

# Columbia Hackathon 2020

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How did COVID-19 impact  
how we live, move, and  
exchange goods?



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# Agenda

Overview

Questions & Hypothesis

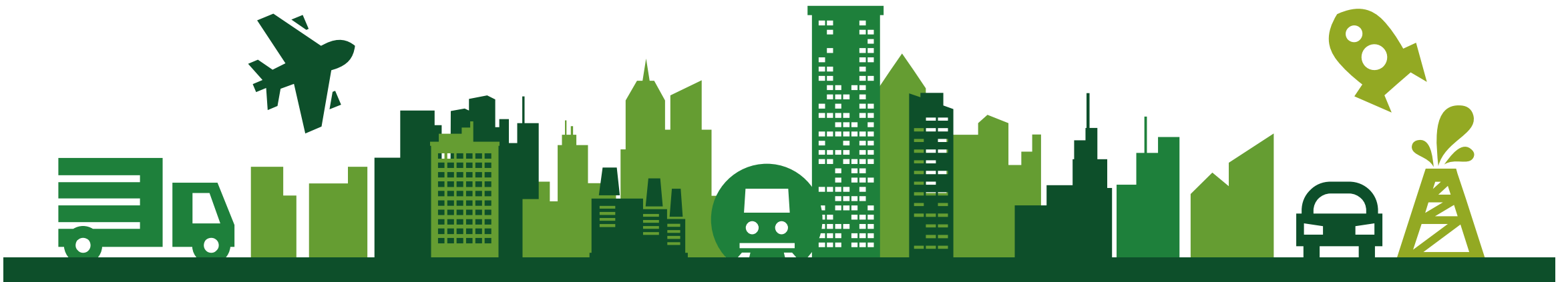
Data Visualization

Model Selections

Conclusion

# Overview

For most people, mobility is one of the basic prerequisites for professional and social life. The spread of COVID-19 have changed and restricted the way people move within the country in an almost unprecedented way. Logistic transportation is also disrupted and implicated by COVID-19, causing short of daily necessities and cutbacks in production and jobs. This project will examine the impact of virus on mobility of people and goods across the globe.

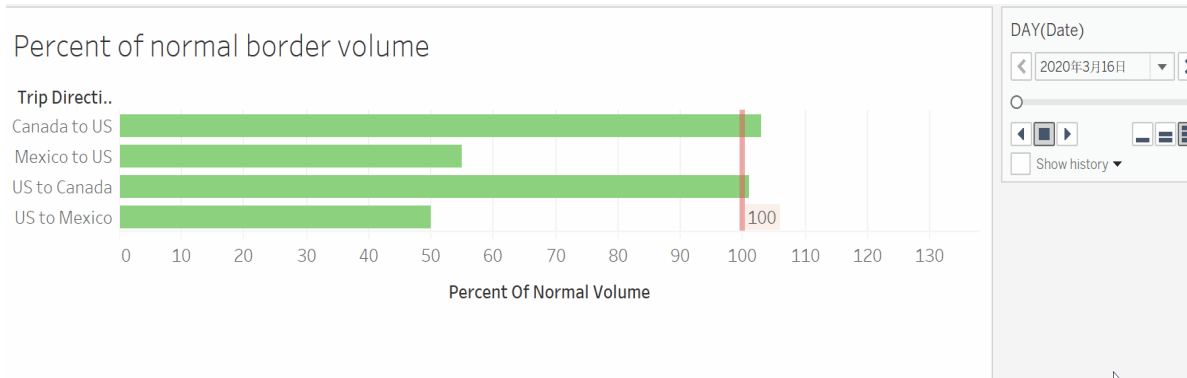


# Question & Hypothesis

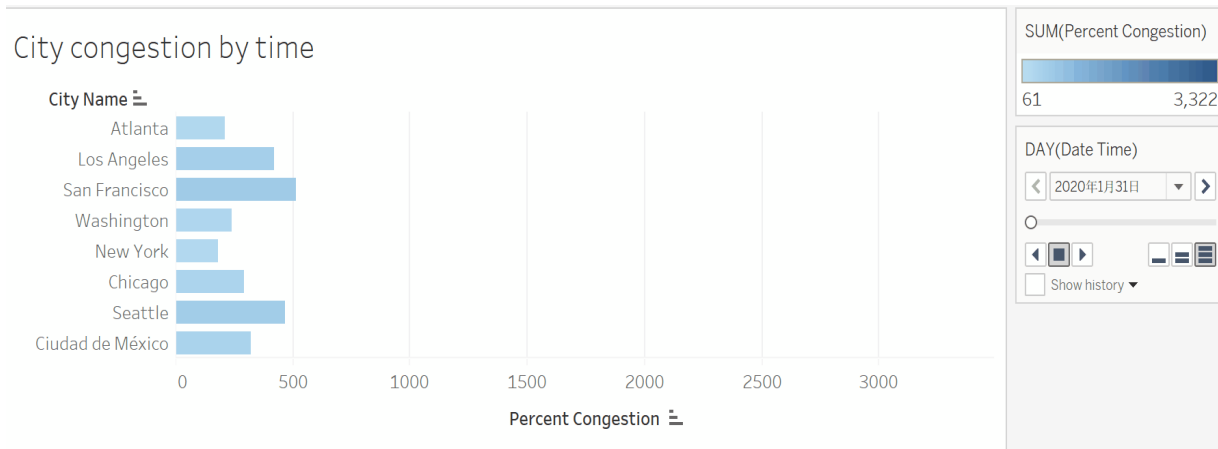
If COVID-19 didn't happen,  
how would things be different?



