below:

Province.State	Country.Region	Lat	Long	22/1/20	23/1/20	24/1/20	25/1/20	26/1/20	27/1/20	28/1/20
	Afghanistan	33.939	67.71	0	0	0	0	0	0	0
	Albania	41.153	20.168	0	0	0	0	0	0	0
	Algeria	28.034	1.6596	0	0	0	0	0	0	0
	Andorra	42.506	1.5218	0	0	0	0	0	0	0
	Angola	-11.2	17.874	0	0	0	0	0	0	0

Figure 1- Five countries observations of confirmed cases

- The recovered covid19 cases data set contains information for 253 countries from date 2020-01-22 to 2020-10-18.

The shape of the data set is 253 observations and 267 attributes. The first 5 observation with a week data from 2020-10-03 to 2020-10-10, cumulative Covid-19 Recovered numbers are as shown below:

Province.State	Country.Region	Lat	Long	3/10/20	4/10/20	5/10/20	6/10/20	7/10/20	8/10/20	9/10/20	10/10/20
	Afghanistan	33.939	67.71	39297	39341	39422	39486	39548	39616	39693	39703
	Albania	41.153	20.168	14117	14266	14410	14568	14730	14899	15066	15231
	Algeria	28.034	1.6596	51995	52136	52270	52399	52520	52658	52804	52940
	Andorra	42.506	1.5218	2110	2110	2370	2370	2568	2568	2696	2696
	Angola	-11.2	17.874	5370	5402	5530	5725	5725	5958	6031	6246

Figure 2 - Five countries observations of recovered cases for a week

- Similarly, the deaths occurred due to covid-19 is retrieved from the above-mentioned repository link. The shape of this data set is 266 observations and 267 attributes.
- The 11 days records showing the cumulative number of deaths occurred from 2020-01-22 among the 5 countries is as shown below:

Province.State	Country.Region	30/9/20	1/10/20	2/10/20	3/10/20	4/10/20	5/10/20	6/10/20	7/10/20	8/10/20	9/10/20	10/10/20
	Afghanistan	1458	1458	1458	1462	1462	1466	1467	1469	1470	1472	1473
	Albania	387	388	389	392	396	400	403	407	411	413	416
	Algeria	1736	1741	1749	1756	1760	1768	1768	1771	1783	1789	1795
	Andorra	53	53	53	53	53	53	53	53	54	55	55
	Angola	183	185	189	193	195	199	211	211	208	212	218

Figure 3 - Five countries observations of deaths for

Tools

- The software development was done using R programming 4.02.
- Visualisation are done using the R shiny package and plotly package.
- To keep track of the team's, progress Gantt chart is used using the tool Excel.

Visualisation to get insights from the data

Firstly, the pie chart and bar chart are used to visualise the number of confirmed cases, number of deaths and number of recovered cases among the top 10 countries.

