

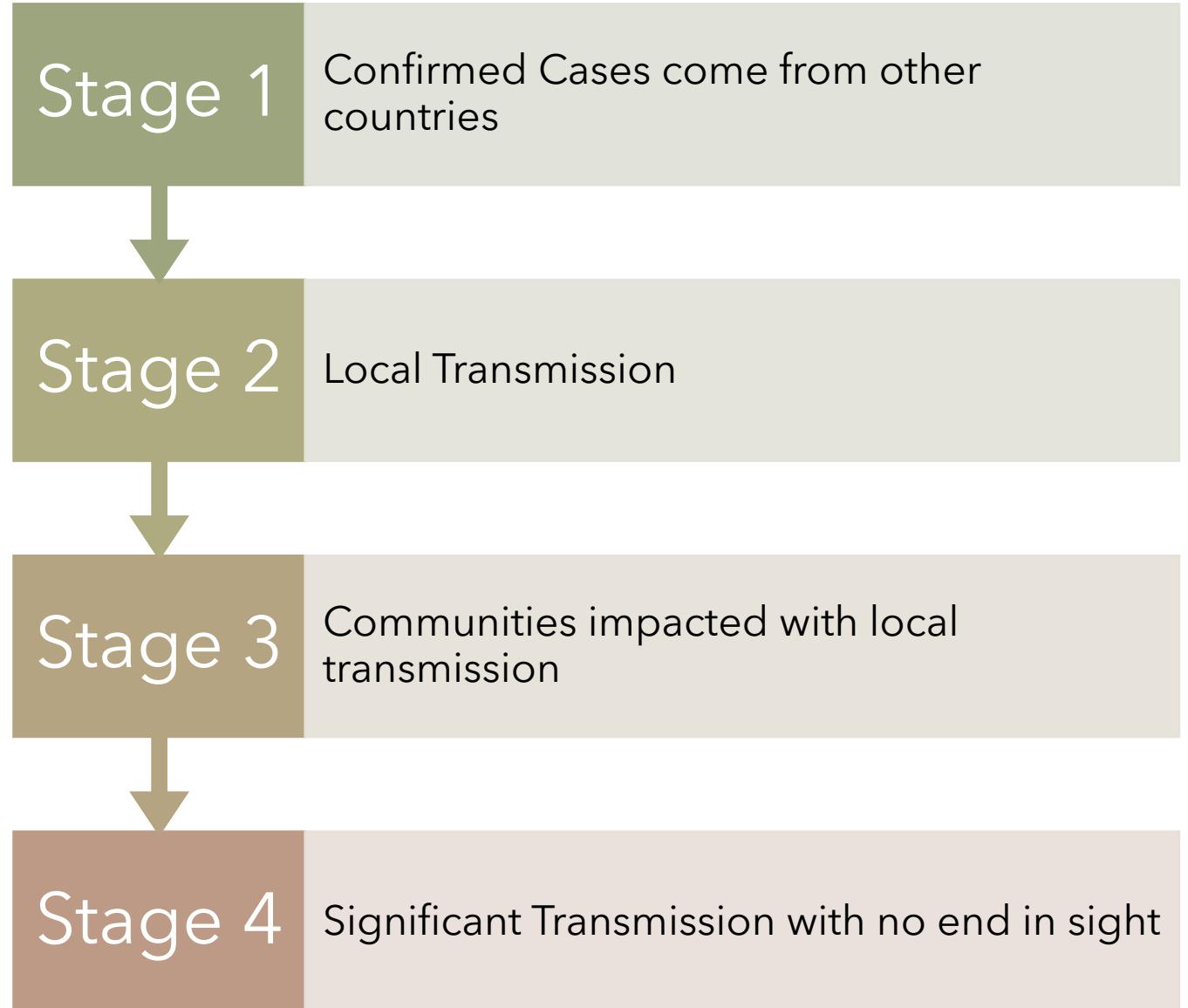


COVID-19: **Data Visualization,** **Growth Factor and** **Predictions**

Introduction

- **COVID-19** is a respiratory illness caused by a novel corona virus.
- Symptoms include fever, coughing, sore throat, and shortness of breath.
- COVID-19 may not be fatal, but it spreads faster than other diseases, like a common cold
- Basic Reproduction number (R_0) of COVID-19 is 2.7

Four Stages of pandemic



Study the Impact and Spread of
the COVID-19 in the Upcoming
Days using Time-Series

Data acquisition and cleaning

Data Provided by **John Hopkins**
University and **NY Times**

Data contains COVID-19
Confirmed, Recovered and Death
Cases

Provide geographical data such as
county and state names including
latitude and longitude information

Data Visualization and Analysis

Quick-glance at the data

Total number of States with Disease Spread: **63***

Total number of Confirmed Cases in the US: **188172**

Total number of Recovered Cases in the US: **7024**

Total number of Deaths Cases around in the US: **3873**

Total number of Active Cases around in the US: **177275**

Total number of Closed Cases around in the US: **10897**

The approximate number of Confirmed Cases per Day in the US: **8961.0**

The approximate number of Recovered Cases per Day in the US: **334.0**

The approximate number of Death Cases per Day in the US: **184.0**

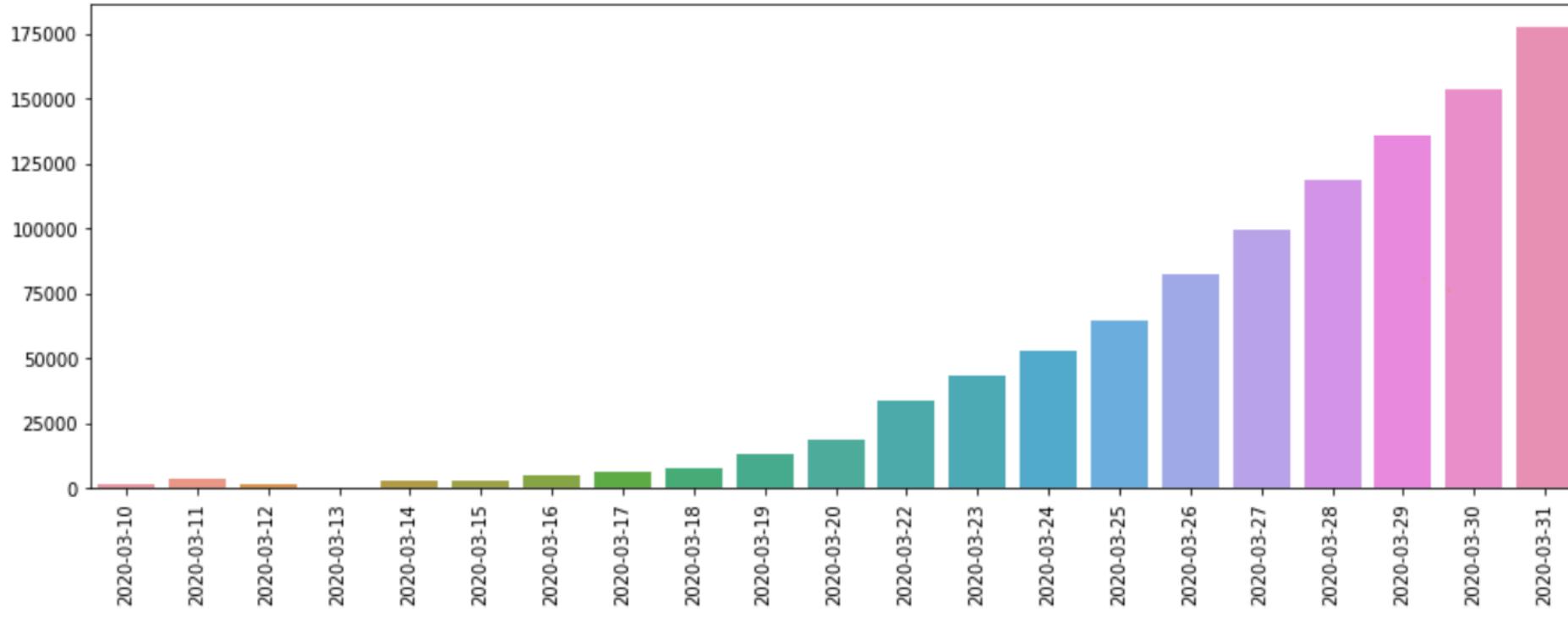
The approximate number of Confirmed Cases per hour in the US: **373.0**