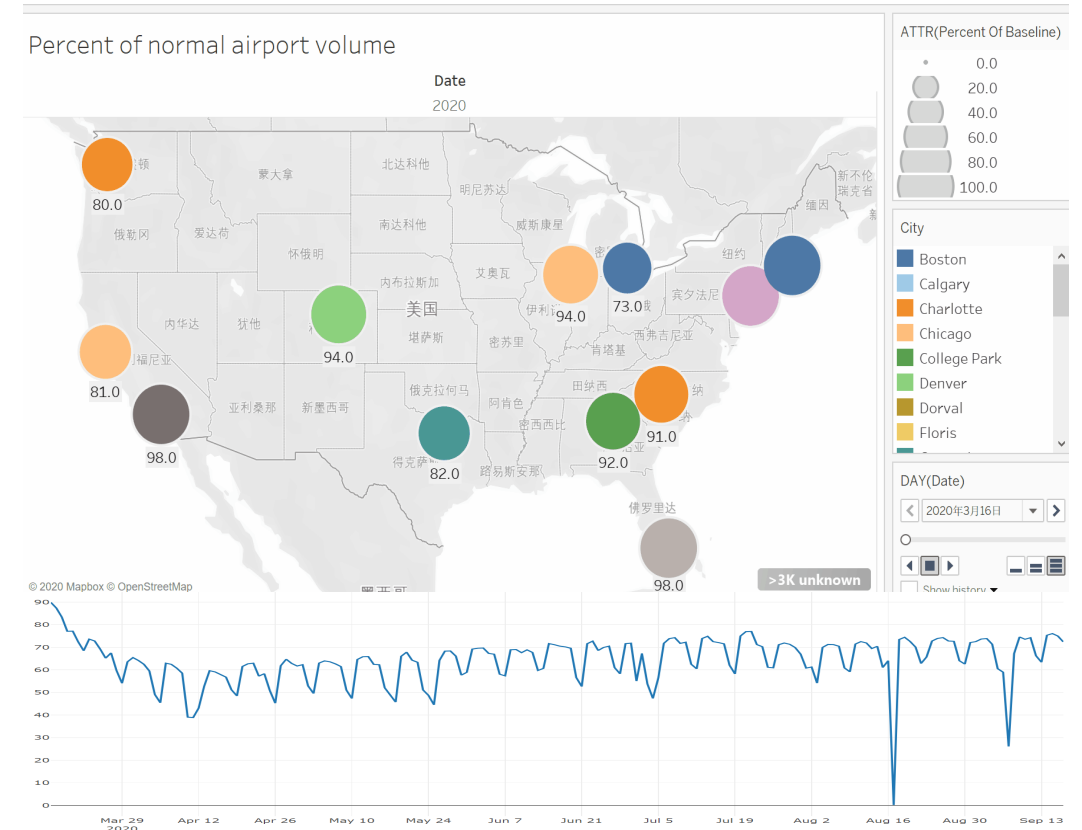
# Data Visualization People Movement Trends



Trend in travel abroad has declined. Travel between US & Mexico bounced back quickly



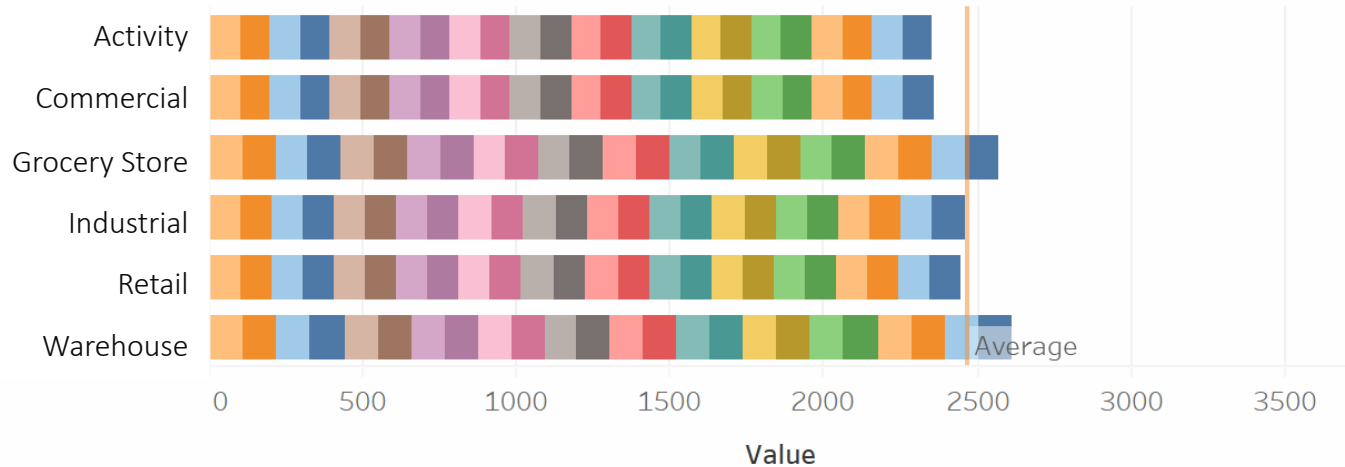
Urban traffic has hit its bottom during April and now is on the uptrend