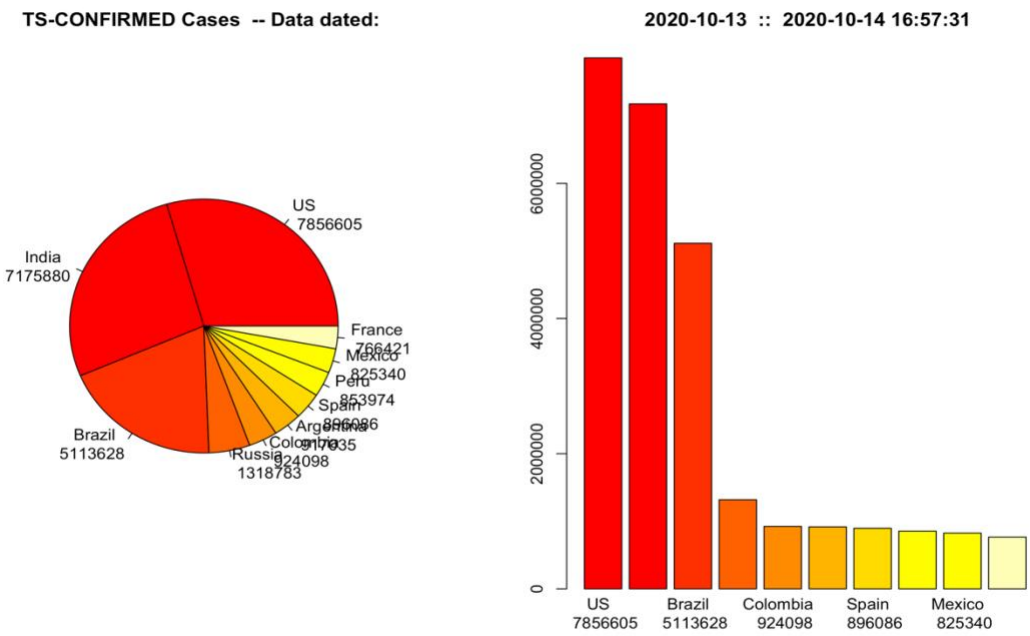

Figure 4 – Number of Confirmed Cases over top 10 countries

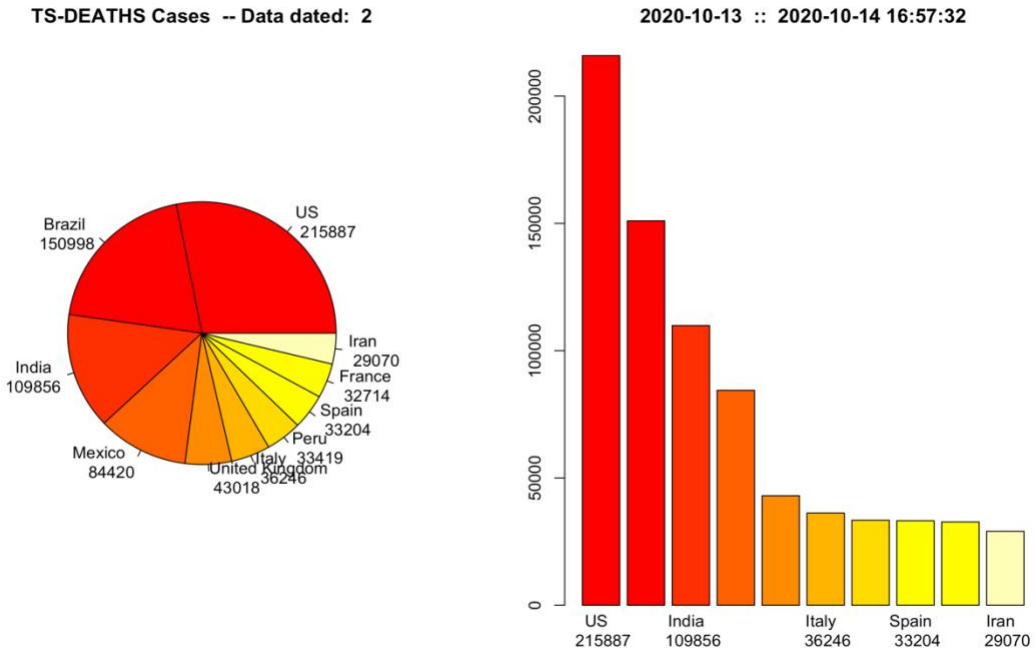

Figure 5 – Number of Death Cases over top 10 countries

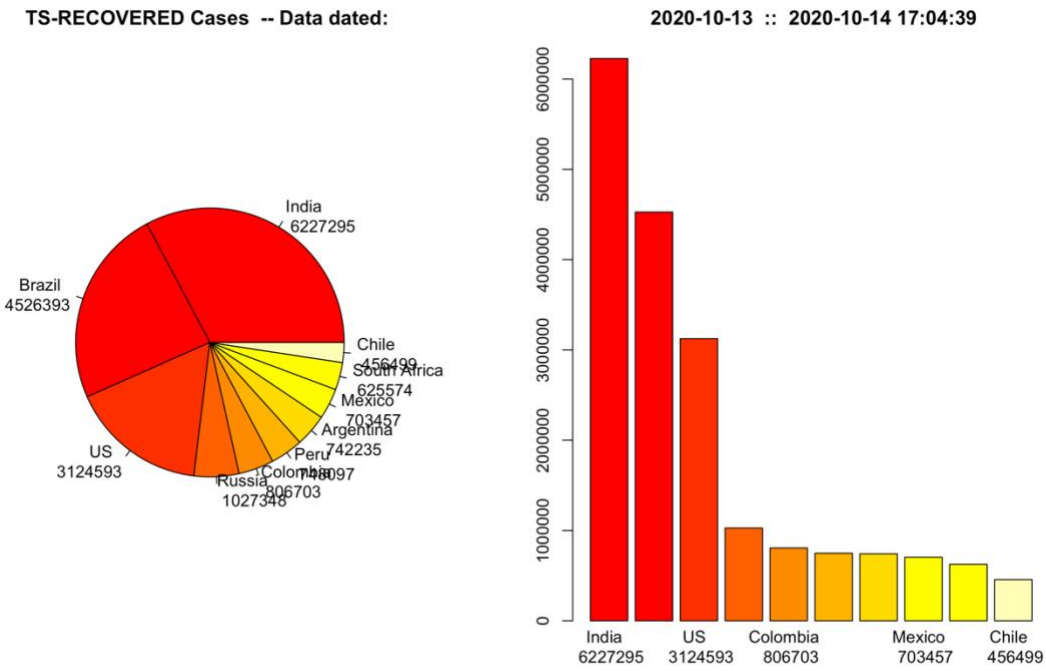

Figure 6 – Number of Recovered Cases over top 10 countries

From the default charts provided by R programming it is not informative, and it is not feasible to plot for all the 253 countries. Hence, an interactive 3D globe visualisation is developed. From this interactive visualisation we can infer the confirmed cases by hovering the cursor over the 253 countries. For instance, a snapshot of the visualisation is as shown in the *Figure 7*,

where the cursor is placed on the Victoria region on the map to get the cumulative number of confirmed covid-19 cases in Victoria from 2020-01-22 to 2020-10-18.

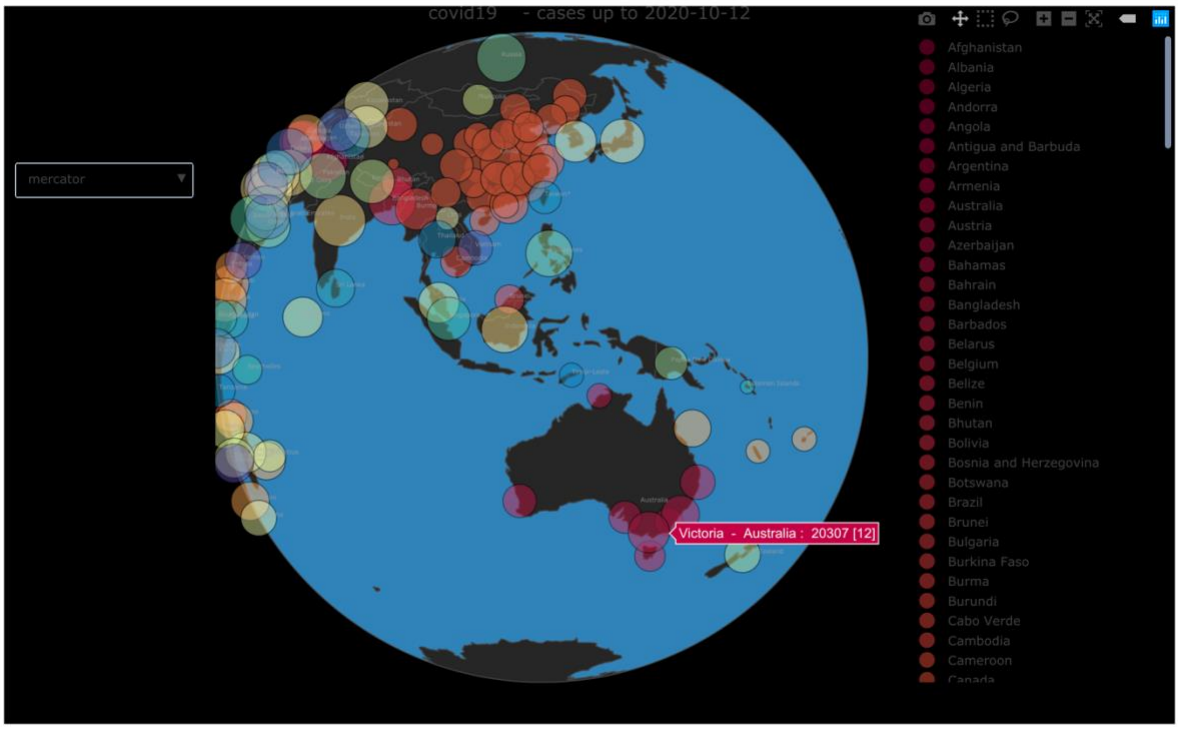

Figure 7 – Snapshot of Live Map Visualisation which shows the confirmed cases for Victoria region

User is allowed the change the orientation of the globe through the dropdown provided on left side of the visualisation. Also, user can select the specific country by the list of countries provided on the right-hand side. For example, if the user selects United States from the country list and select the miller as shape of the earth, the output is as shown in the *Figure 8*.

Figure 8 – Snapshot of Live Map Visualisation about confirmed cases for country USA with globe shape miller

To know the trend of cumulative confirmed cases across the countries a choropleth world map is used provided by the plotly package and a date slider is attached to it. The date starts from 2020-01-22 to 2020-10-18 and the confirmed cases scale changes dynamically as change in the dates. A snapshot of the visualisation is provided as shown in *Figure 9* for the date 2020-07-15.