The approximate number of Recovered Cases per hour in the US: **14.0**

The approximate number of Death Cases per hour in the US: **8.0**

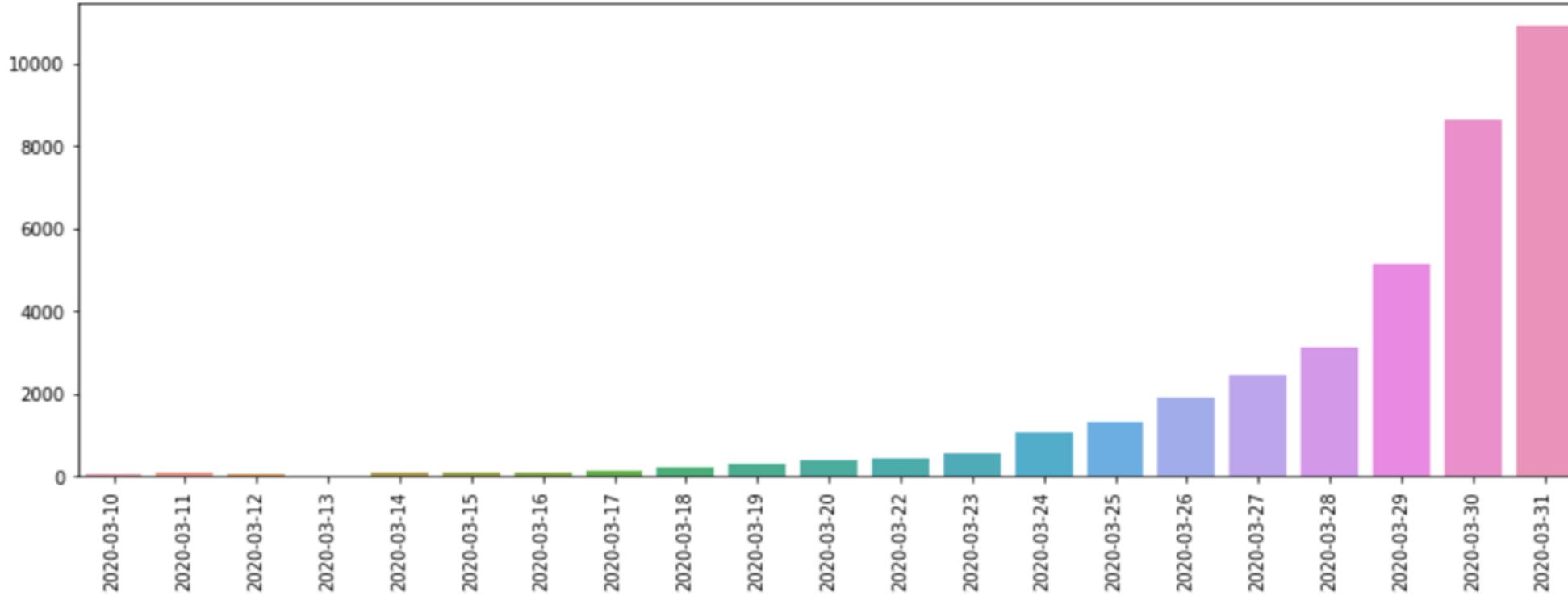
*Include the US territories and cruise ships that arrived at port with COVID-19 cases

Distribution Plot for Confirmed Cases over Date



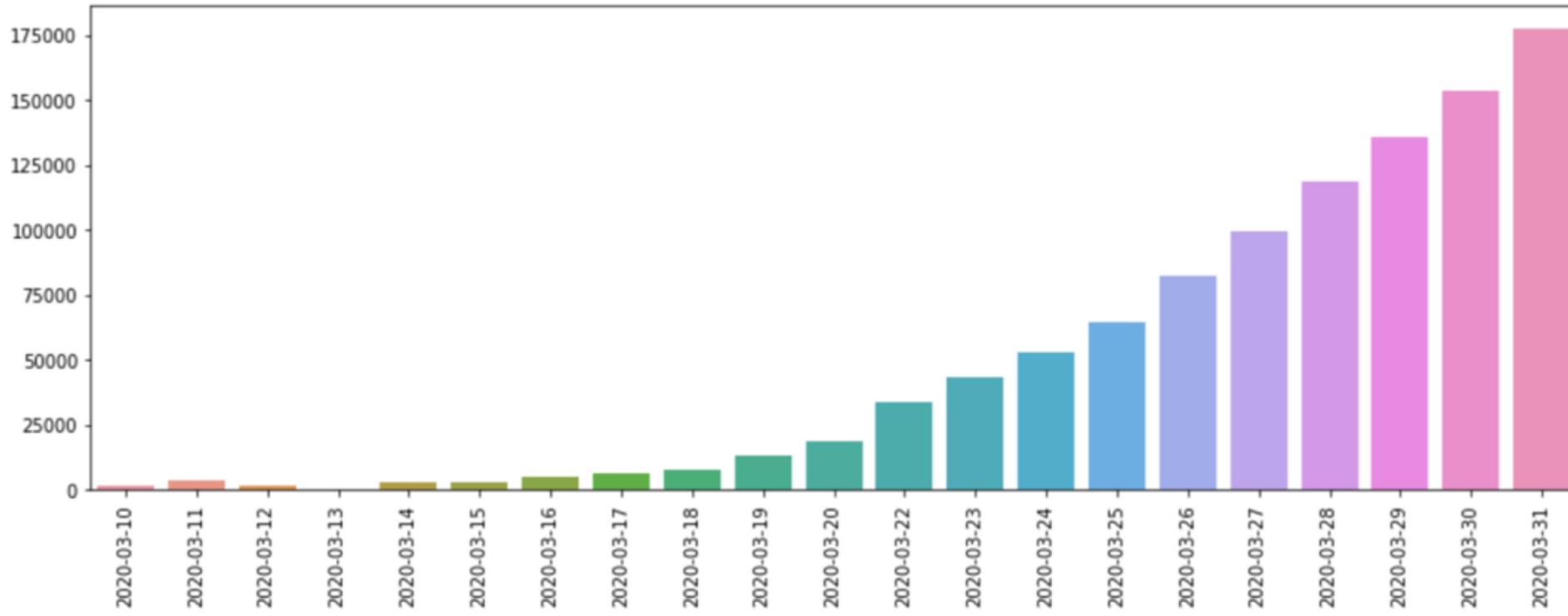
Distribution of Confirmed Cases Over Date

