COVID -vs- Magic

Magic 8 Balls

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Who We Are

The Federal Department of Health has put together a team of data scientists to help investigate the COVID-19 outbreaks of 2020 and 2021.

Why We're Here

By comparing both SIR and ARIMA models using national COVID-19 data from the CDC, we want to determine if SIR or ARIMA is a better predictor of new COVID-19 infections.

We will tell you...

01

What is SIR

02

SIR findings

03

ARIMA

04

Tableau

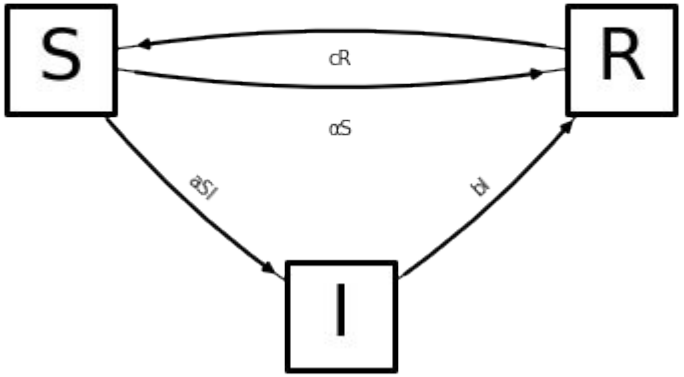
05

Conclusions and Recommendations

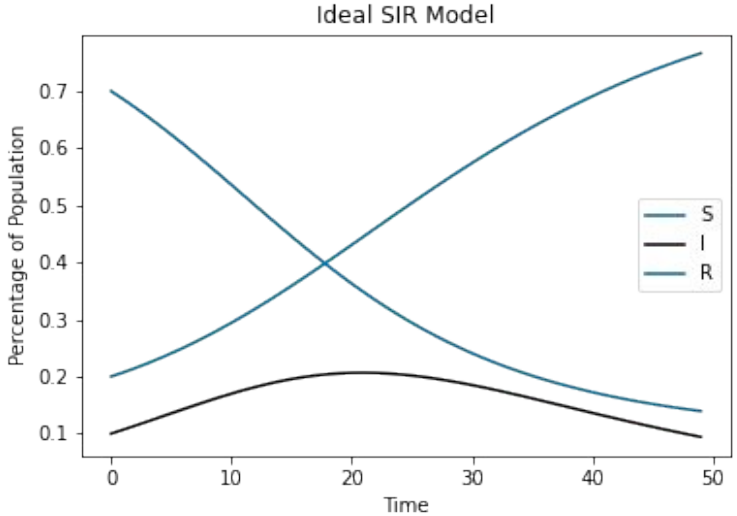
S

I

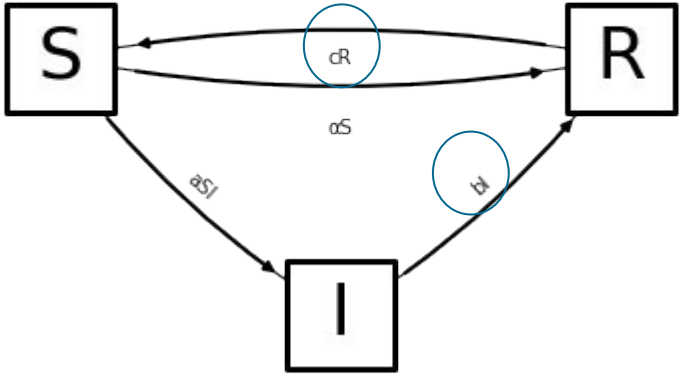
R


S
R
I
αR
αS
αSI
βI

$$P = S + I + R$$


Ideal SIR Model
Percentage of Population
Time
S
I
R
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0
10
20
30
40
50