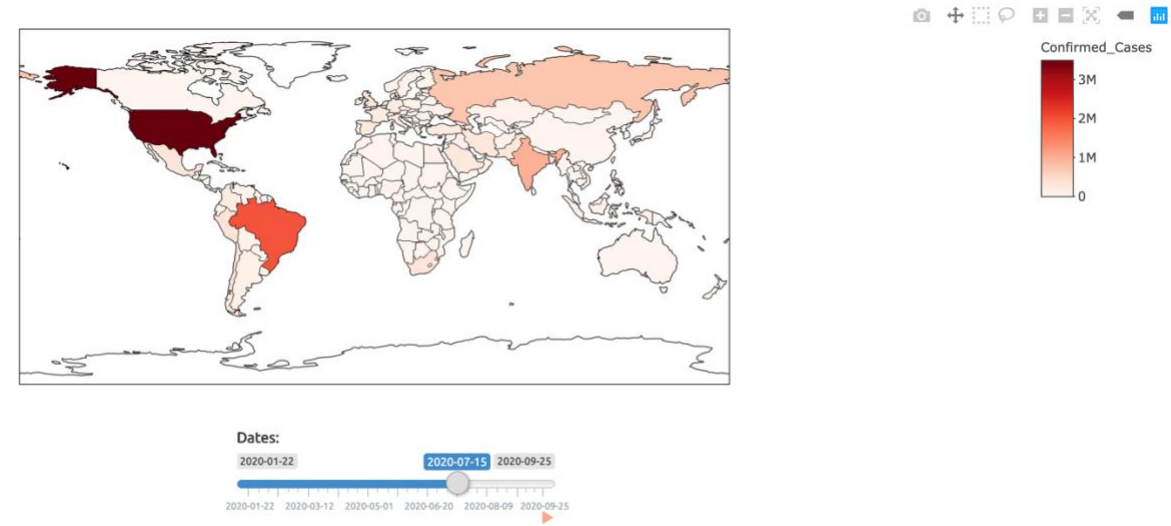

Figure 9 – World map visualisation to show the trend of COVID-19 cases across the countries

Machine Learning Models

To predict the number of Covid-19 cases in different countries based on the previous 10 months of time series data three machine learning models are used on each countries data.

Linear Regression Model

Initially the data was fit into a linear regression model. In this scenario linear regression model assumes a linear relationship between date and cumulative Covid-19 confirmed cases. From the output it is inferred that, Linear Regression was not a good idea. In the current context, we are interested in predicting the future, which would be extrapolation (prediction outside the range of the data) for linear regression. Extrapolating linear regression is not often reliable because of autocorrelation. In the dataset considered the observations were correlated and we have a biased estimate of the variance. Drawing insights from fitting the linear regression model will land us prediction error.[7]

Prophet Model

Prophet model is used on a time series data when there is no linear relationship between the two attributes. From the previous model, it is inferred that there is no linear relationship between date and cumulative Covid-19 confirmed cases. Hence Prophet model is better to predict the cumulative Covid-19 cases. Prophet modelling predicted that the cases will keep increasing in future, which is not the case.[8] The downside was, it did not consider the recovered population or the deaths in its prediction. Since no infectious diseases till date was not been contained the increase in the number of cases will definitely come to zero. It was at

most necessary for us to inculcate recovered population and deaths along with confirmed cases in forecasting. Hence, we couldn't depend on the predictions made by this model.

Susceptible-Infected-Removed (SIR) model

An SIR model is an epidemiological model that computes the theoretical number of people infected with a contagious illness in a closed population over time.[9] This model assumes that the data are reliable and with this model it is possible to predict the number of infected, removed and recovered populations and deaths in the country. In the classic SIR model, the susceptible population decreases monotonically towards zero. However, this is not valid in the case of COVID-19 virus. But when compared to other machine learning models it works the best for a contagious disease like COVID-19. SIR model is one such model which handles all these three data accurately to forecast the cases/deaths in future.

Comparing Models

From the above mentioned three models' predictions, Linear Regression model was not suitable for time series data and there was no linear relationship between Date and COVID-19 cases. Prophet model was not considering the recovered cases or deaths during the prediction hence it was not suitable for this scenario. On the other hand, SIR model was better when compared to other two models in terms of prediction and for the time series of COVID-19 data. Hence SIR model was selected for the predictions and based on each country's covid-19 cases predictions corresponding business solutions are found.

Shiny Application

The shiny app is built to view the interactive visualisation for cumulative COVID-19 cases and the three-machine learning model output. The quick guide to use the shiny app is as follows:

- By default, the **Global COVID 19 Cases** Tab is selected, which shows the visualisation mentioned as shown in *Figure 10.* [6]

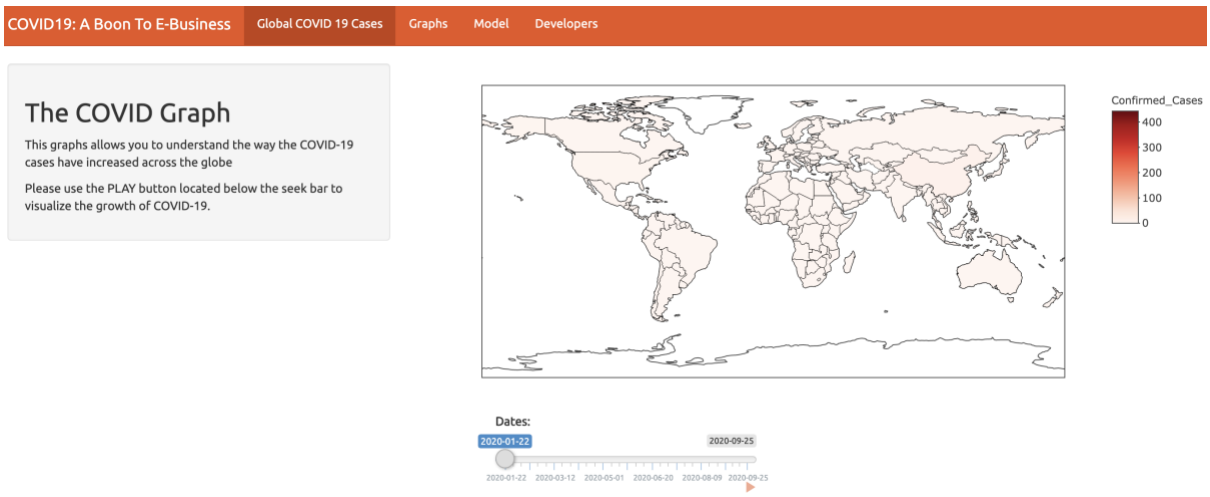

Figure 10 – Shiny App Global COVID 19 Cases Tab, which shows the details about the confirmed cases with the scale over the period of 10 months

- The Second tab **Graphs** is used to show the COVID 19 number of confirmed cases, recovered cases, Deaths, and Active cases over the period based on the country selected from the drop-down using line plot with the sub-tab **Cases** as shown in *Figure 11*. Among the two-line plots first one follows the normal scale and the second plot is using the log scale for the Y-axis. From the sub-tab **Growth,** the change in COVID-19 cases and growth rate along the months are displayed as shown in *Figure 12*.

