COVID-19 Data Analysis

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Motivation

- COVID-19 pandemic is an evolving ongoing worldwide challenge.
- Datasets are updated daily (new variants, etc.)
- Recently, we got abundance of vaccination data, which was not the case before.

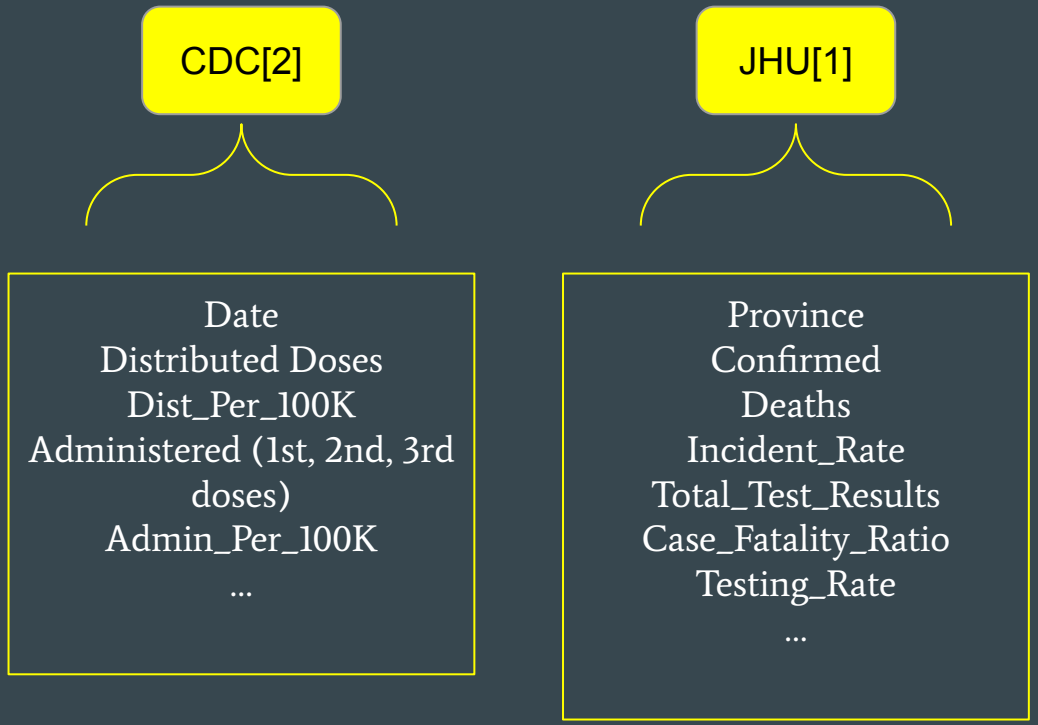
- Reevaluating common beliefs.
- Investigating the impact of vaccination.
- Investigating epidemic aspects of new variants.

Data Overview

Key factors:

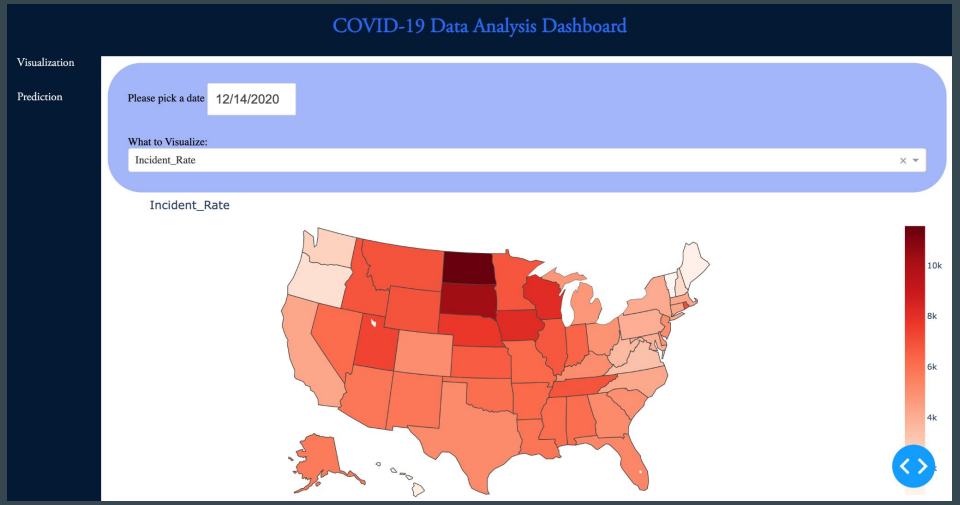
1) Reliability.
2) Update frequency.

We used one set of datasets from “Center for Disease Control and Prevention (CDC)”, and one set of datasets from “Johns Hopkins University (JHU)”