Distribution Plot for Closed Cases Cases over Date



Distribution of Closed Cases Over Date

Distribution Plot for Active Cases Cases over Date



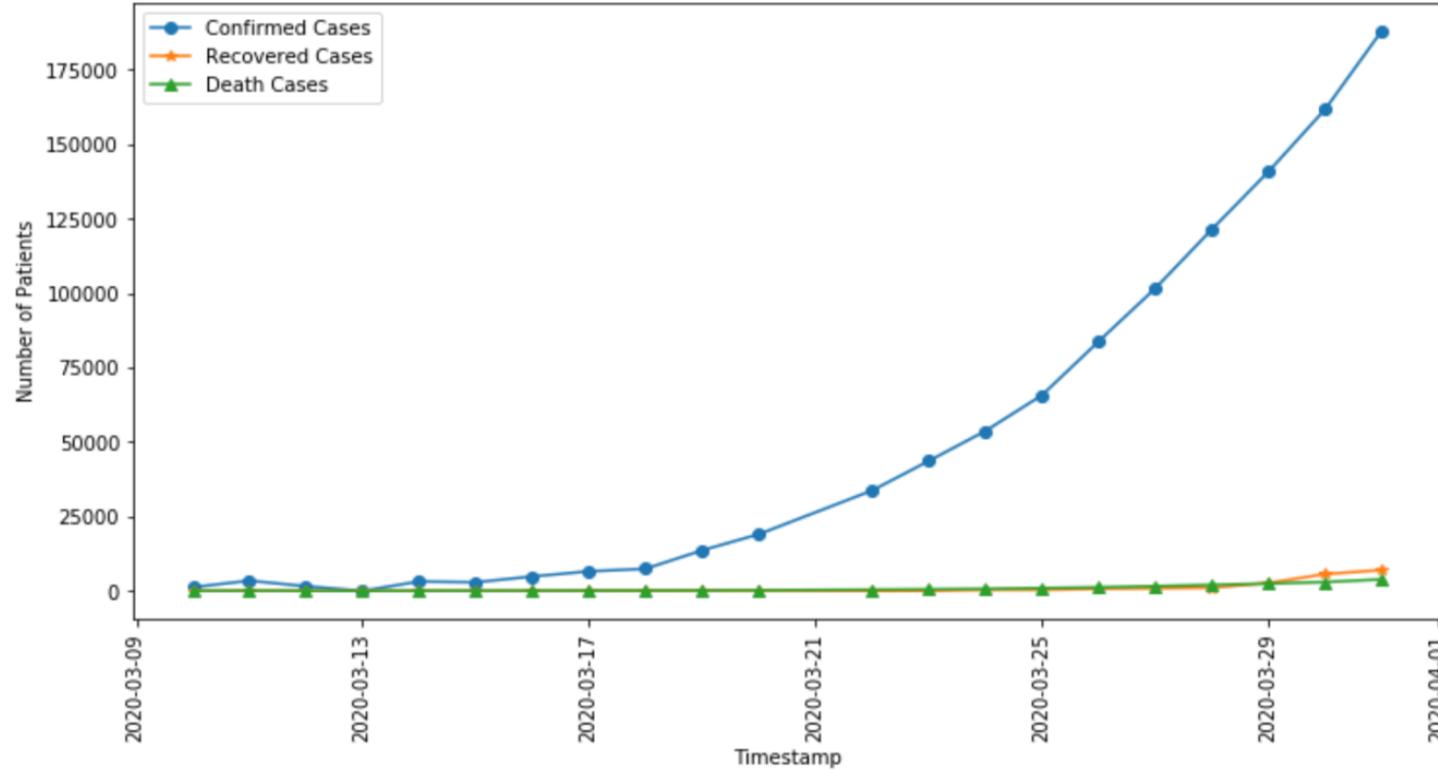
Distribution of Active Cases Over Date

Number of Confirmed Cases



Confirmed Cases Progression

Growth of different Types of Cases over Time



Growth of Different Types of Cases over Time

Mortality and Recovery Rate

- Mortality Rate:

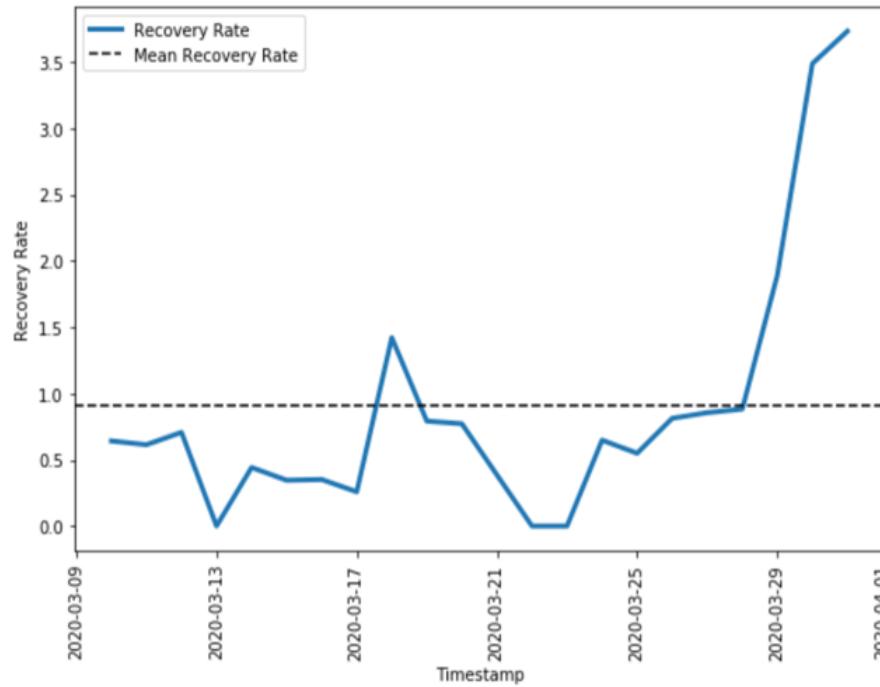
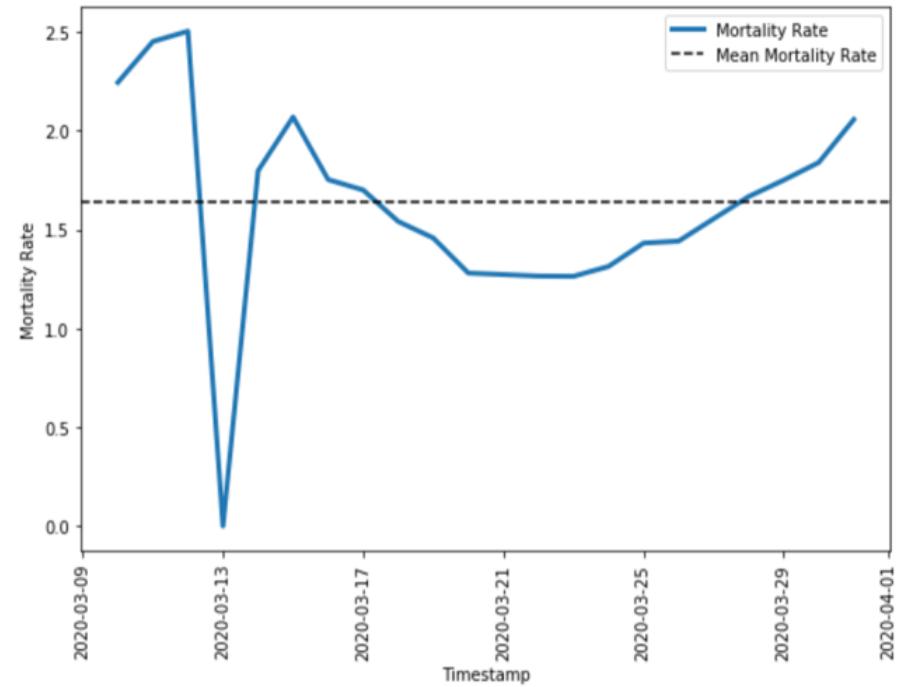
$$\text{Mortality Rate} = \left(\frac{\text{No.of Death Cases}}{\text{No.Of Confirmed Cases}} \right) * 100$$

- Recovery Rate:

$$\text{Recovery Rate} = \left(\frac{\text{No.of Recovered Cases}}{\text{No.Of Confirmed Cases}} \right) * 100$$



Average Mortality Rate 1.6379006535179035
Median Mortality Rate 1.6677916989084445
Average Recovery Rate 0.9142291434073323
Median Recovery Rate 0.64756233717901