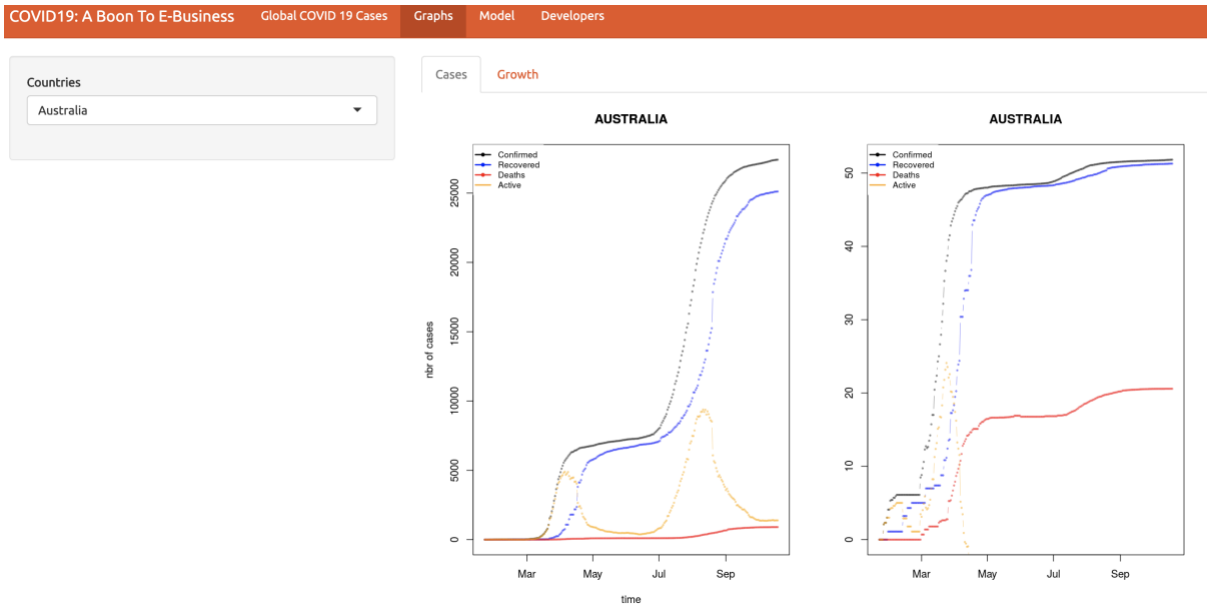

Figure 11 – A snapshot of Shiny App when Graphs Tab and subtab Cases is selected, which shows the details about the confirmed cases, recovered cases, Deaths, and Active cases for the country Australia which is selected through dropdown

Figure 12 – A snapshot of Shiny App when Graphs Tab and subtab Growth is selected, which shows the details about the growth rate along the months from January 2020 to October 2020 for Australia

From the above *Figure 12*, it is clear that the COVID 19 cases in Australia has reached the lowest point in end of June and the second wave started from the beginning of the July month.

- The third tab **Model** is used to display the model prediction for the three machine learning models: Linear, Prophet and SIR respectively. The user can select the countries from the dropdown provided and it displays the country's corresponding model prediction outputs. A snapshot attached below is for the country United States and SIR model output.

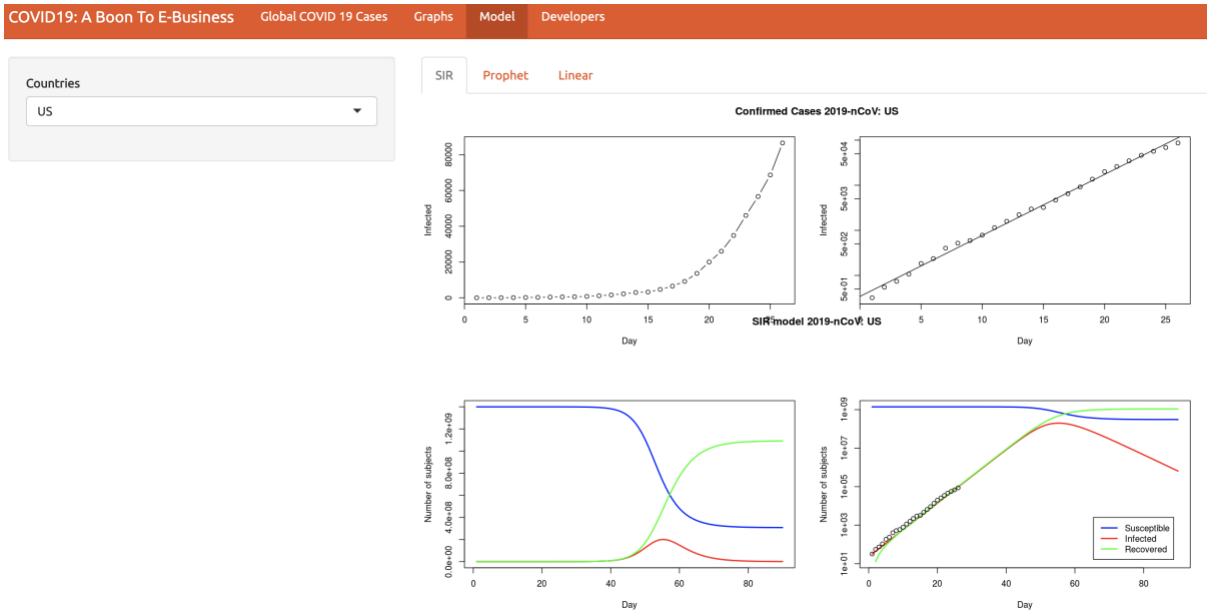

Figure 13 – A snapshot of Shiny App when the main Tab Model is selected and sub Tab is SIR, which displays the SIR model predictions for country US

From the SIR model prediction results, infected cases in US has reached its peak at around 55th day and also it does not mean that the new infection is near to zero at around 80. Since the susceptible population is not yet zero, the model predicts that new infections will continue to grow but at a slow rate.

Similarly, when the user clicks on Prophet Subtab. We get the COVID cases trend, for United States according to the Prophet model it is unfortunately the trend is increasing. Also, from the week graph, we can clearly see that there are more new cases on weekends than on weekdays.