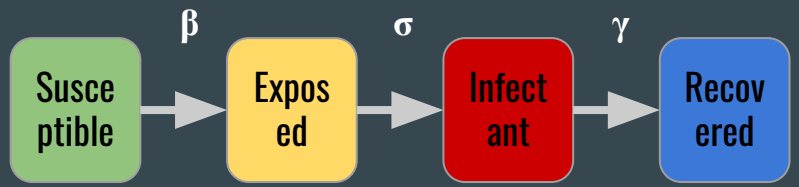


Methodology

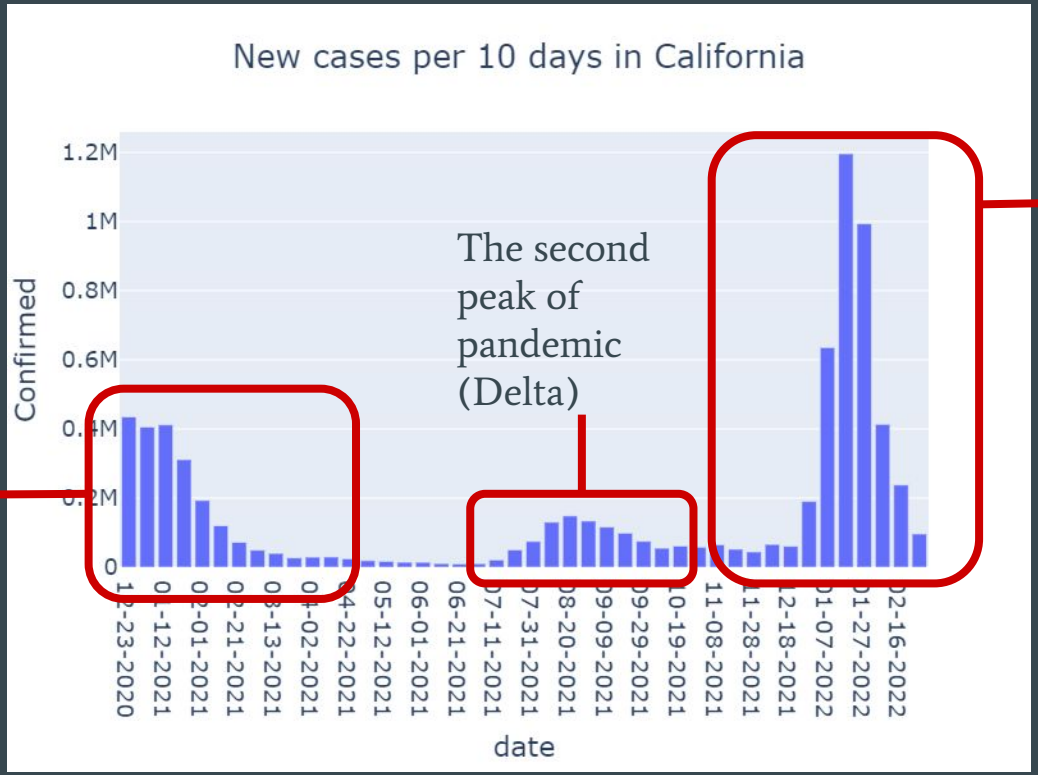
- Web based interactive dashboard for visualization (Demo available in Github repo)



- More sophisticated data analysis
  - Ex: Pandemic mathematical modelling



The General Trend (New Infectant)

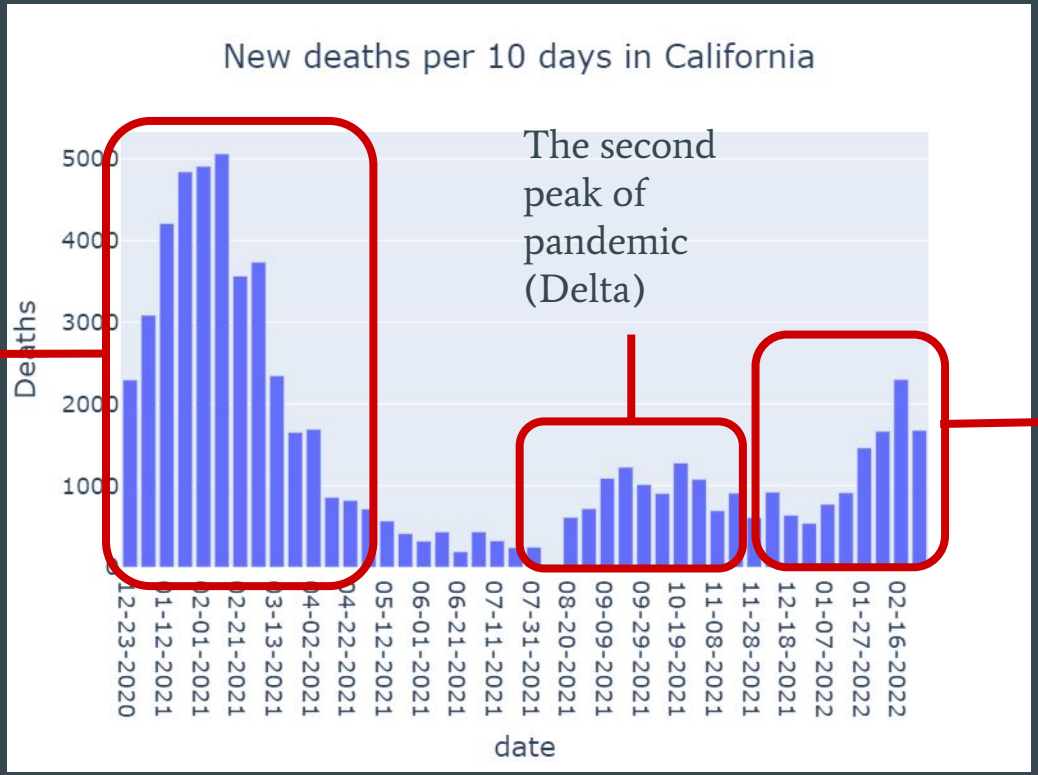


The first peak of pandemic

The Third peak of pandemic (Omicron)

General Trend (New Death)