Average Mortality and Recovery Rate

Growth Factor

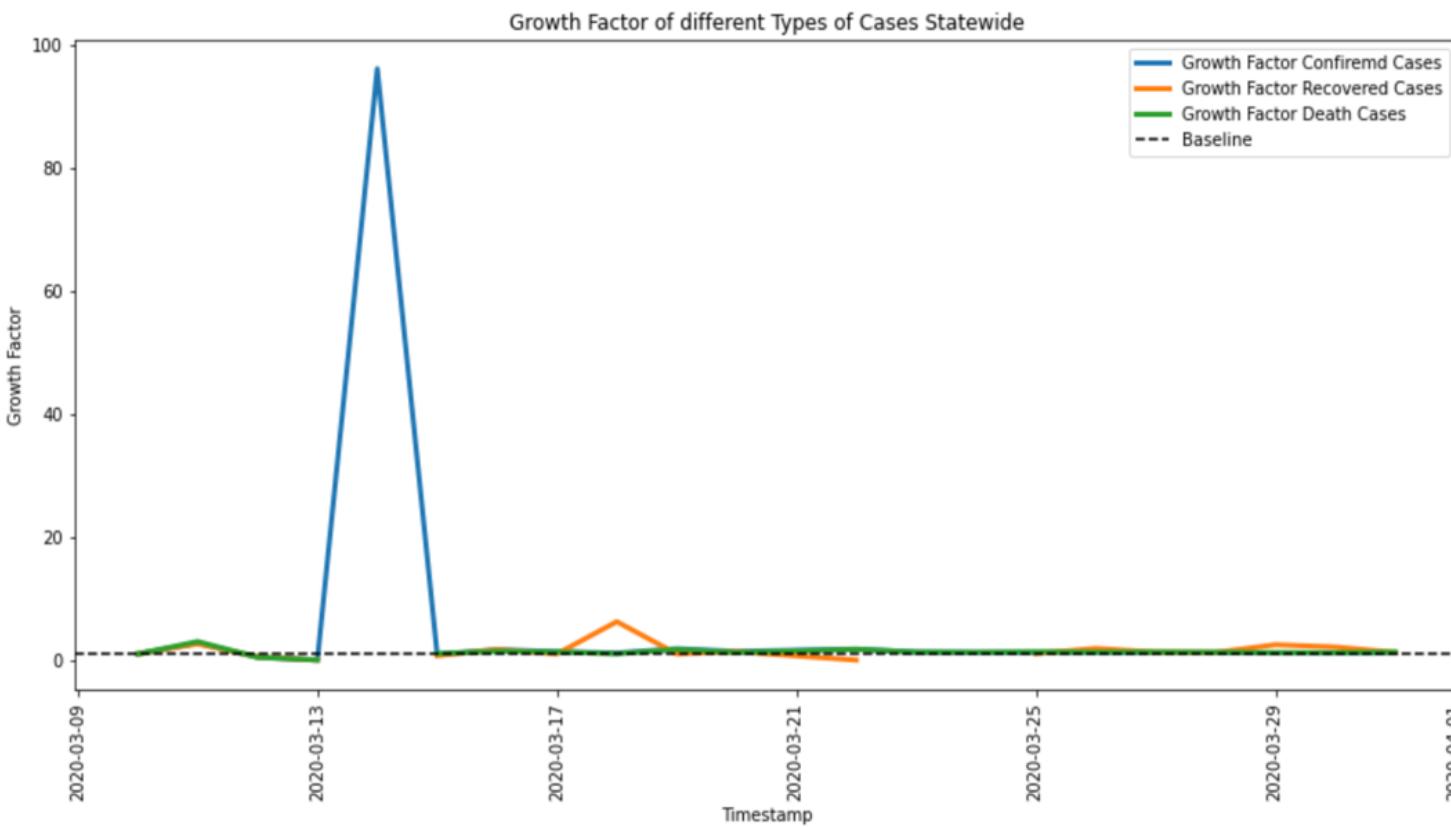
- Grow Factor (GF):

$$\text{Growth Factor} = \frac{\text{Today's Total (Confirmed + Recovered + Deaths)Cases}}{\text{Yesterday's Total (Confirmed + Recovered + Deaths)Cases}}$$

- GF > 1 indicates an increase in the corresponding case.
- GF > 1 but trending downward is a positive sign.
- GF > 1 consistently is the sign of exponential growth.
- GF = 1 indicates there is no change in any kind of cases.



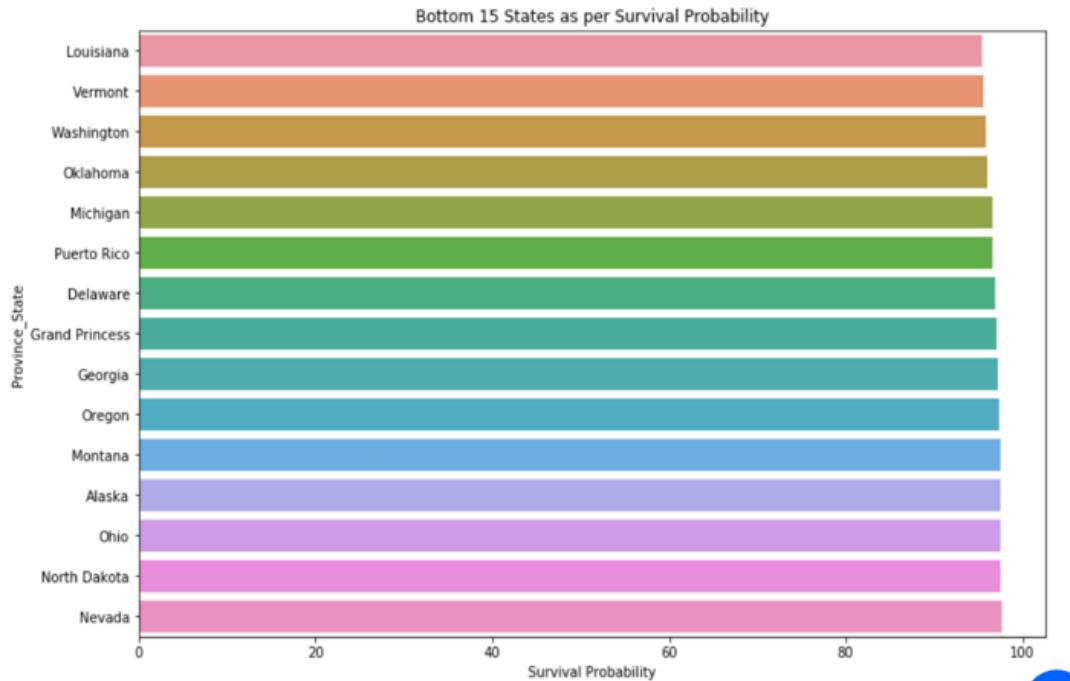
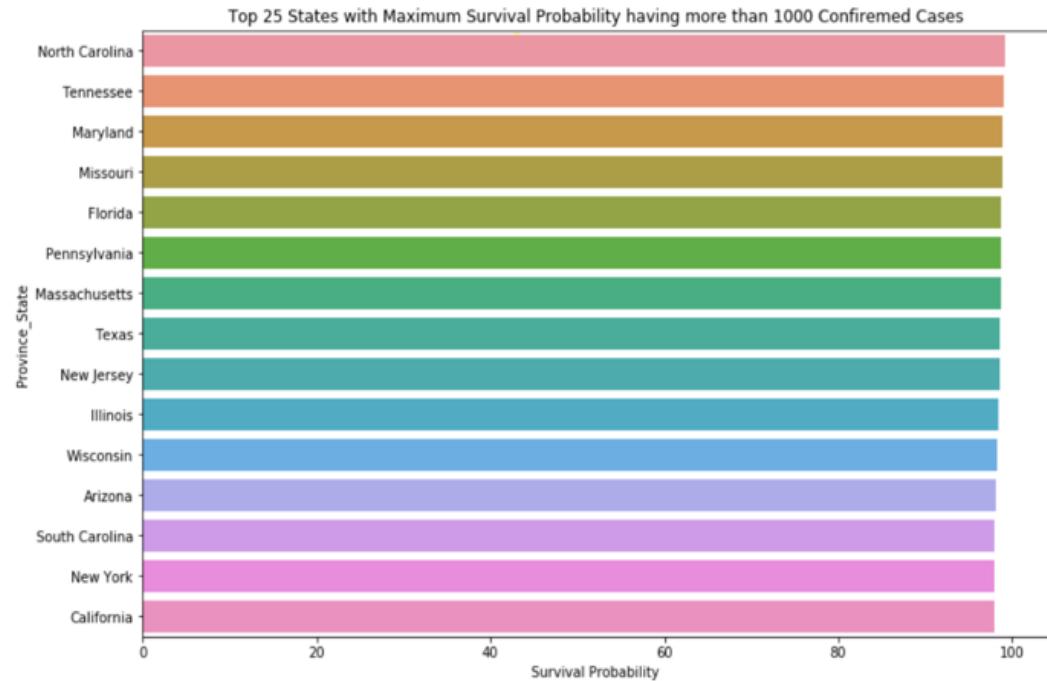
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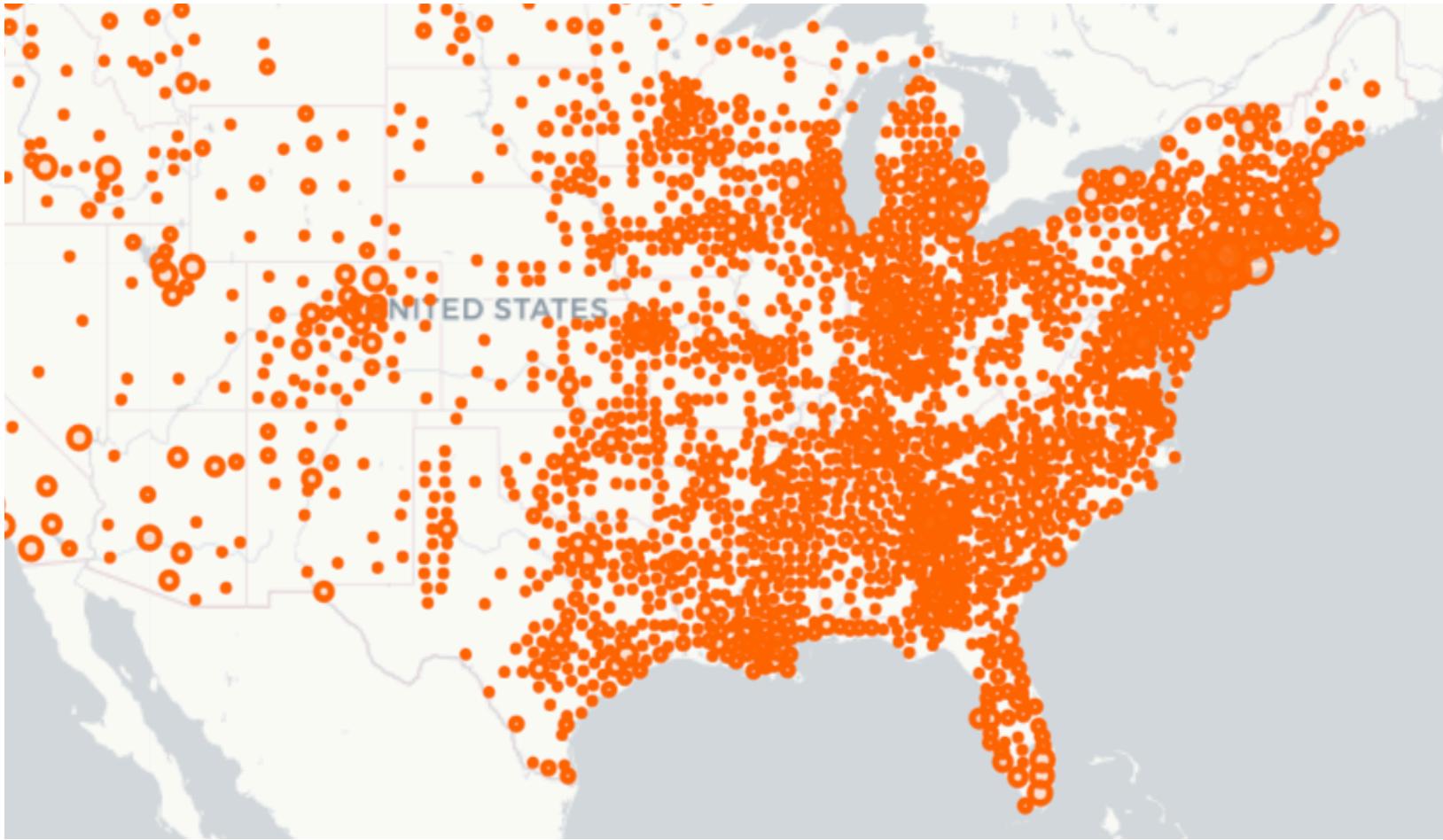
Growth Factor of different Type of Cases Statewide