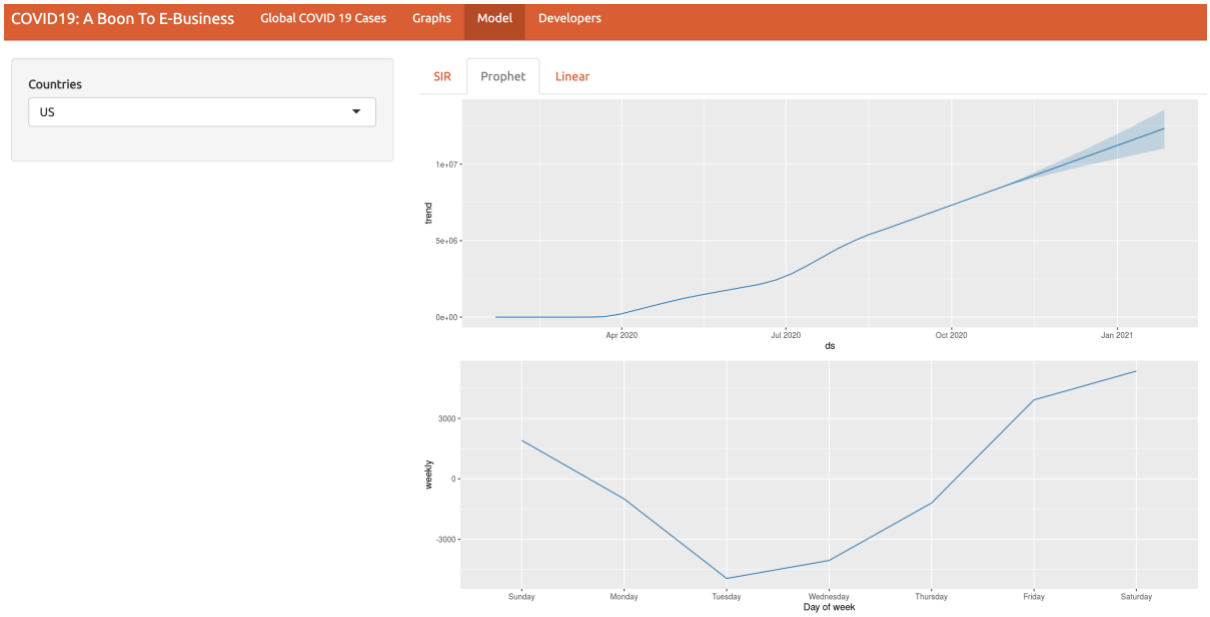

Figure 14 – A snapshot of Shiny App when the main Tab Model is selected and sub Tab is Prophet, which displays the Prophet model predictions for country US

The third Sub tab is Linear, and its corresponding modelling output is as shown in the *Figure 15* below.

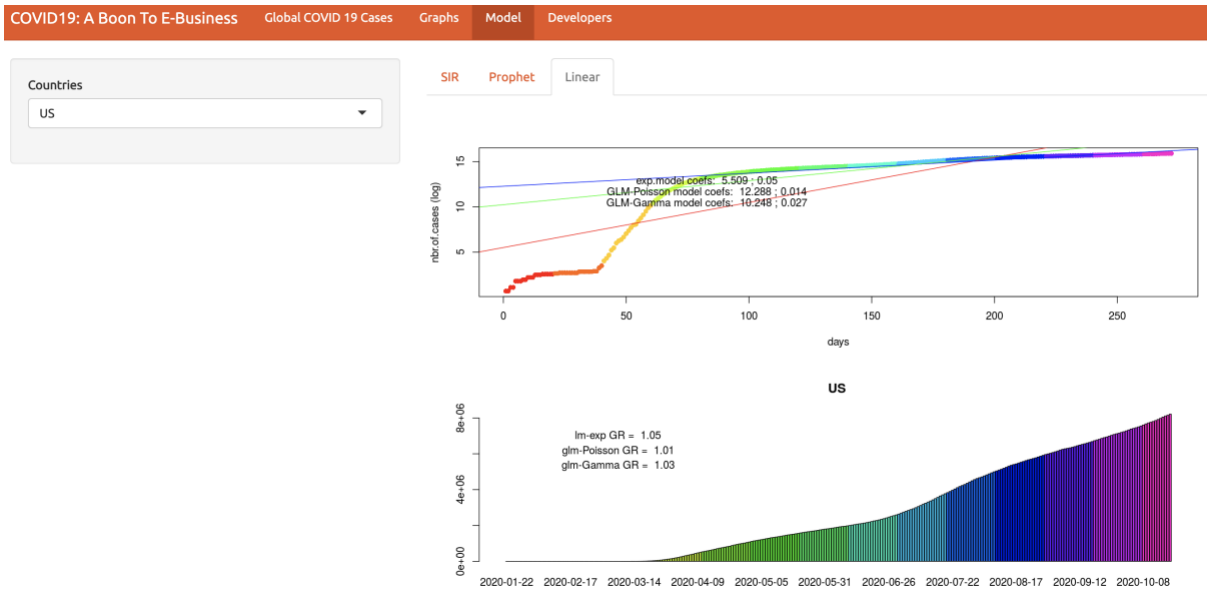

Figure 15 – A snapshot of Shiny App when the main Tab Model is selected and sub Tab is Linear, which displays the Linear model predictions for country US

The link to the above-mentioned shiny app is https://iamamogh.shinyapps.io/covid19Analysis/

Impact and Significance of Results

Impact on E-Learning

The COVID-19 pandemic took the world by surprise. Globally, everything as stopped, projects have been delayed, workplaces are closed, and schools are shut globally, over 1.2 billion children are out of classes [11]. Education suffered a severe damage leading to a many event which affected the future scope of students. As a result, education has changed dramatically, with the increase of the e-learning [10].

Due to this situation many digital learning platforms have been started and started to provide free access to their services such as BYJUS, Udemy etc., it has seen 200% increase in the number of students which in turn increased their business [11]. There is a significant surge in usage of the video conferencing tools, online learning software, language apps and virtual tutoring since COVID-19 started [11] [10]. By this the number of subscribers increases in the countries where the infection is yet to reach the peak with imposed lockdown restrictions. And there is high chance of decreased count of student subscribers in the countries where the infections have met the peak and released with the lockdown restrictions.

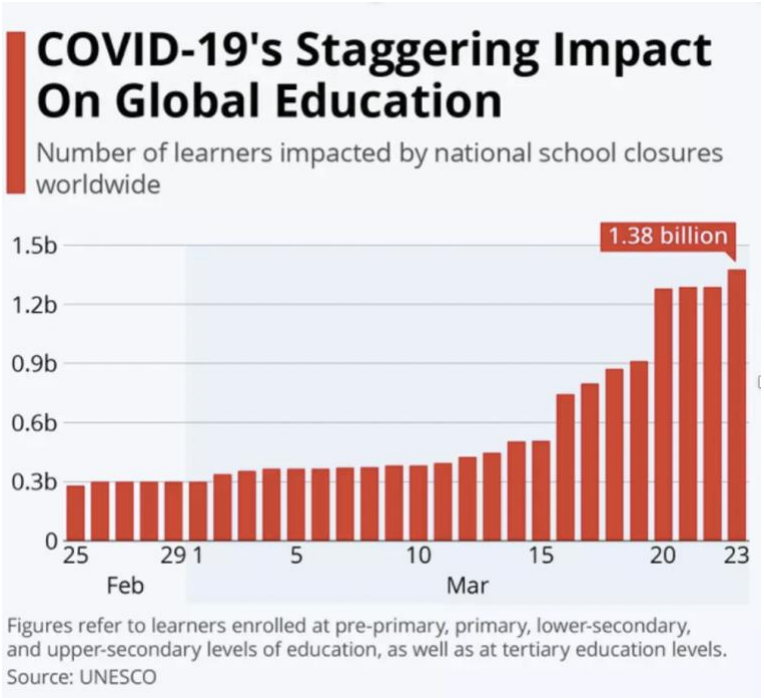

Figure 15 – Trend of learners enrolled at pre-primary, primary, lower-secondary, and upper-secondary levels of education, as well as at tertiary education levels

At this pandemic situation maintaining the number of students is very important and its very crucial to prioritize the subscribers and the count of them across the countries where the restriction still exists. This can be achieved by increasing the sense of community, purpose and focus on them who are connecting from different locations [11] [12]. By increasing the collaboration among the teams that are working remotely across different time zones via video conferencing or through instant messaging [12]. Also, by creating engagement in live sessions with certain planning such as, sharing the materials in advance, remanding the

participants prior the sessions start. Use of online tools such as polling and gathering the students through chats within the groups and the tutor. Engaging the moderator within each breakout groups to manage the speakers and solving any problems or issues being faced once the session is completed [12]. By maintaining these active steps, the number of the subscribers can be stabilised and increase the business in the case of the countries where there are lockdown restrictions still being imposed.