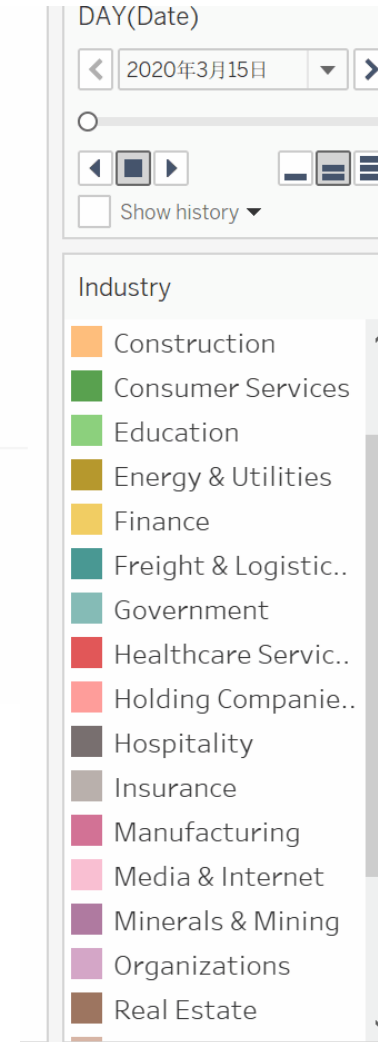
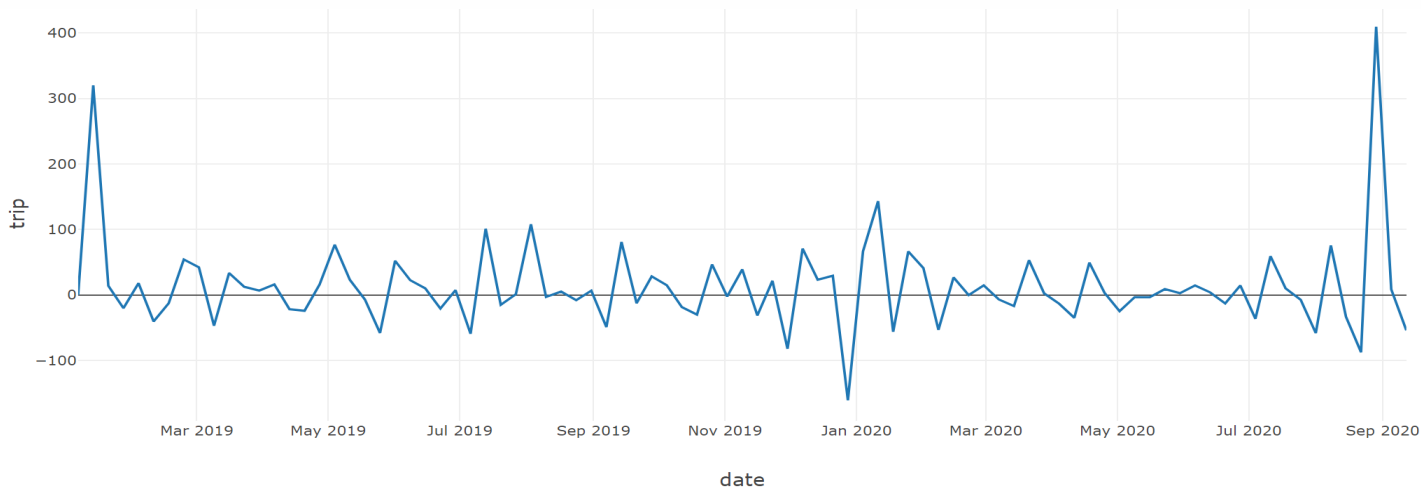
Passenger Volumes dropped about 50% during March and gradually recovered