Mean Survival Probability across all States 98.11397400457422
Median Survival Probability across all States 98.18181818181819
Mean Death Probability across all States 1.8860259954257828
Median Death Probability across all States 1.818181818181813

Text(0.5, 1.0, 'Bottom 15 States as per Survival Probability')

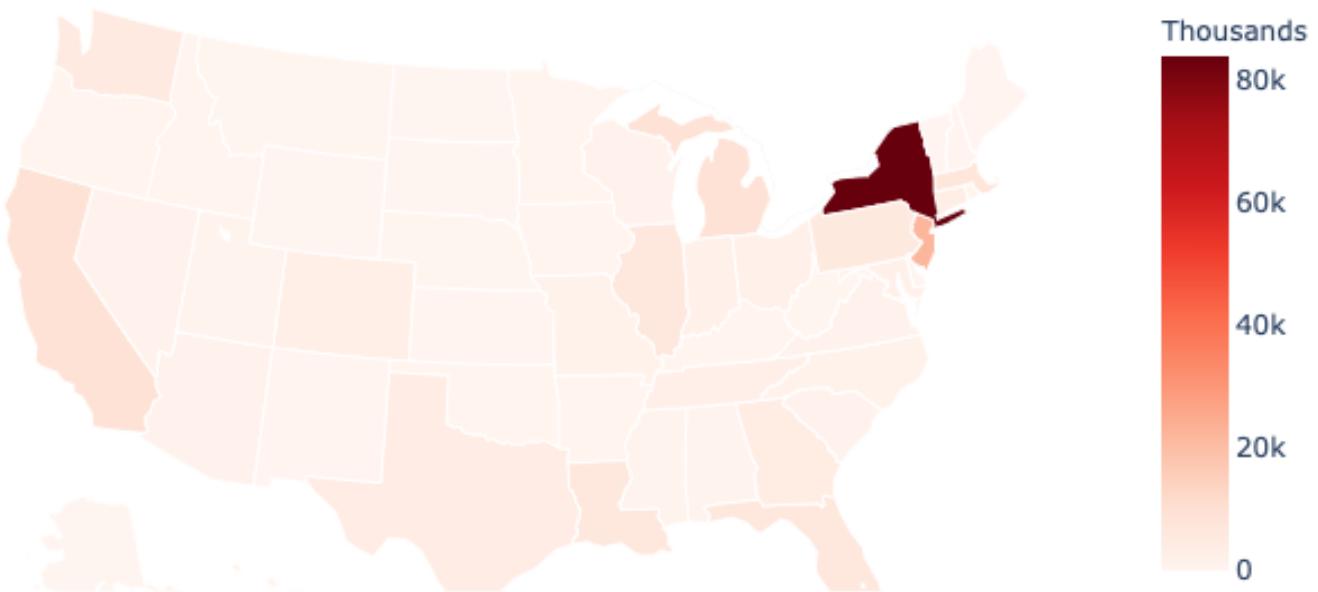


Survival Probability



Counties Map with Disease Case Progression

Total Confirmed Cases by State
(Hover for breakdown)