The count of the cases is decreasing in few countries such as Australia, China, New Zealand etc., in these countries the business of e-learning may decrease. In these countries the business of e-learning can be increased by providing special offers for the students, decreasing the cost of courses, sharing the materials of the course and introducing exciting prizes which will be helpful at their difficulty period.

Due to this pandemic situation the workload of the employees will be more, and the maintenance of the workforce limit is very important. As technology and industries are evolving more people have the capability of working from home or remotely hence flexibility for employees should be given [12]. The part time working availability should be given to the workers on their busy schedule days. Providing financial and non-financial assistance to the employees to help them quickly to develop effective teleworking capacity. Providing the paid sick leave to assist the workers and their families who are impacted with COVID-19. Hence by taking these measures the workforce employees can be maintained.

Impact on E-commerce

COVID-19 global pandemic will likely be one of the defining events of 2020 and has its implications on the e-commerce sector [13]. The situation has rapidly changed and caused the restaurants, bars, movie theatres and gyms in many cities are been closed. Meanwhile many office workers are facing new challenges of working remotely full time [13].

From the below *Figure 16* we can observe the collection of the groceries being stored by the people due to COVID crisis. The graph has a blue and red lines, the blue line shows the assortment of the groceries in the year 2019 and the red lines represents the groceries collection in the year 2020. By this, we can see the drastic changes in the field of e-commerce during the initial stages of COVID.

In parallel there was an accelerated growth in online retail sales in Italy and later in Australia, Spain and France where the penetration of the online shopping has increased. The additional growth can be possible for the countries haven't reached the peak of the cases that can meet the exponential growth in demand. Hence there is expected increase in the e-commerce to the countries which has higher cases and vice versa.

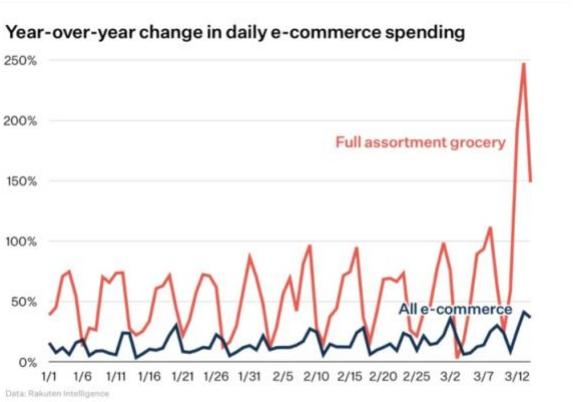

Figure 16 –Trend of Customer spending on e-commerce

To adopt the past consumers population in e-commerce business during this pandemic situation few ideas and solutions has to been taken and they are:

- Create customer value:

  The pandemic has created two different crises: the first, the health and safety crisis, acting as a catalyst for the second, financial crisis [14]. This situation has made the retailers to consider the financial situation of the customers in developing the new strategies and plans to address the consumers financial concerns such as layaway or payment plans [14]. Also focusing on customers values by providing discounts for signing up for subscription, auto-shipping and product bundles.

- Golden opportunity for marketing:

  Due to store closures and stay-at-home orders, the purchasing habit of the customers has been changed dramatically and it's easy to influence the customers with new products, new channels or having new experiences. Brands and retailers are no longer a compete for buying certain accessories [14]. Hence the companies just need to compete for the customers. So, investing in new marketing field will yield back the business.

- Take time to evaluate the e-commerce technology

  Usage of new technologies such as cloud-based e-commerce solutions will ensure the latest innovations work instantly without any disruptive upgrades. It enables the businesses to create new customer experience quickly. The business needs to create the tools to pivot and react quickly with the changes in the environment [14]. Review the technology stack, order management, product information management, and customer experience to see where the limitations are, and to ensure these systems will deliver reliably.

The management experience will be understood by taking the customers expectation from the brands. Only by taking the people review the business can understand the gaps that lies between the customers and the organisation views [14]. To achieve this, it is recommended to clients to measure the quality of experience for every customer using real time feedback and the teams can work out on the solutions for it.

Having the proper data will allow the organisation to prioritize the most painful gaps first. Some corrective actions will require deeper investigation (for example delivery expectations not being met) and then process changes [14], while others can be addressed right away. With this experience data in our hands, we can act quickly and close the gaps until they are left with best practices, which should be rolled out and expanded across all your departments [14].

The combination of the two solutions helps us to tackle the key aspects of e-commerce disruption with no mistake and increase number of new customers and also the existing customers.

The delivery employees of each business should be increased so that there is no delay in transporting the goods to the customers, this also increases the pay of the employees which will be helpful in this pandemic situation for their financial assistance. Also, increasing the deliver boys in the warehouse increases the online services for the customers. By

implementing these services in the business, the workforces of the employees will be efficiently handled.

Impact on OTTP

The outburst of COVID-19 has surged the demand of the OTT platforms such has Disney+, HULU, Prime Video, Hotstar, and HBO+ etc. These channels have changed the world entertainment and media by providing the different services during lockdown period [15]. This pandemic has shifted the social lives of the people towards online. In early 2020, Netflix has gained nearly 15.8 million subscribers and other streams such as amazon, hotstar has also observed a good spike of new subscribers [16].

The streaming media research (add reference) informs that the video streaming increased by 20% in early 2020 across the world. By this COVID situation OTT platforms have seen the drastic spike in the number of the subscribers [16]. And, the biggest surge in viewing the platforms is more during the daytime between 10am to 5pm and it has increased by 40%. By this we can infer that the business of the OTT platforms will increase in all the countries with high restrictions and decrease in other hand [16].

To ensure the growth momentum of these platforms post covid-19, many strategies must be followed by every companies to maintain the count of the subscribers. By developing new strategies to increase the weekly, monthly active users, increasing the subscribers base, improving the visualisations of the videos to increase the viewer experience and collecting the data of the user feedbacks and behaviours [15].

There is a prediction that the number of subscribers decreases in the countries with a smaller number of cases. In these countries the OTT video streaming services must focus on the customers data from all the channels to enable the long-term user loyalty and they must follow few strategies to maintain the business [15]. Firstly, prompting the first-time users to enable the push notifications that gives a chance to run the targeted and personalized campaigns that will highlight the interest of person. Recommend New and featured Content using personalized banners to showcase the premium, featured and high engaged video so that users don’t spend much of their time in deciding which video to watch [15]. Promote new and upcoming movies by leveraging it in the Instagram stories and bringing awareness about new movies and series. Communicate the users about the changes being made on the app for example the hotstar app prompt about the addition of new logo of Disney+. The relationship between the user and the brand can be increased by taking the feedback and reviews about the video streaming [15]. Create communication with the user via emailing them about their feedback and coming with the solution.