The first peak of pandemic

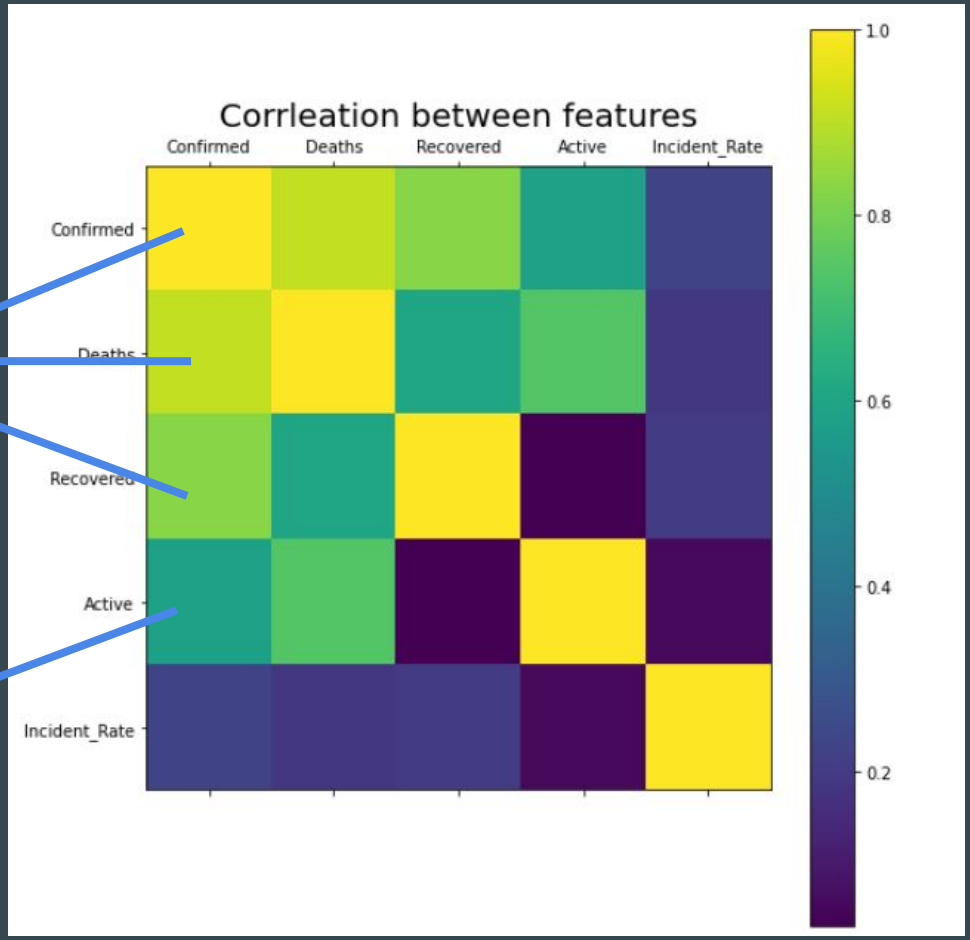


The Third peak of pandemic (Omicron)