Easy Parameters in SIR



Recovery Rate, b

Once per 14 days

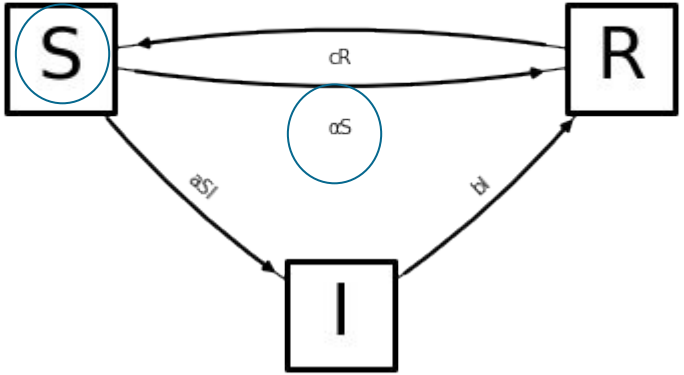
b=1/14

Deimmunization rate c

Once per 100 days

c=1/100

DIFFICULT Parameters in SIR



Initial Susceptible Fraction r

S at start of model

Fraction of p-I that can become I

At start of model time

r > 80%

Transmissibility a

Related to

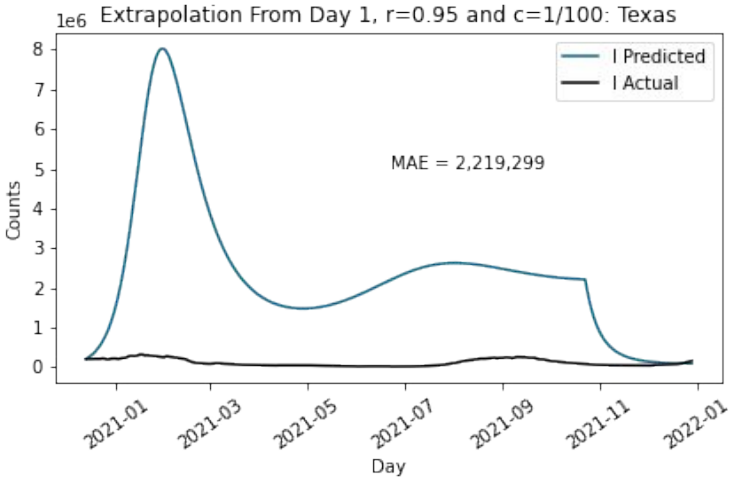
virus reproduction rate r_0 =2.8