# Data Visualization Logistic Transportation

Percent of baseline in different industries



Port transportation volume



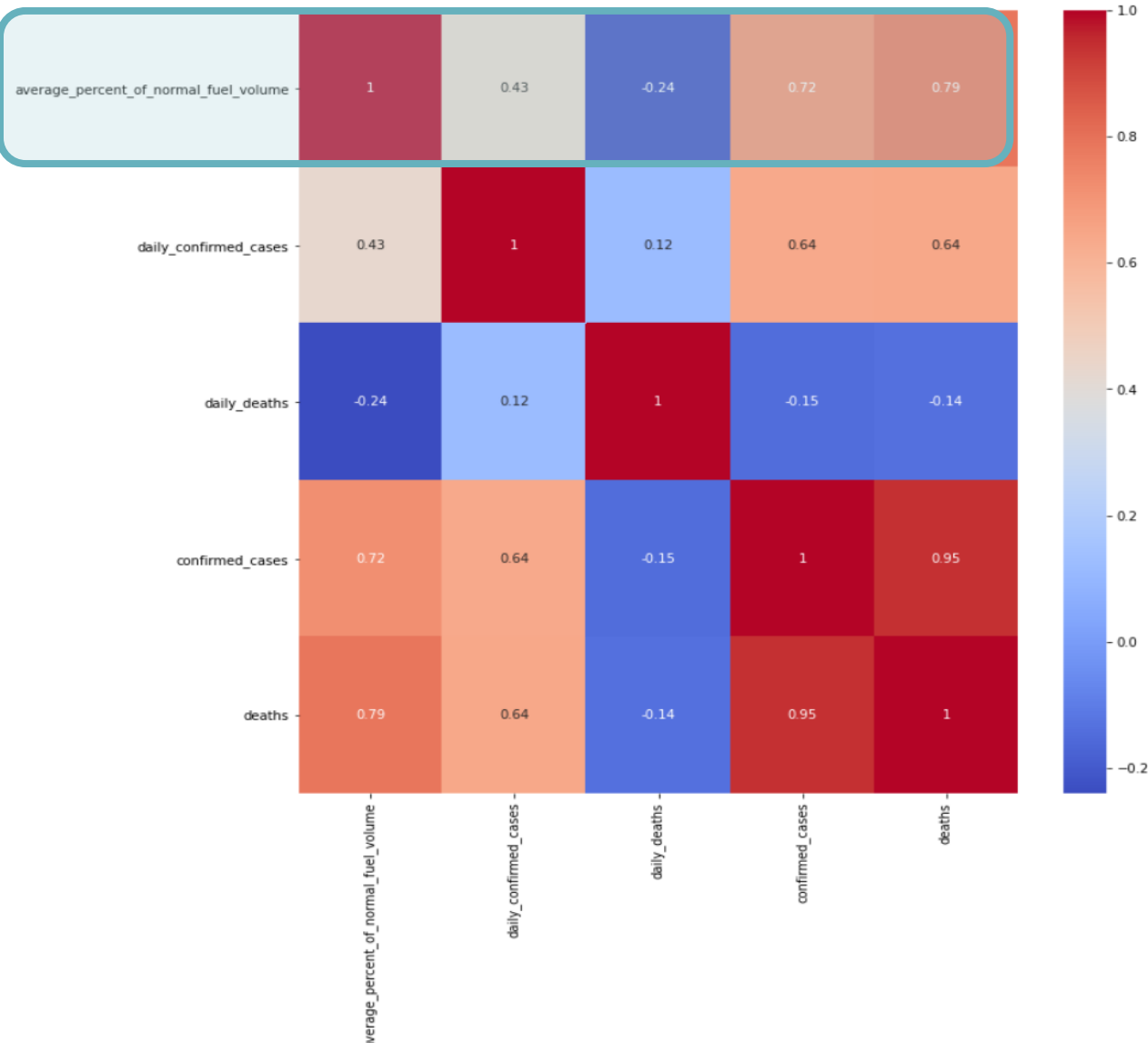
Compared with other industries, Activity, Grocery Store, and Warehouse's downturns are slower

Port transportation get backup and running after September.

# Model Selections

# Data Exploration

## How does covid affect people mobility?



### Covid & Fuel Volume correlation Heatmap

Daily fuel volume was selected as one of the metrics that measures people mobility impact from COVID because of its correlation with confirmed covid cases and related deaths

#### Matrix result:

Daily fuel volume has a high positive correlation with both **cumulative confirmed cases** (0.72), and **cumulative death** (0.79)