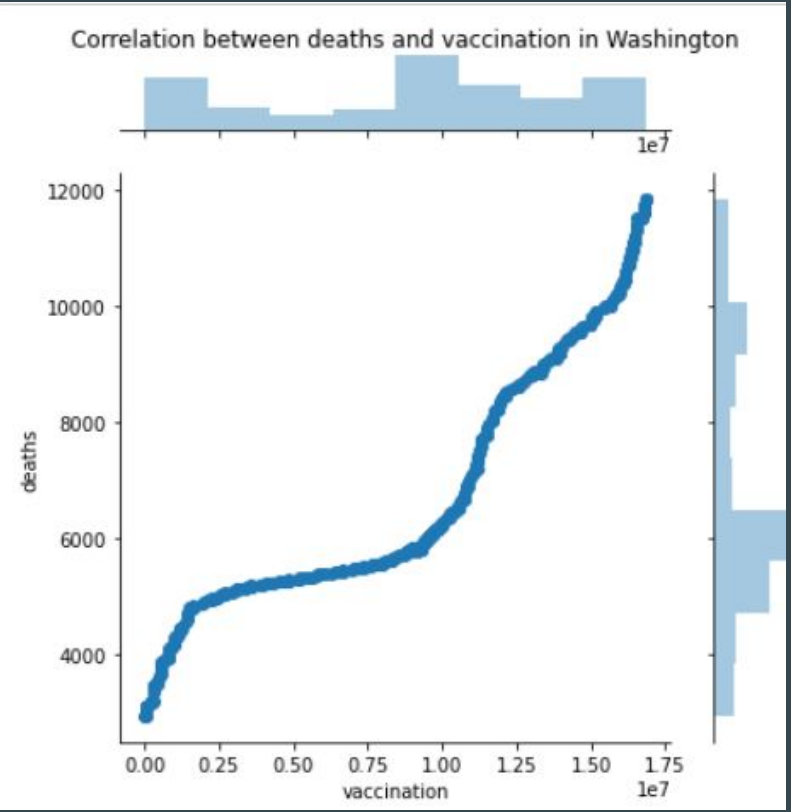
Correlation

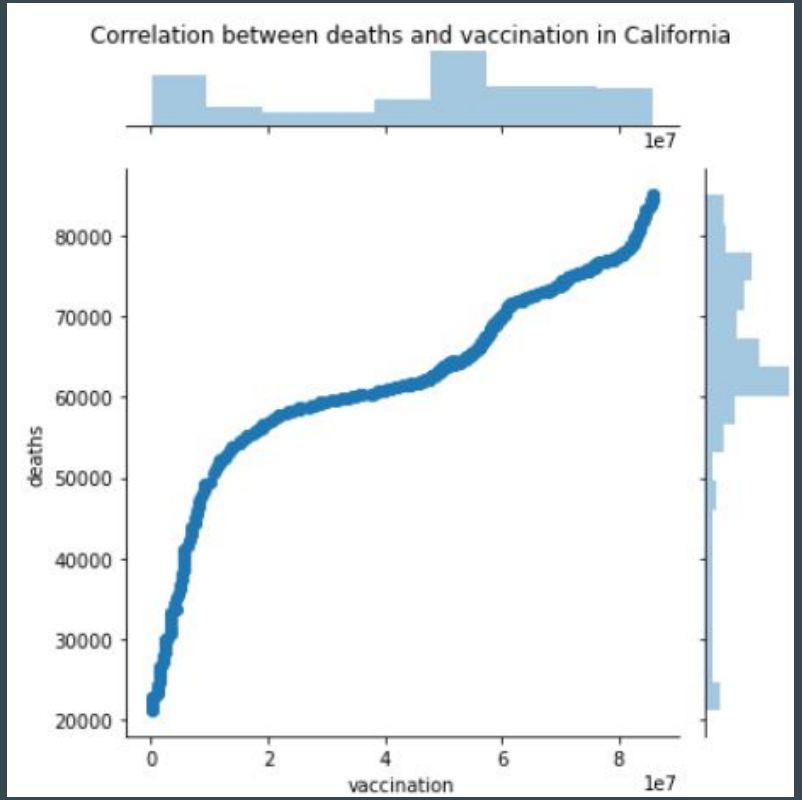
Death and recovered are highly correlated with the Confirmed