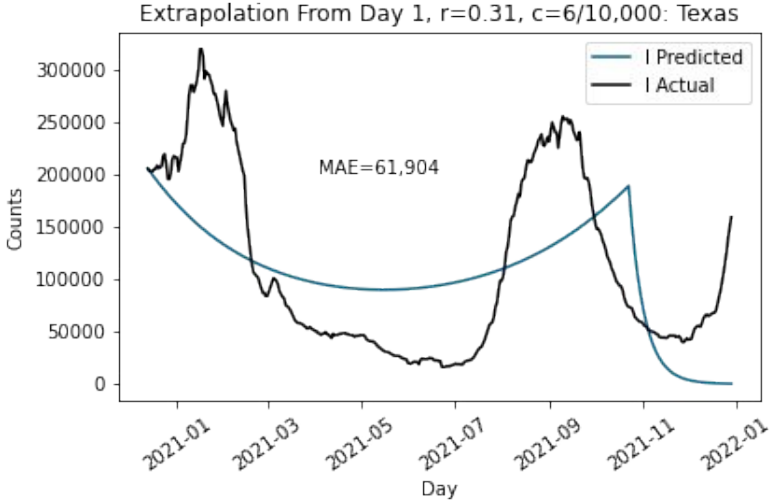
and population p

$a = r_0 b/p$

Long Term SIR: Texas

SIR **massively** overpredicts for reasonable parameters on long time scales



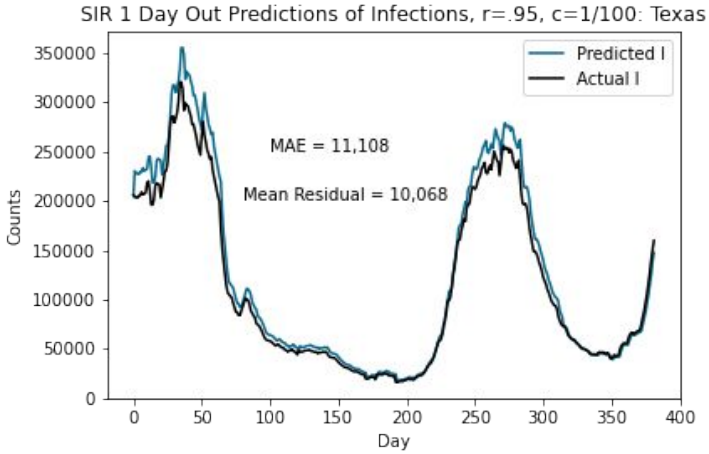


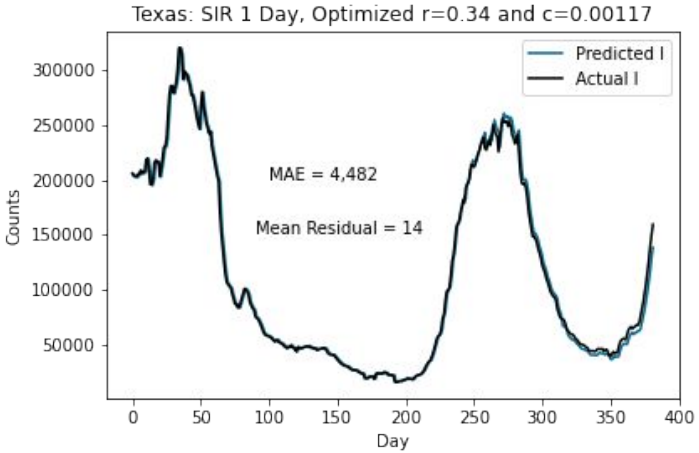
Optimized parameters are **unreasonable** values

Short Term SIR: Texas

SIR **massively** overpredicts for reasonable parameters:

10,000 per day





optimized parameters are **unreasonable** Parameters

Reasons SIR Overpredicts

Behaviors

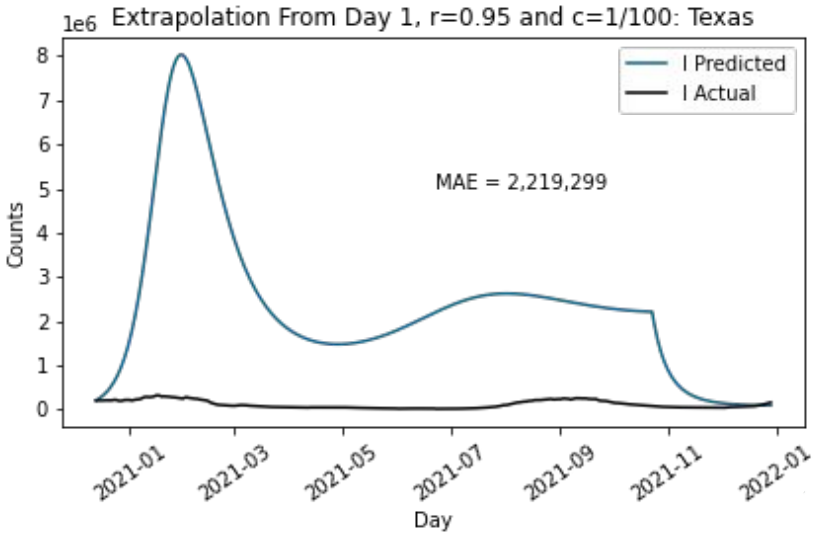
COVID Precautions

Population Density

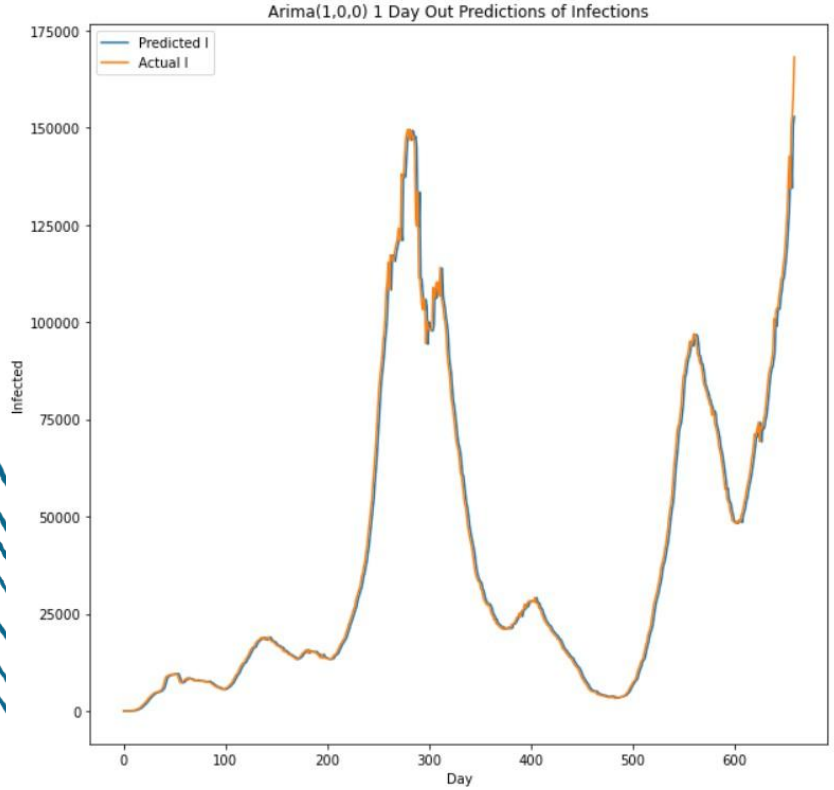
Montana vs New York

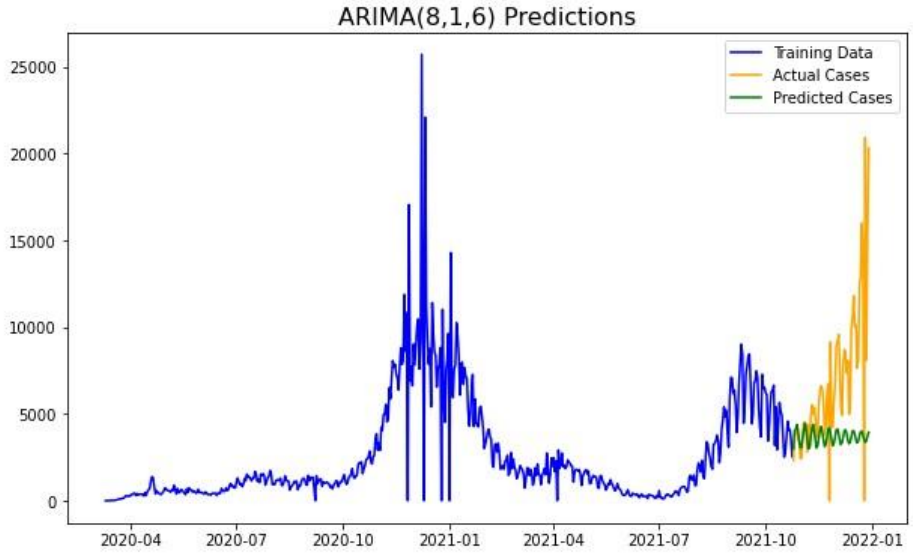
Variants

Changes in rate of transmissibility (R0)