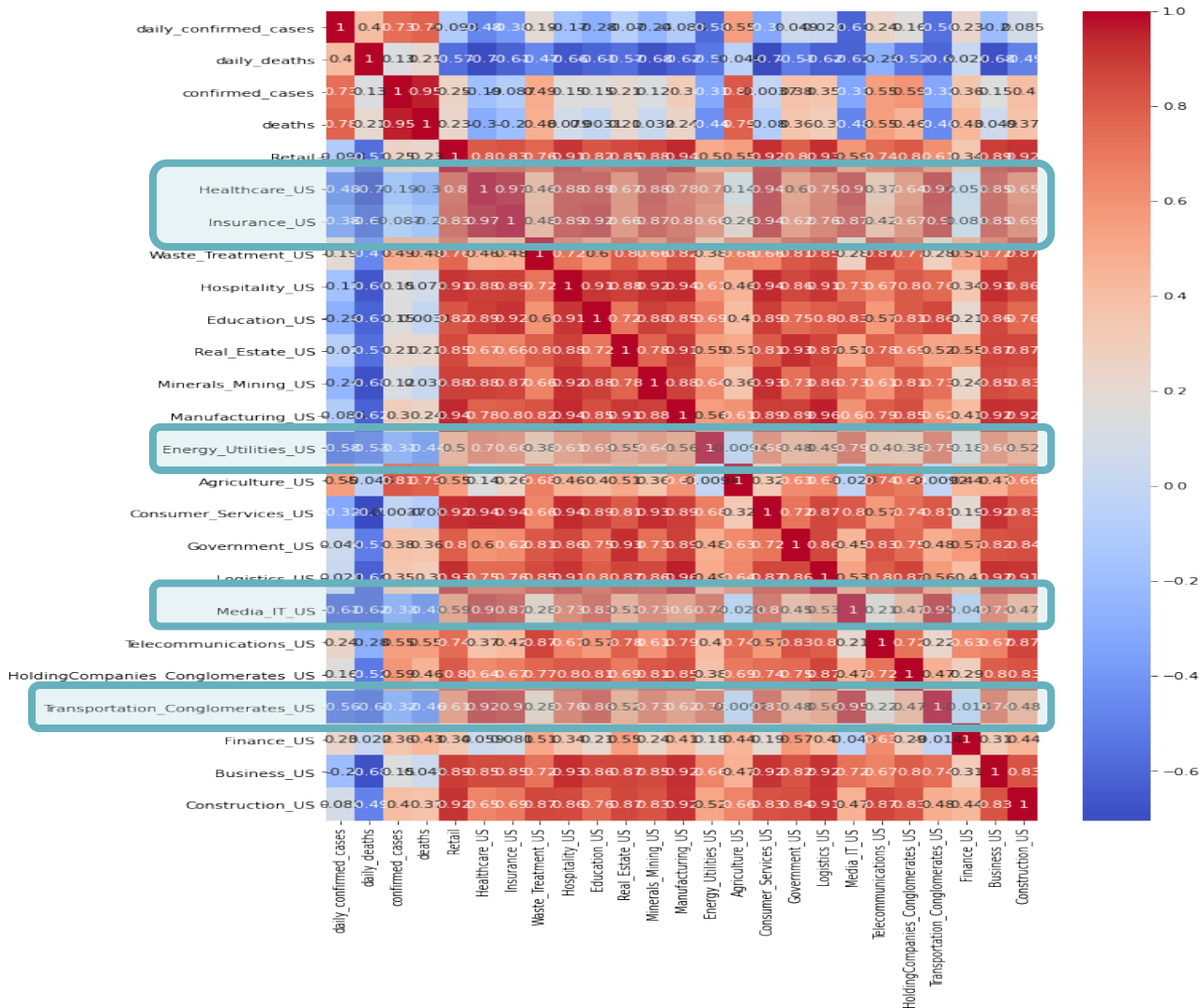
- As the confirmed cases raised, car usage went up, which shows an increase in people mobility

(data range: 2020.02.03 - 2020. 09.15)



# Data Exploration

## How does covid affect goods?



## Covid & commercial correlation Heatmap

COVID **impeded the growth** of these industries (cumulative confirmed cases and deaths are negatively correlated with) :

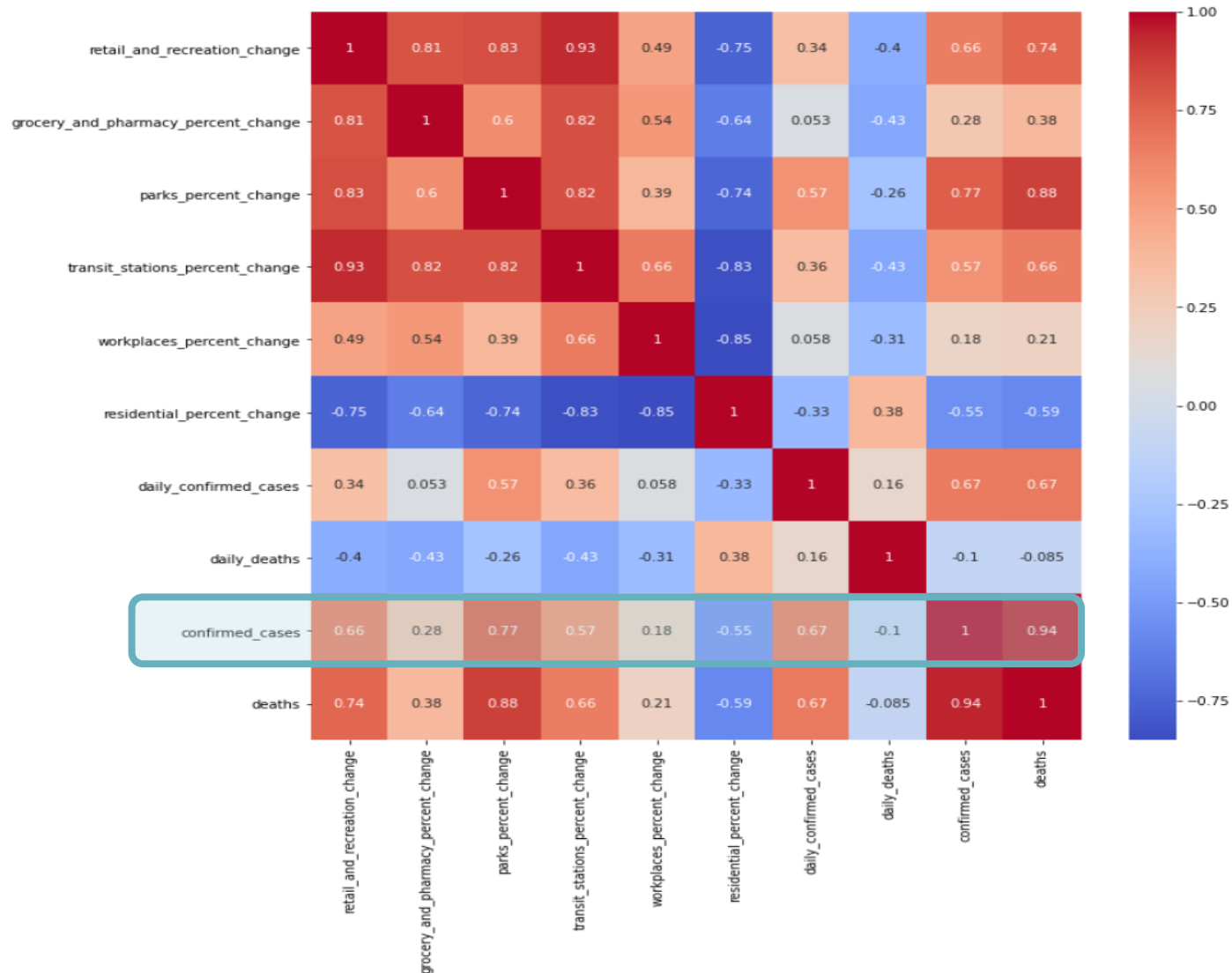
- Healthcare industry
- Insurance industry
- Energy & Utility industry
- Media & IT industry
- Transportation industry