Active is computed from the features above, therefore must be redundant

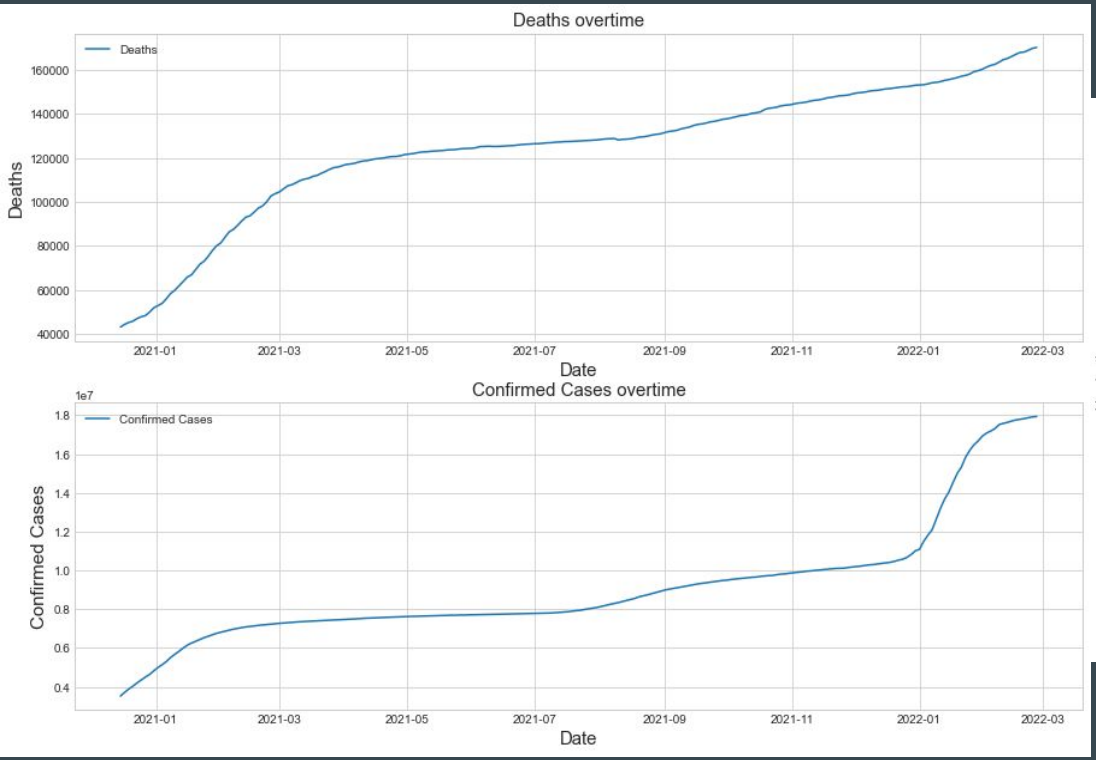


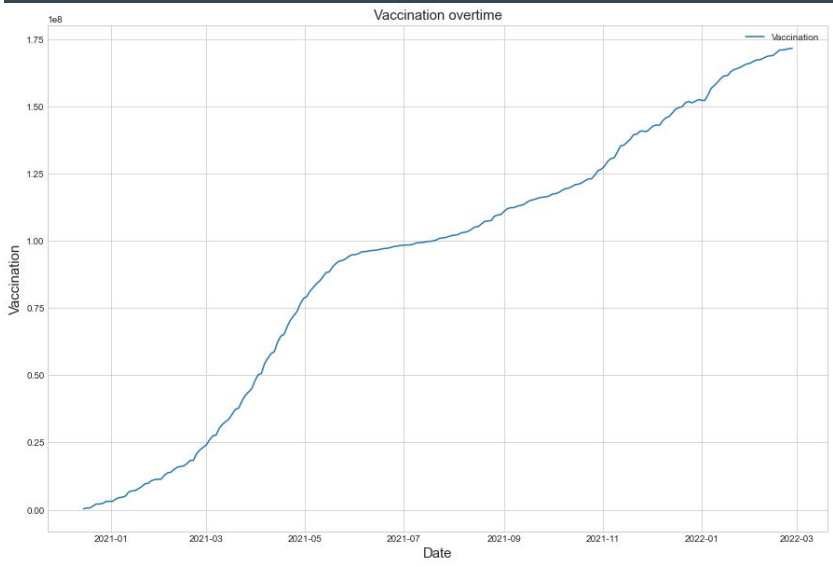
Vaccine vs. General Trend



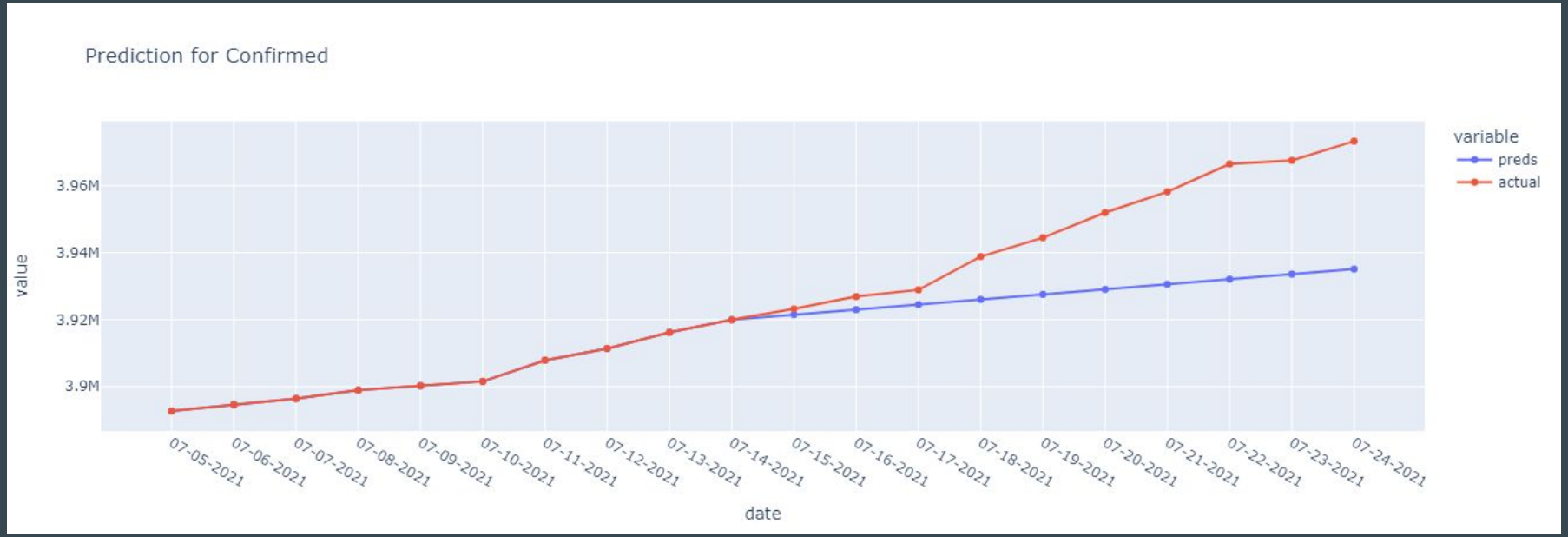


Impact of Vaccine - Death vs Confirmed Cases(CA)



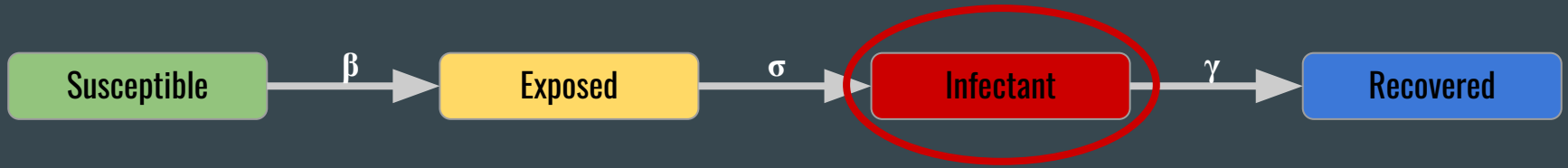


Simpler Prediction(CA)



Estimation of Pandemic Parameters

The four stages a patient goes through:

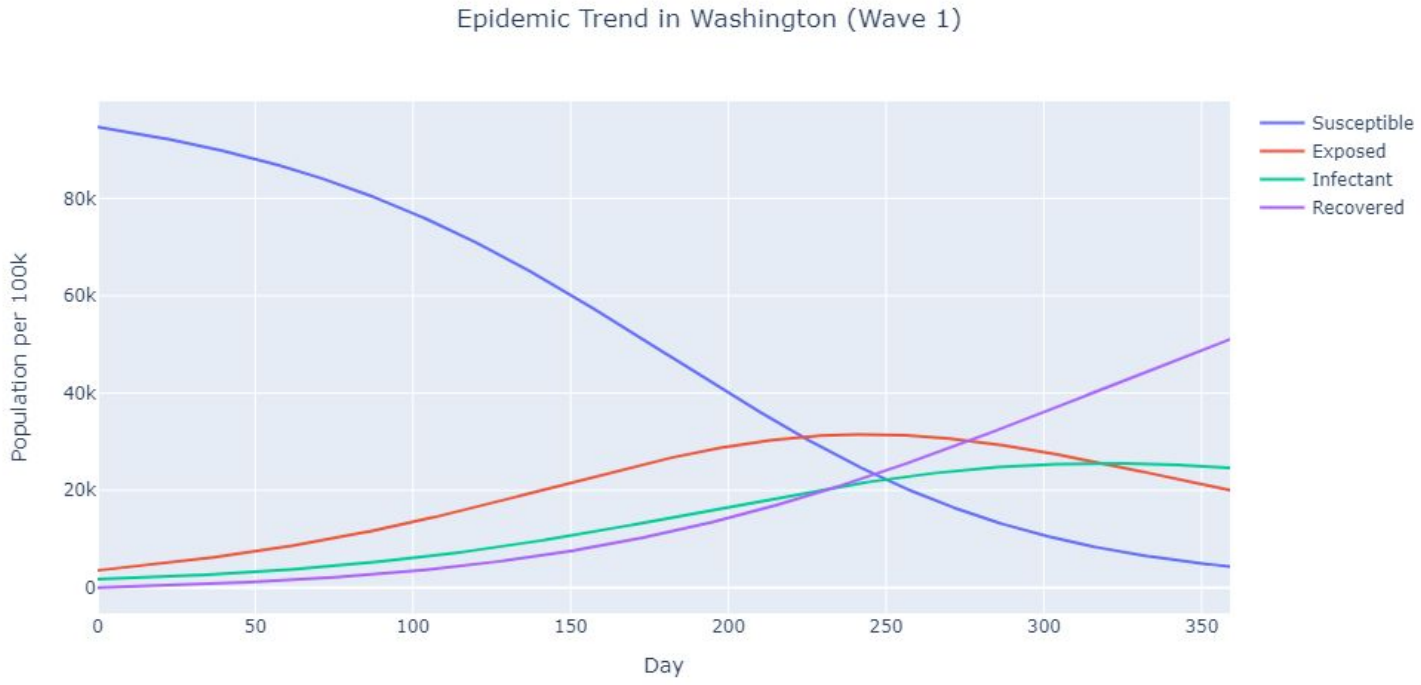


Only this is recorded!

Beta: the possibility of transmission
Sigma: The speed of the symptom reveals
Gamma: The speed of recovery

To estimate these features of pandemic, we minimize the loss function between the real and predicted infectant population.

Epidemic Trend (Wave 1)



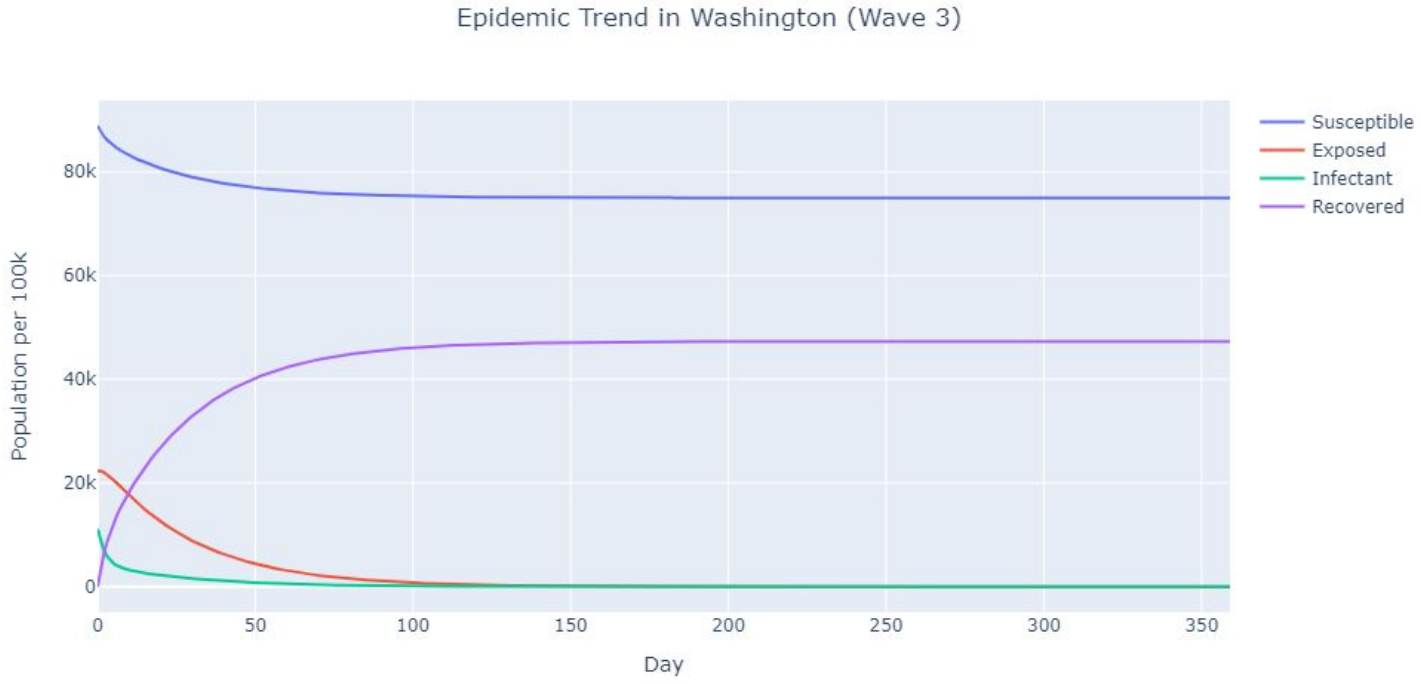
Parameters:

β : 0.06

σ : 0.01

γ : 0.01

Epidemic Trend (Wave 3 Omicron)



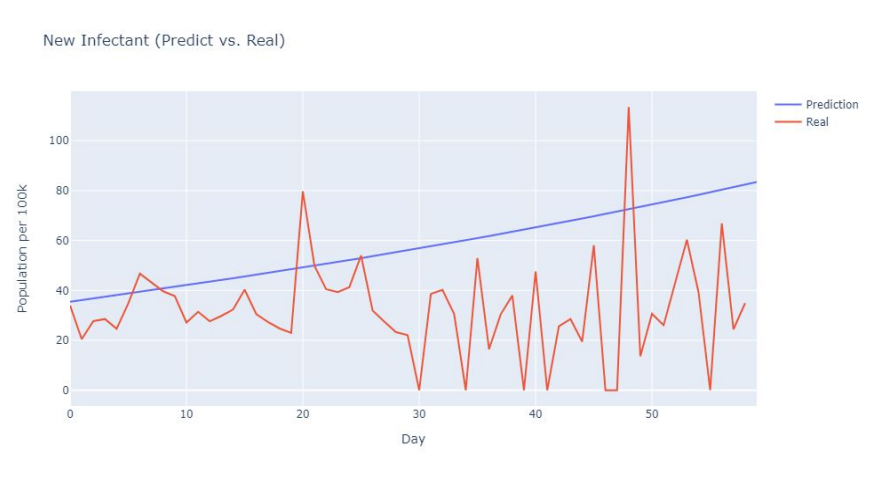
Parameters:

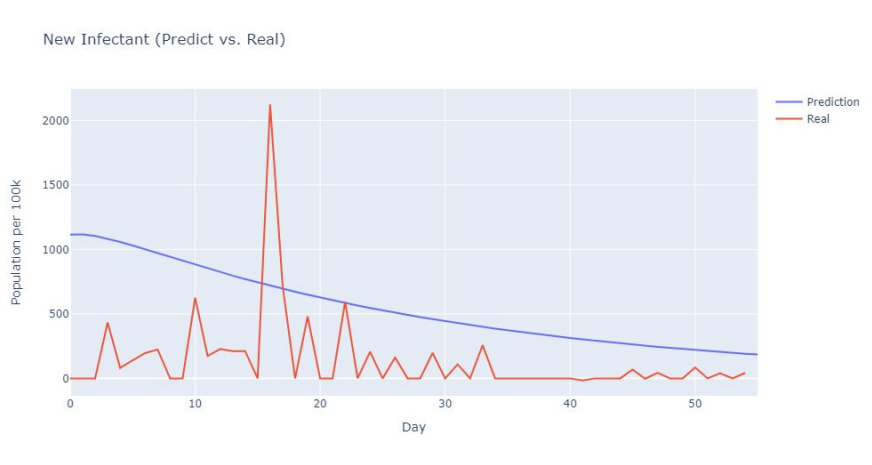
β : 0.14

σ : 0.05

γ : 0.32

Prediction using the SEIR model





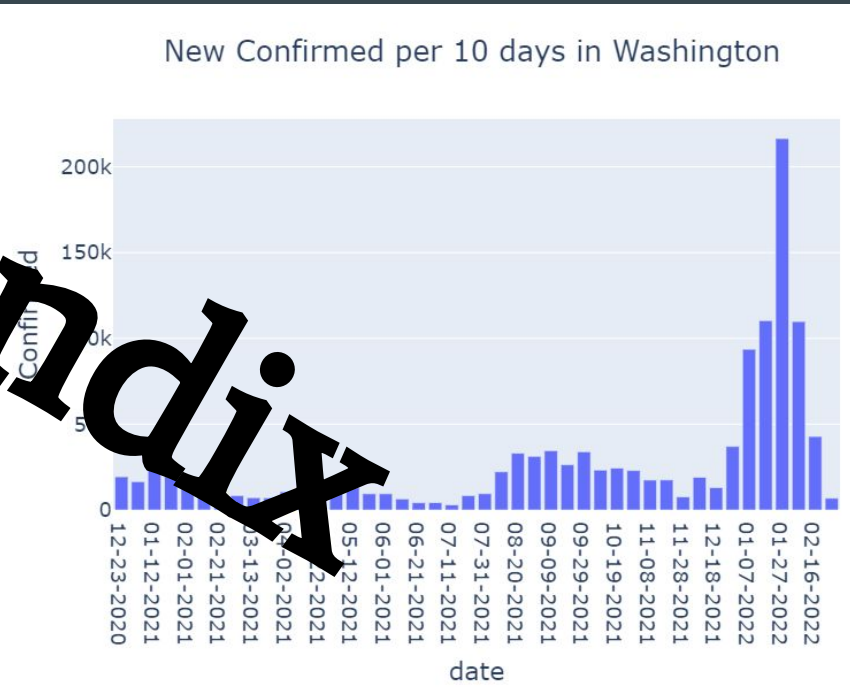
SEIR model is helpful when computing the internal relations.
However, it considers too many features and is very likely to be influenced by other features.
The prediction is not very accurate.