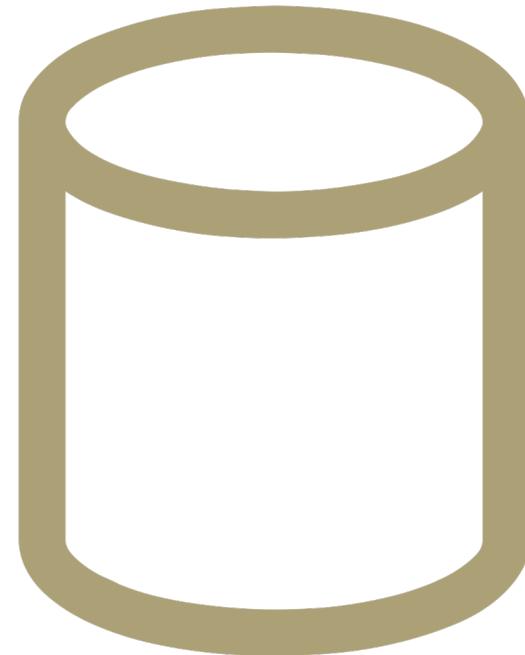
Statewide Confirmed Cases Map

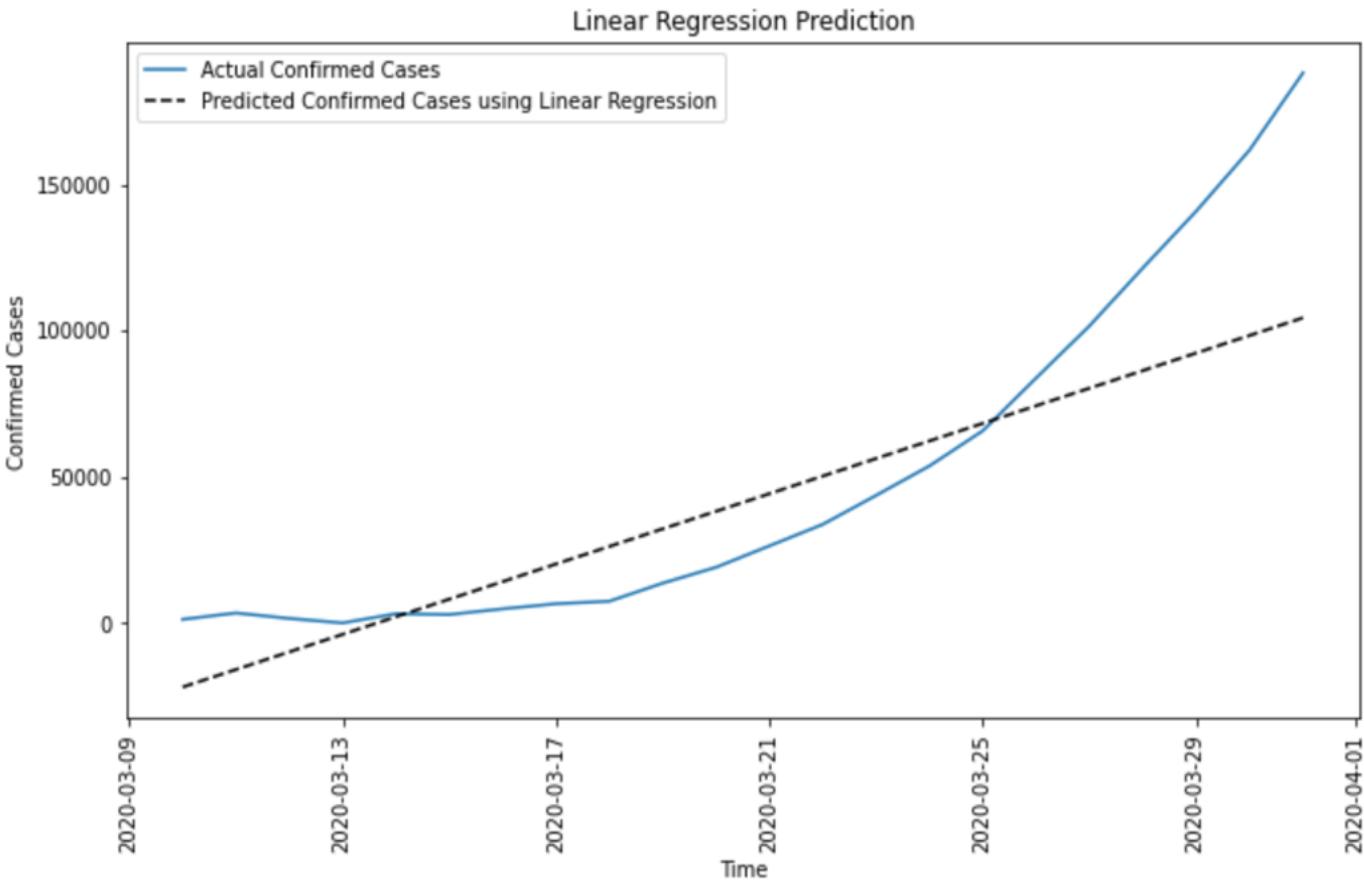


Predictive Modeling

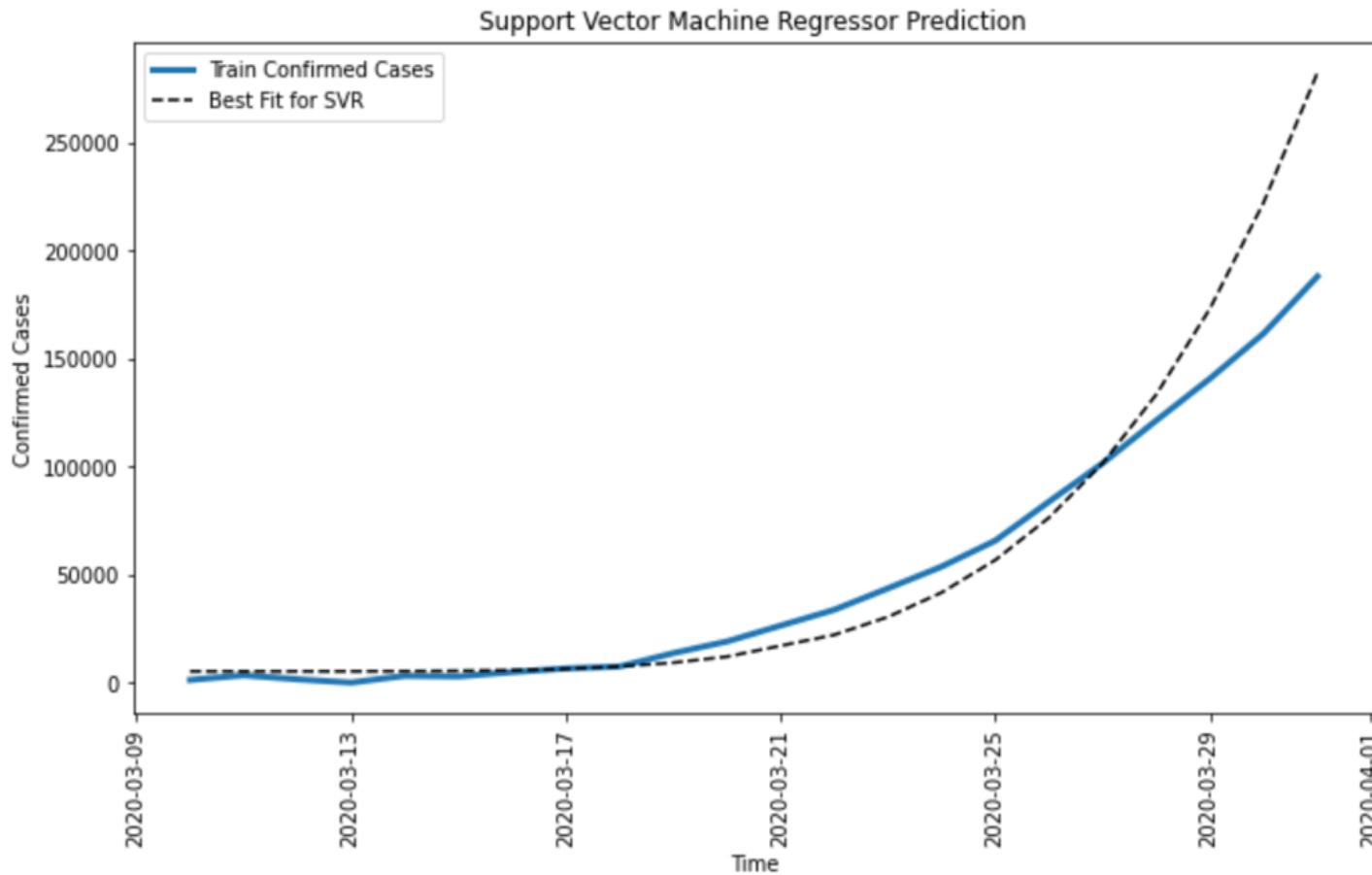
Model Used for Analysis

- Simple Linear Regression
- Holt's Linear Model
- Holt's Winter Model
- Support Vector Machines (SVM)
- Facebook's prophet model