COVID **stimulated the development** of (cumulative confirmed cases and deaths are positive correlated with) :

- Agriculture industry

# Data Exploration

## How does covid affect goods mobility?



### Covid & commercial correlation Heatmap

COVID **impeded the growth** of  
(cumulative confirmed cases and deaths are negatively correlated with) :

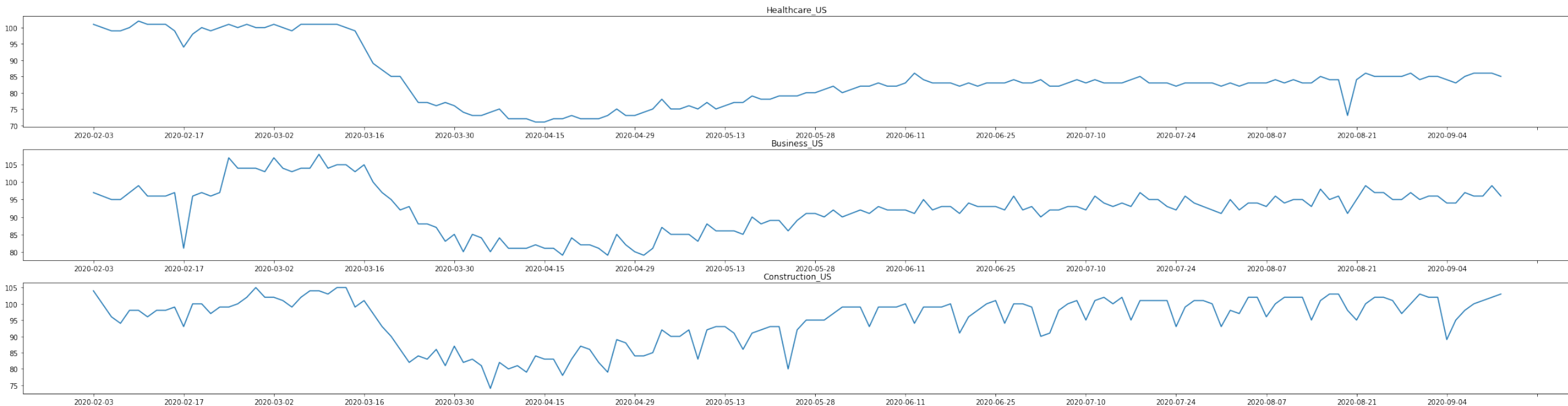
- Residential

COVID **stimulated the development** of  
(cumulative confirmed cases and deaths have a strong positive correlation  $> 0.5$  with) :