Due to this pandemic situation the workload of the employees will be more, and the maintenance of the workforce limit is very important. As technology and industries are evolving more people have the capability of working from home or remotely hence flexibility for employees should be given. The part time working availability should be given to the workers on their busy schedule days. Providing financial and non-financial assistance to the employees to help them quickly to develop effective teleworking capacity. Providing the paid sick leave to assist the workers and their families who are impacted with COVID-19. Providing

bonus amount and helping them financially during their difficult days. Hence by taking these measures the workforce employees can be maintained.

Summary

Coronavirus has evolved in Wuhan, China. Experts said that the virus has an initial rapid spread due to two factors:

1. A population of million inhabitants that increased the chance of person to person contact.
2. Busy transportation hub increased the likelihood of cases of other locations.[17]

Due to COVID-19, many large-scale companies have initiated work from home opportunities. But smaller industries did not have any option rather than closing their industries and stores. They have suffered a lot for the past several months and still going to suffer until they recover. We have developed a shinyapp which shows the effect of COVID in all countries especially in USA, UK, and many European countries. Shinyapp has three tabs which shows ML models, Graphs about cases versus days and live map.ML models that we have used are Prophet, SIR and Linear regression. The data has been downloaded from the package (covid19.analytics) which was available in R. The prophet model will show the confirmed cases against the month and days of week. The day, Saturday, has recorded high number of cases than in other days. From SIR model, the results of affected, recovered and susceptible can be observed according to the population of the country. Our business problem can be solved with these models. The problem for e-business has been solved with many strategies. The most important techniques are pricing, promotion, marketing through social media and other platforms. Online businesses and small industries can overcome this critical situation by promoting their products with the help of customer relationship management. Hiring high skilled employees and review employee policies can earn maximum profits.

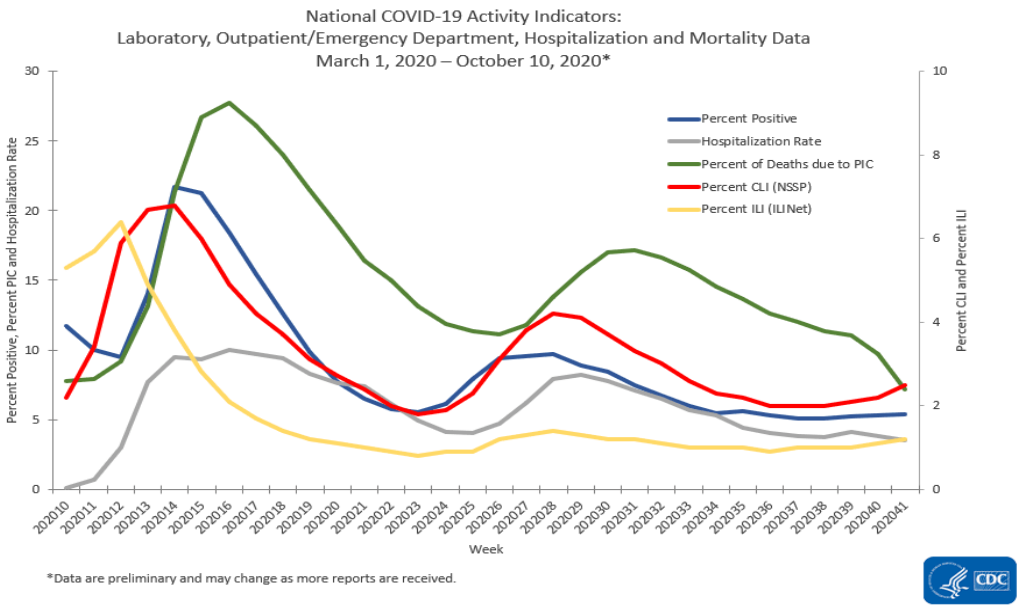

Figure 17 – National COVID-19 Laboratory, Outpatient, Hospitalization and Mortality Data from March 1,2020 to October 10,2020

Above graph will show about the COVID-19 activity. Blue line represents the number of people got the COVID result as positive. Hospitalization rate has been increased during initial period and it has become constant from the following periods. Deaths due to COVID has increased drastically on January end. Many people have been tested because they feel CLI (COVID-Like Illness). Red line shows the percentage of people get tested due to CLI. Yellow line gives an insight about the ILI (Influenza-Like Illness).

Live map will show cases across the globe. The slider has been added to change the dates from 22-01-2020 to 18-10-2020. We have encountered many business problems and have made solutions for that.

Future improvements

Hyper parameter tuning is used to choose a set of optimal parameters for a learning algorithm. These parameters will define the model architecture. The hyperparameters can control the learning process while the other parameters are learned. We are planning to further analysis of offline business who has affected more. This analysis will be useful for offline business if there is another pandemic arise in future. In shinyapp, live map will show the effects according to the date using date slider. There is a deficiency if they want to see the affected people for a particular country. So, we are planning to add a country which can select the country from the drop-down box.

Ethical and Social Considerations

Digital technologies such as mobile phones, social media, and artificial intelligence can also play a substantial role in dealing with pandemics. They make it possible to monitor, anticipate and influence the spreading of diseases and the behaviour of human beings [18]. However, it is important to make sure that ethical, social and political issues related to the use of these technologies are adequately addressed.

1. Massive genomic screening and data privacy during a pandemic.
2. Biobanking access and data privacy.
3. Contact tracing and geo-localisation.
4. Patients triage and prioritization.
5. Quarantine measures.
6. Drug and vaccine development during pandemics.
7. Mitigation measures such as full and partial closures.
8. [19] Pandemic infrastructure and its usefulness post-pandemic.
9. Distance learning, especially in the biosciences.

Issues Encountered

We have faced many numbers of issues. Mainly, we did not know about time series data. The covid-19 data has a date column with large number of data. We are not able to merge or gather data according to same date as the date for various data is same which may result in increased in size of the data. We found difficult when we try to transfer our programming file

from Python to R. In ShinyApp, we are not able to add world live map as it has no functions or packages to add. More efforts have been made for slider dates in ShinyApp under Global tab. As it is showing the number of affected people over the world for a period of almost six months, we found it as difficult to add slider for those dates. Lacking articles.

Project Management

Communication Tools

The team has been communicated with WhatsApp and Microsoft Teams. For a clarification and meeting related questions, WhatsApp is used. And for sharing files, Teams has been used. We had a meeting after every lecture on Monday and will discuss about the assignment. We have made a continuous track of the assignment throughout the period from starting to the preparation of slides. The team worked together to get the done assignment with perfect project management plan, and we executed it well according to the plan. The chart will show the contribution of project and the work that we have worked for. We have crossed many roadblocks during the project but still we achieved what we want at the end of the project.

Contributions

The team has contributed equally. Each and every team member will update the work accordingly and shared the files with the team. The chart below shows the contributions of team members to this group assignment. The spark PLUS will tell about us the effort, management, contributions in this project. Everyone has given equal amount of space and time and more efforts to complete this achievement.