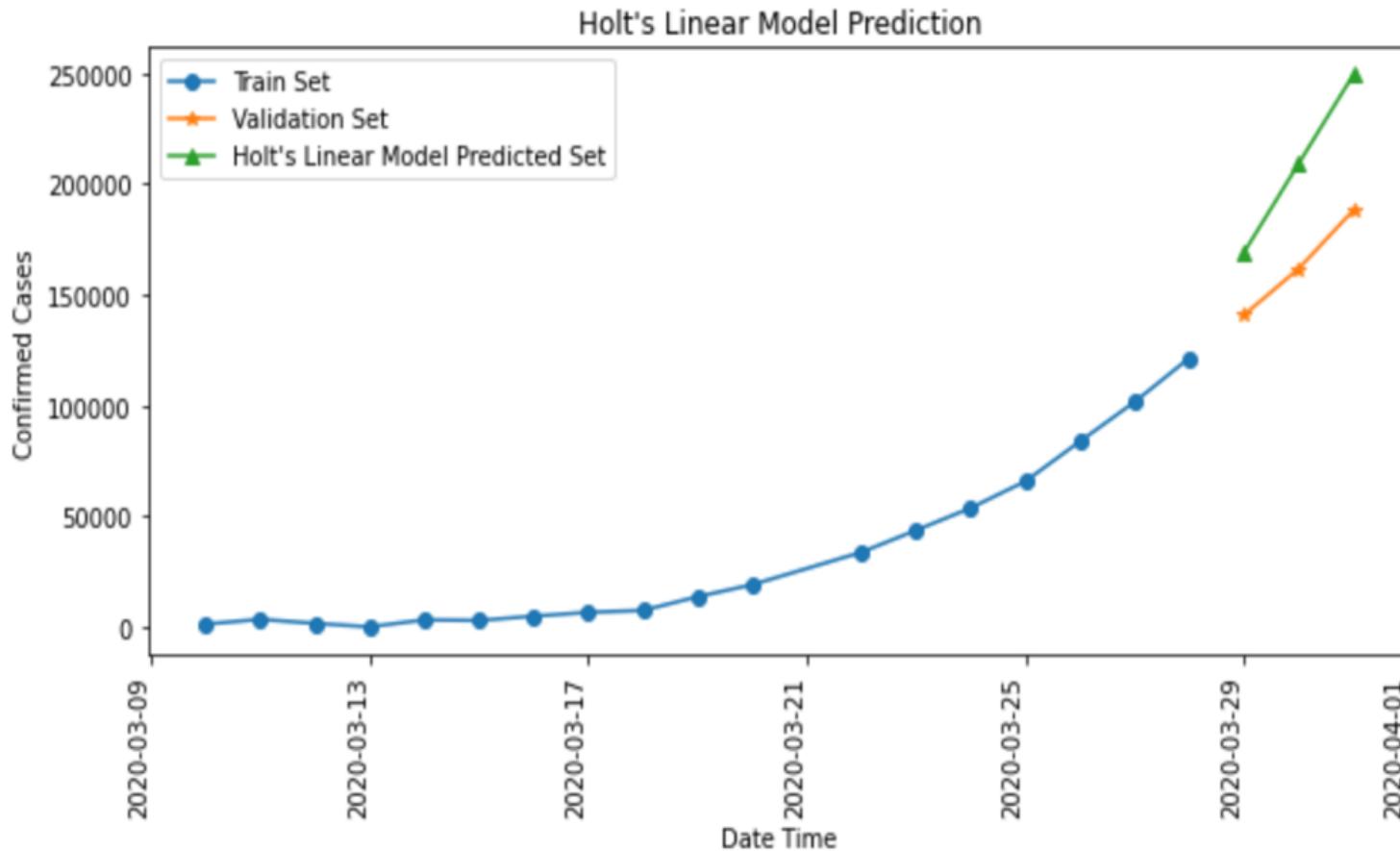




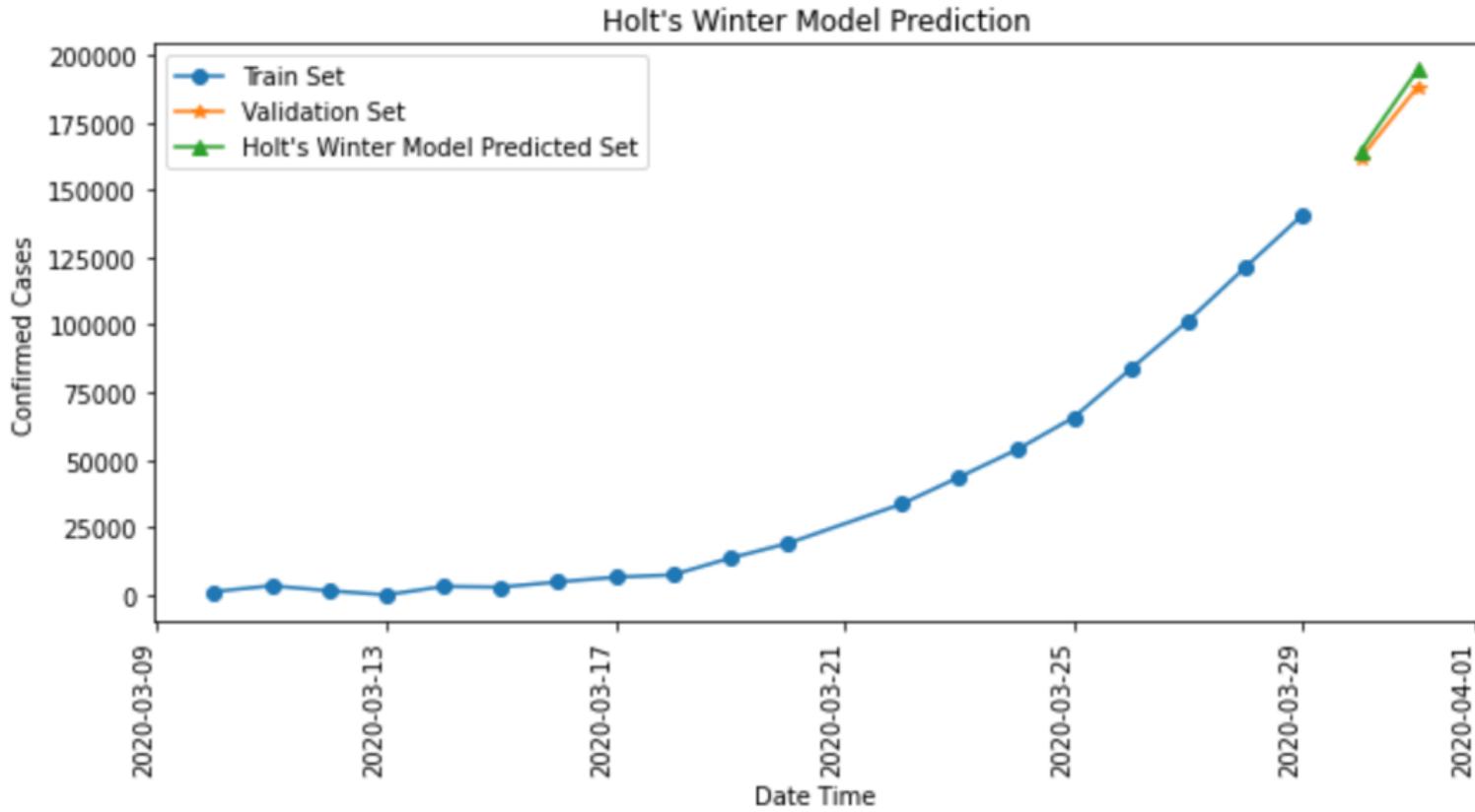
Simple Linear Regression



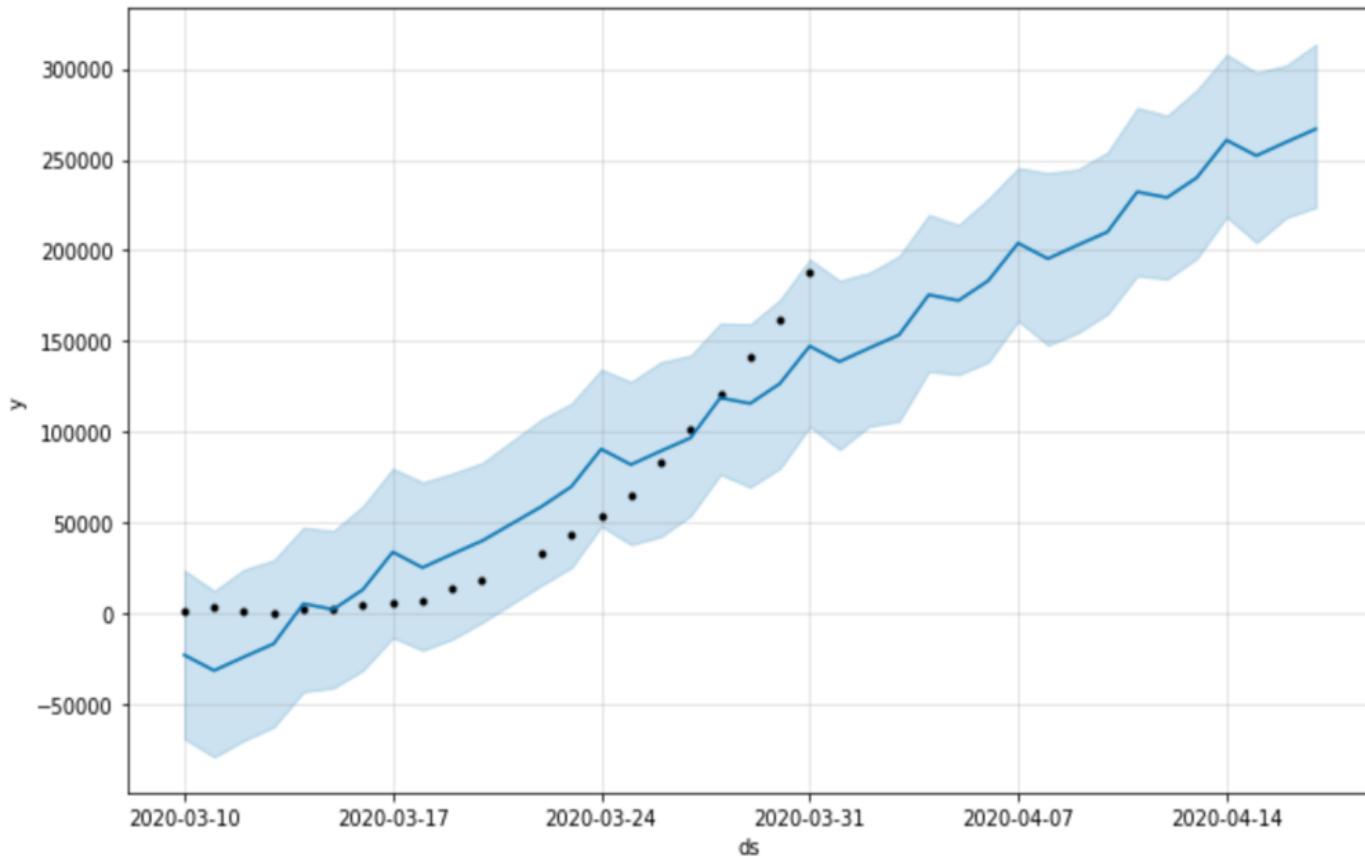
Support Vector Machine



Holt's Linear Model



Holt's Winter Model



Prophet Model

DATE	LINEAR REGRESSION PREDICTION	SVM PREDICTION	HOLT'S LINEAR MODEL PREDICTION	HOLT'S WINTER MODEL PREDICTION	PROPHET'S PREDICTION	PROPHET'S UPPER BOUND
4/1/20	110394.25	355217.01	289484.19	225522.10	138833.65	181474.98
4/2/20	116408.09	442325.70	329586.96	263600.41	146292.53	191622.57
4/3/20	122421.94	545975.18	369689.73	305422.62	153527.18	195521.15