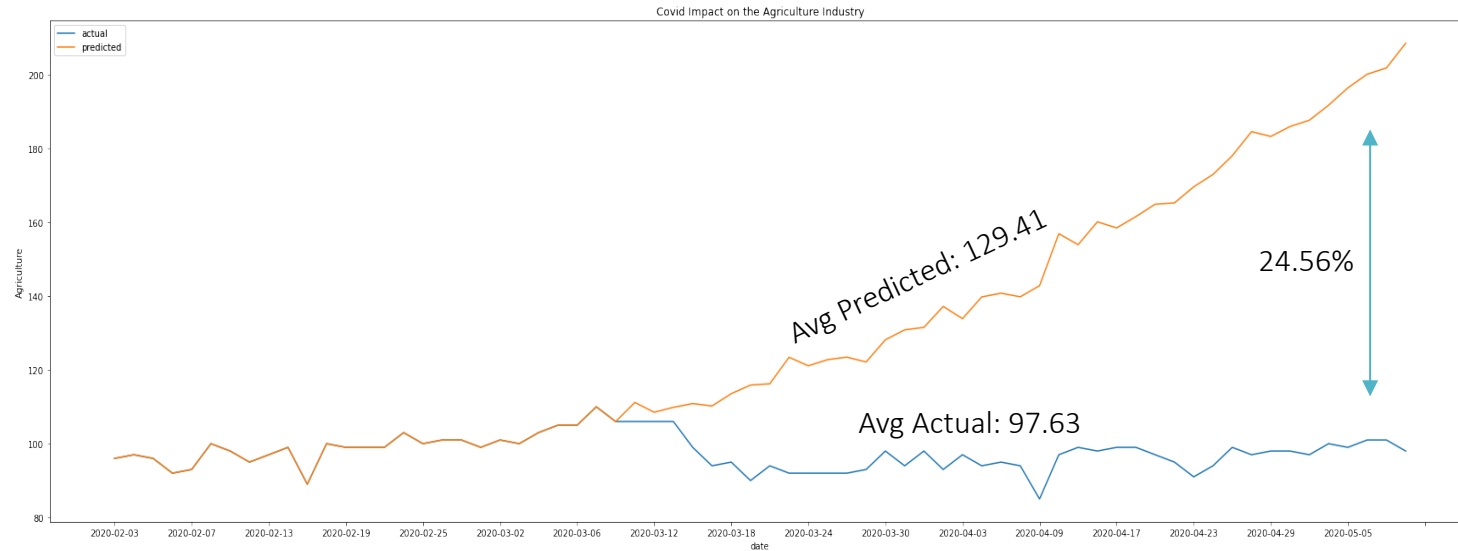
- Retail and recreation
- Parks
- Transit stations

# Data Exploration Industry Index Change

- Plotted the change of index value for all the 22 industries ('Healthcare Services & Hospitals', 'Insurance', 'Waste Treatment', 'Hospitality', 'Education', 'Real Estate', 'Minerals & Mining', 'Manufacturing', 'Energy & Utilities', 'Agriculture', 'Consumer Services', 'Government', 'Freight & Logistics Services', 'Media', 'Retail', 'Telecommunications', 'Holding Companies & Conglomerates', 'Transportation', 'Finance', 'Business Services', 'Construction', 'Organizations')
- From 2020.02.03 to 2020. 09.15
- All the industries experienced the downside growth since March, and some industries had a plummet on 2020.02.17
- Question – How much did COVID affect each industry?



# Covid Impact industrial growth with vs. without Covid



## Agriculture industry (positive correlation)

0.8 correlated with cumulative confirmed cases

- The difference between predicted value (129.41) and the actual value (97.63) is relatively small
- Without Covid, Agriculture can perform 24.56% better