References

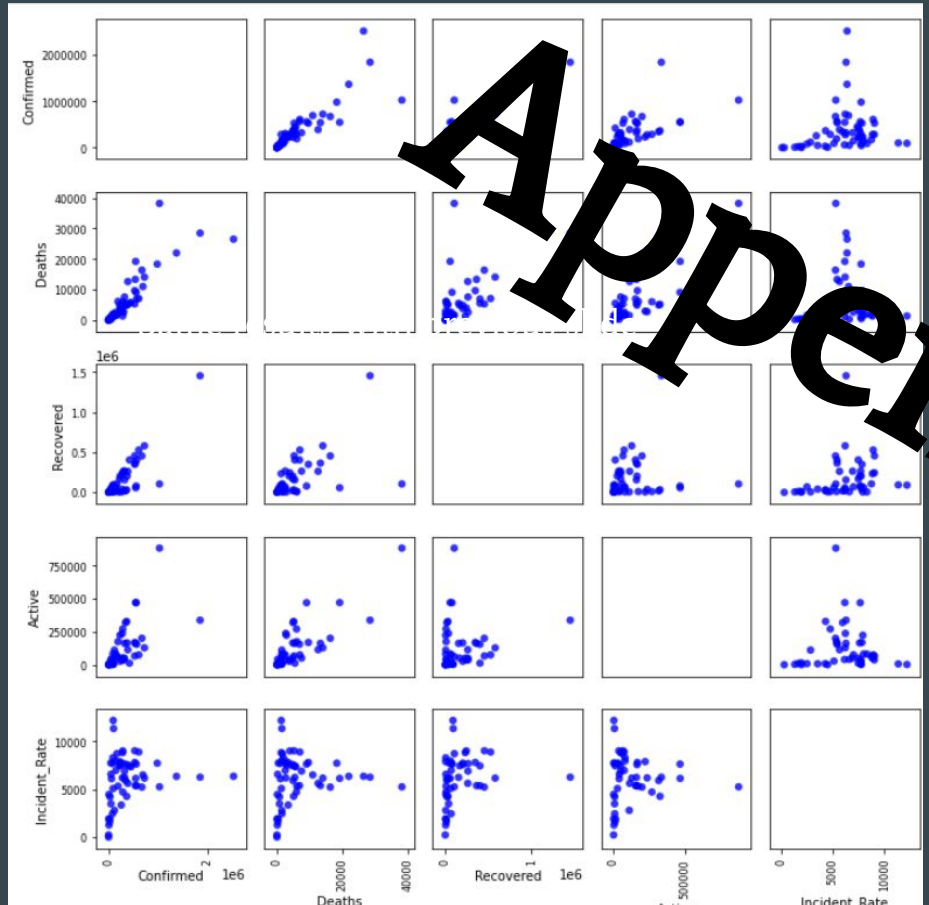
[1] COVID-19 Data Repository by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University

[2] COVID-19 Vaccinations in the United States,Jurisdiction, data.cdc.gov.

Another Case (Washington)



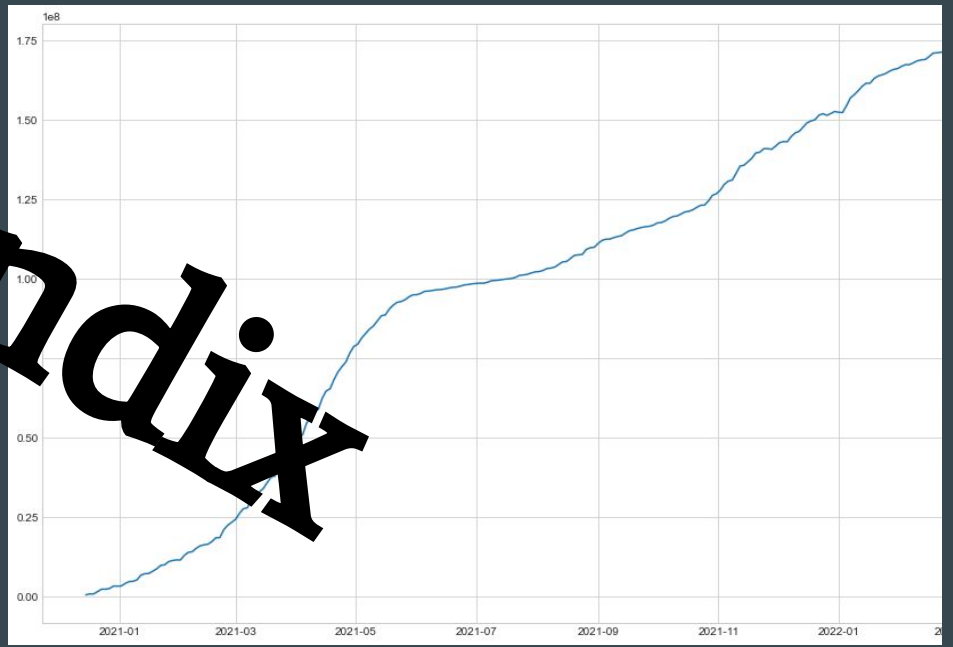
Appendix


Confirmed
Deaths
Recovered
Active
Incident_Rate
1e6
Confirmed
Deaths
Recovered
Incident_Rate

Appendix

Impact of Vaccine - Death vs Vaccine(CA)

Appendix



Comparison of different ages

Appendix