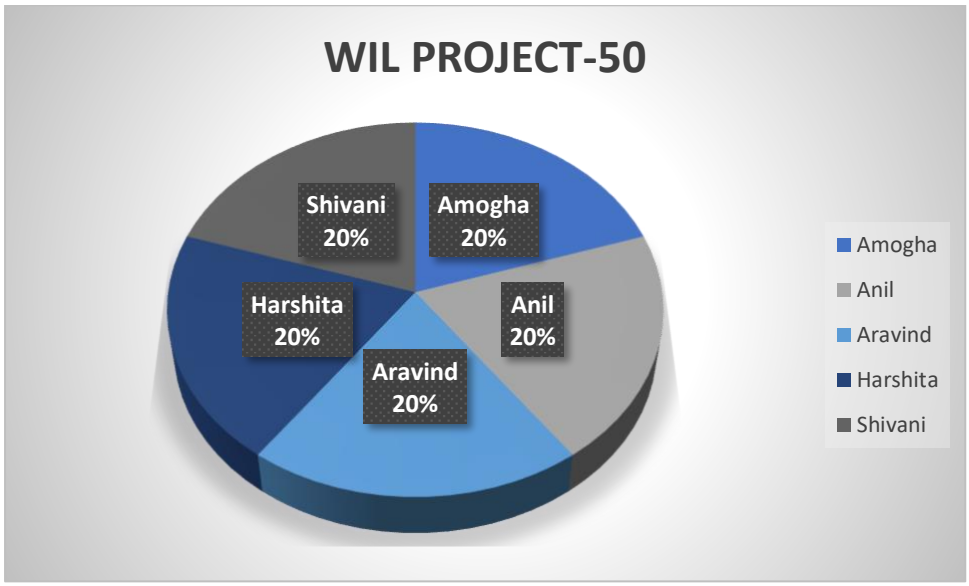

Figure 18 – Contributions of the team members from the group WIL Project - 50

Gantt Chart

Figure 19 – Gantt chart which shows the flow of work done and divided among the team members from Team communication set up to the final report

References:

1. 2020. [online] Available at: <https://www.mckinsey.com/~/media/McKinsey/About%20Us/COVID%20Response%20Center/PDFs/COVID-19-response-checklist-for-B2C-marketing-leaders.pdf> [Accessed 20 October 2020].

2. 2020. [online] Available at: <https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/covid-19-strategies-for-getting-ahead-of-the-pandemic-crisis> [Accessed 20 October 2020].

3. StableWP. 2020. *13 Online Marketing Strategies To Survive And Thrive In COVID-19*. [online] Available at: <https://stablewp.com/13-strategies-to-tackle-covid-19/> [Accessed 20 October 2020].

4. OECD. 2020. *Supporting People And Companies To Deal With The COVID-19 Virus: Options For An Immediate Employment And Social-Policy Response*. [online] Available at: <https://www.oecd.org/coronavirus/policy-responses/supporting-people-and-companies-to-deal-with-the-covid-19-virus-options-for-an-immediate-employment-and-social-policy-response-d33dffe6/> [Accessed 20 October 2020].

5. J "covid19.analytics," 28 09 2020. [Online]. Available: https://cran.rproject.org/web/packages/covid19.analytics/index.html.

6. "Plotly," 2020. [Online]. Available: https://plotly-r.com/maps.html.

7. Jason Brownlee, "Machine Learning Mastery," 25 March 2016. [Online]. Available: https://machinelearningmastery.com/linear-regression-for-machine-learning/#:~:text=Linear%20regression%20is%20a%20linear,the%20input%20variables%20(x).

8. Kan Nishida , "learn data science," 13 April 2017. [Online]. Available: https://blog.exploratory.io/an-introduction-to-time-series-forecasting-with-prophet-package-in-exploratory-129ed0c12112.

9. Ian Cooper, Argha Mondal, and Chris G. Antonopoulosb, "Elsevier Public Health Emergency Collection," 28 June 2020. [Online]. Available:

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7321055/#:~:text=Assuming%20the%20published%20data%20are,the%20number%20of%20susceptible%20individuals.

10. T. M. L. M. a. M. M. O. i. p. Alok Kshirsagar, "Adapting workplace learning in the time of coronavirus," McKinsey Accelerate, 17 March 2020. [Online]. Available: https://www.mckinsey.com/business-functions/mckinsey-accelerate/our-insights/adapting-workplace-learning-in-the-time-of-coronavirus. [Accessed 20 August 2020].
11. F. L. Cathy Li, "The COVID-19 pandemic has changed education forever. This is how," World Economic Forum, 29 Apr 2020. [Online]. Available: https://www.weforum.org/agenda/2020/04/coronavirus-education-global-covid19-online-digital-learning/. [Accessed 20 August 2020].
12. Y. E. Council, "8 Ways the Workforce Will Change in 2020," Inc., 3 Dec 2019. [Online]. Available: https://www.inc.com/young-entrepreneur-council/8-ways-workforce-will-change-in-2020-according-to-business-leaders.html. [Accessed 20 August 2020].
13. S. Meyer, "Understanding the COVID-19 Effect on Online Shopping Behavior," BIgCommerce, [Online]. Available: https://www.bigcommerce.com.au/blog/covid-19-ecommerce/#generational-purchasing-responses-to-covid-19. [Accessed 20 August 2020].
14. B. Chung, "Top 3 e-commerce recovery strategies," The Future of Customer Engagement and Experience, [Online]. Available: https://www.the-future-of-commerce.com/2020/08/28/e-commerce-recovery-strategies/. [Accessed 20 August 2020].
15. P. A. J, "Here's why OTT Services like Netflix are in the Glare of Publicity amidst the COVID-19 Crisis," Research DIve Information Sight Impact, 30 July 2020. [Online]. Available: https://www.researchdive.com/blog/heres-why-ott-services-like-netflix-are-in-the-glare-of-publicity-amidst-the-covid-19-crisis. [Accessed 20 August 2020].
16. "How-to Streaming Now: 10 Effective Strategies for Video OTT Businesses to Increase Engagement and Revenue," UseInsider, [Online]. Available: https://useinsider.com/effective-strategies-for-ott-video-streaming-services/. [Accessed 20 August 2020].
17. F. Plapp, " The COVID-19 Pandemic:," The Pathologist, 07 06 2020. [Online]. Available: https://thepathologist.com/subspecialties/the-covid-19-pandemic-a-summary. [Accessed 20 August 2020].
18. D. Greenbaum, "COVID-19 pandemics: ethical, legal and social issues," Research Topic, [Online]. Available: https://www.frontiersin.org/research-topics/15658/covid-19-pandemics-ethical-legal-and-social-issues#overview. [Accessed 20 August 2020].
19. P. Chanthalangsy, "Integrating ethical considerations in COVID-19 response critical," UNESCO, 21 05 2020. [Online]. Available: https://en.unesco.org/news/integrating-ethical-considerations-covid-19-response-critical. [Accessed 20 August 2020].