4/4/20	128435.78	668416.67	409792.50	355662.39	175597.33	217944.84
4/5/20	134449.63	812096.97	449895.2	410387.28	172453.10	219121.88

Models Performances

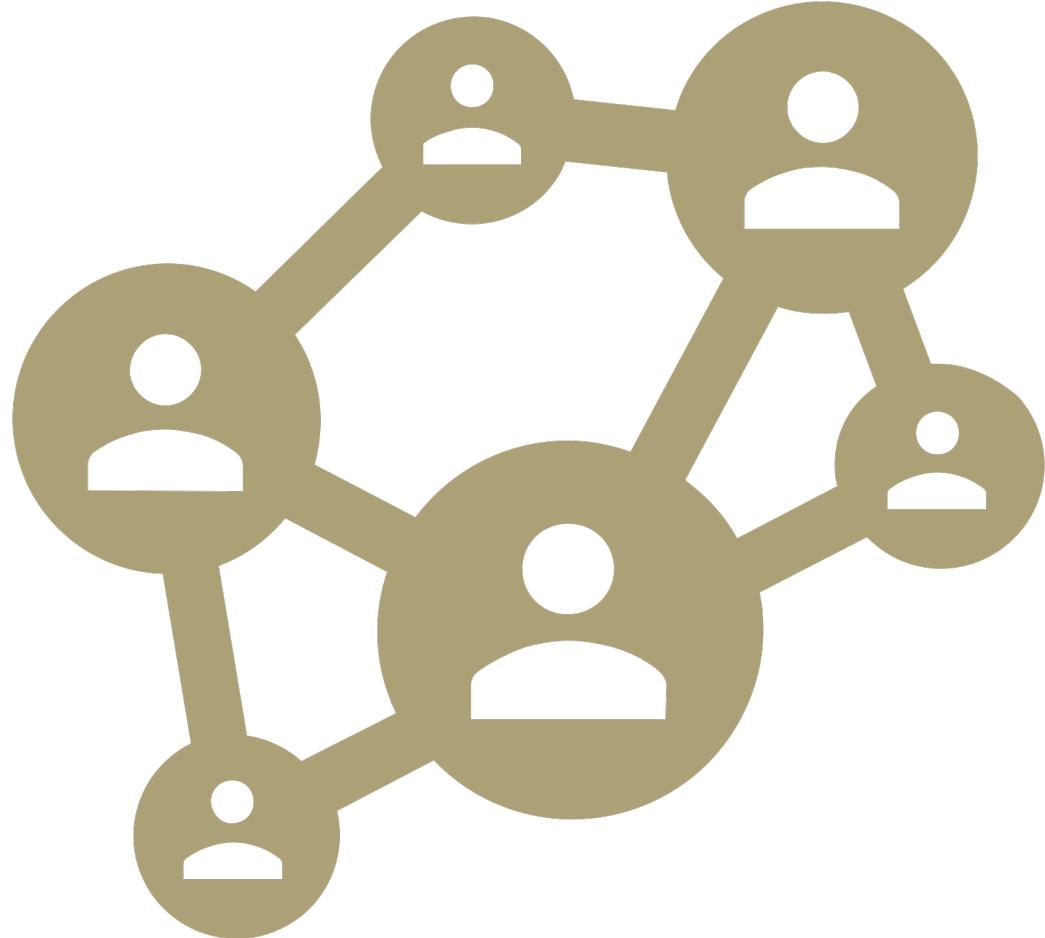
Conclusions

COVID-19 doesn't have a very high mortality rate

Healthily growing Recovery Rate implies the disease is curable

The only matter of concern is the exponential growth rate of infection

Perform pandemic controlling practices like Testing, Contact Tracing, and Quarantine with speed greater than the speed of disease spread at the state and federal level.



**Stay Safe and
follow Social -
Distancing
Practices!**