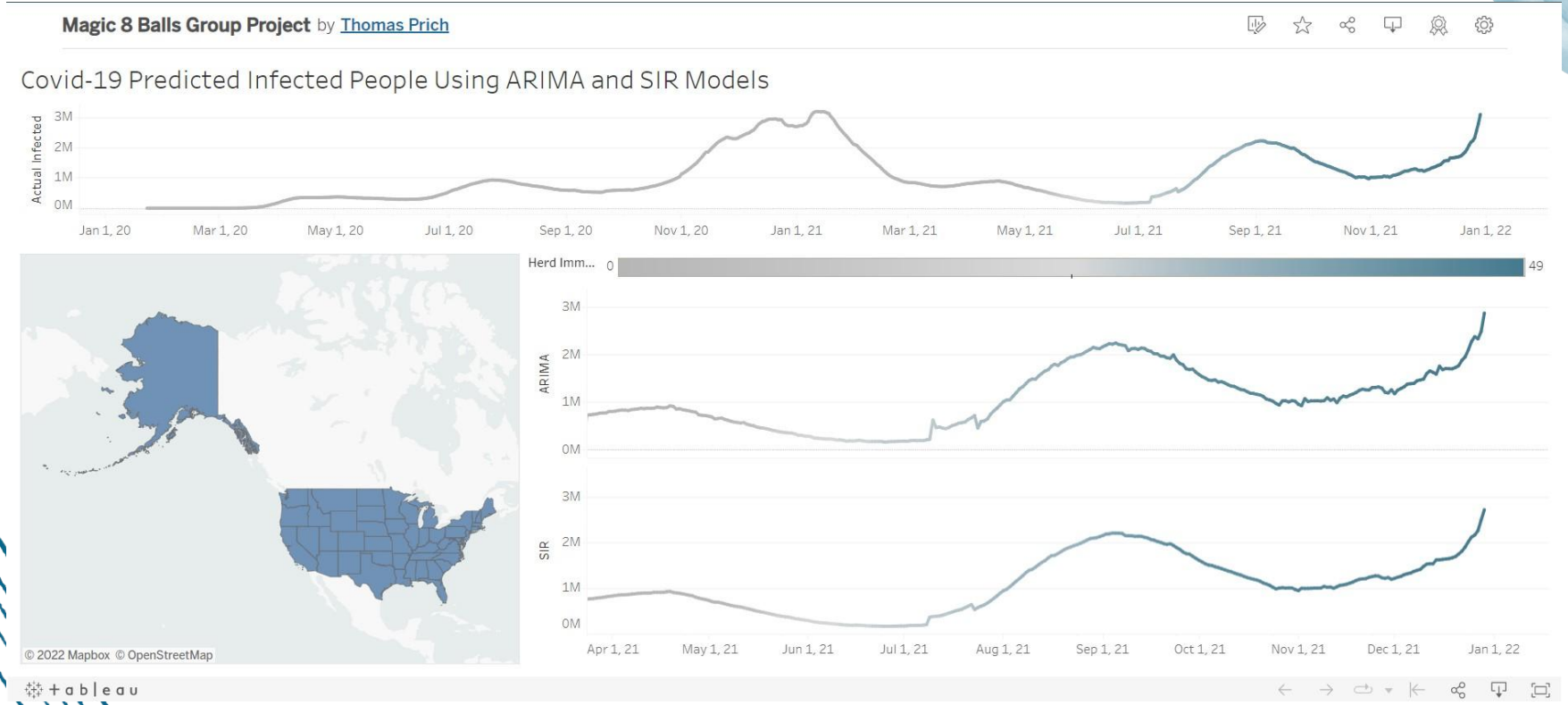


ARIMA


Arima(1,0,0) 1 Day Out Predictions of Infections
Predicted I
Actual I
Infected
Day
175000
150000
125000
100000
75000
50000
25000
0
0
100
200
300
400
500
600


ARIMA(8,1,6) Predictions
Training Data
Actual Cases
Predicted Cases
25000
20000
15000
10000
5000
0
2020-04
2020-07
2020-10
2021-01
2021-04
2021-07
2021-10
2022-01

Tableau



https://public.tableau.com/app/profile/thomas.prich/viz/Magic8BallsGroupProject/Dashboard1

Conclusions and Recommendations

Conclusions

- SIR overpredicts
- SIR only considers some factors
- SIR is better for worst case scenarios

Recommendations

- Use ARIMA for more accurate predictions
- Tuning SIR parameters for more accuracy longer term

Thanks!

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