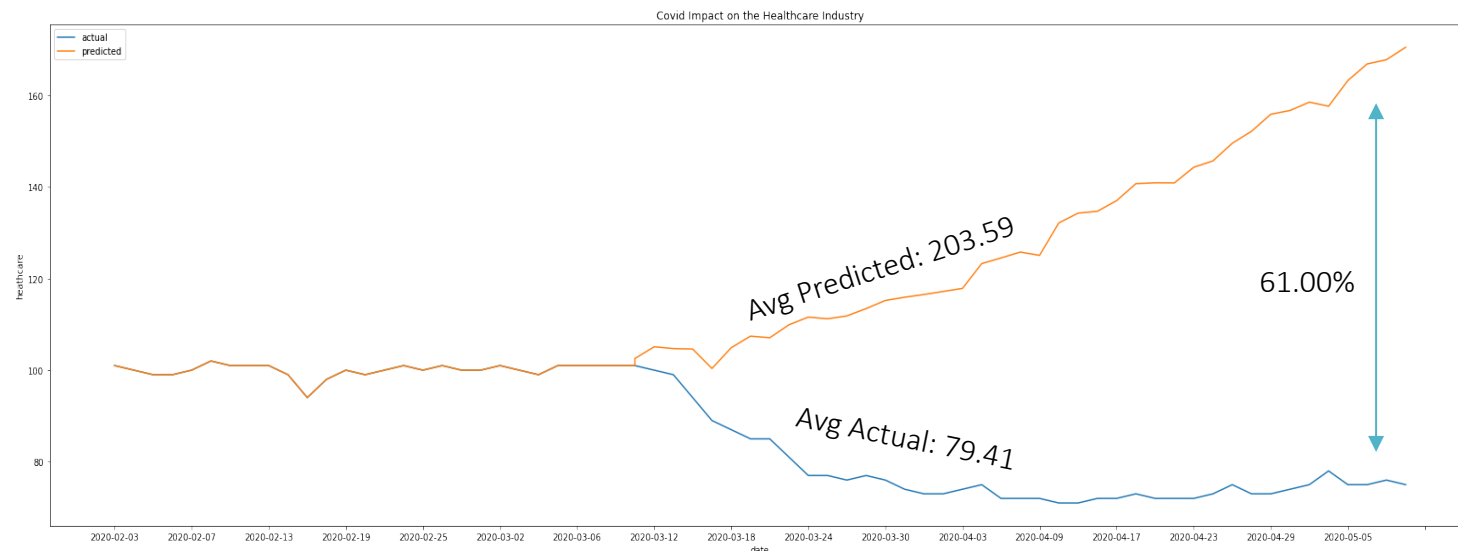
## Quantify the effect of COVID

Trigger point:

cumulative confirmed case > 1000 (March 11, 2020)

Approach: use ARIMA with data from Feb to March as training data to predict later 60 days

Limitation: limited training data



## Media industry (negative correlation)

-0.3 correlated with cumulative confirmed cases

- The difference between predicted value (203.59) and the actual value (79.41) is large
- Actual value started to drop since March
- Without Covid, Media can perform 61% better

# Model Selection

## Random Forest

Residential Percent Change prediction:  
Best random forest model reaches R2 of **0.60174**

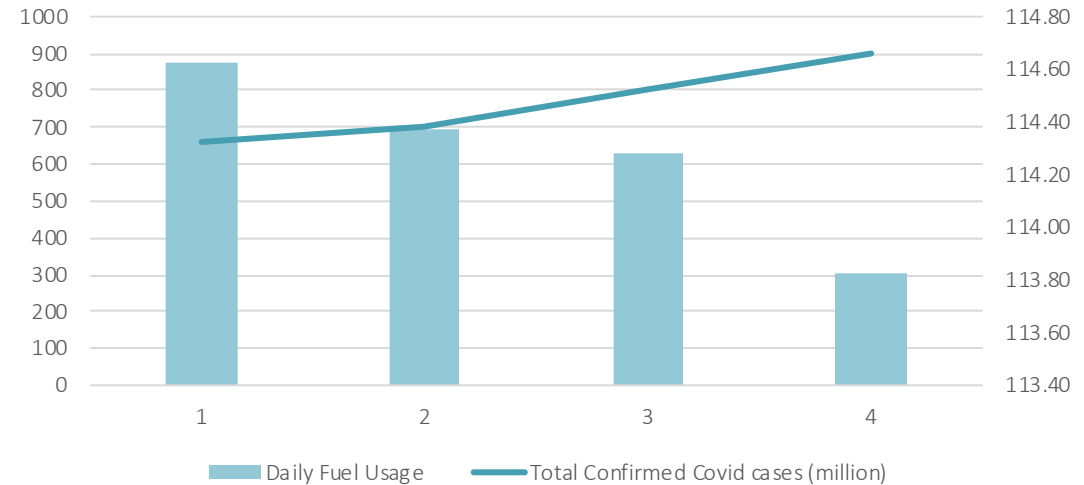
Fuel daily usage prediction:  
Best random forest model reaches R2 of **0.8934**

## XGBoost

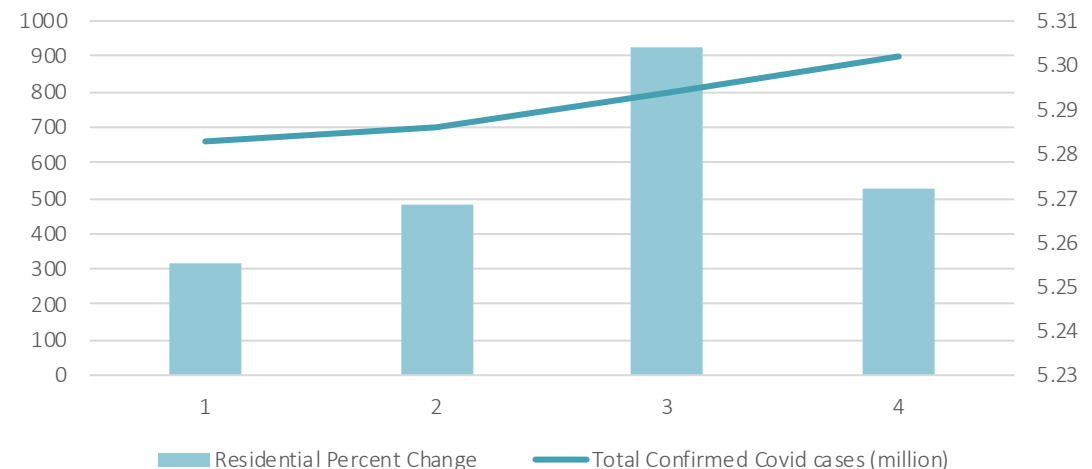
Surprisingly, XGBoosting models **underperformed** random forest in predicting both metrics.

We suspect the reason for this is that XGBoosting overfitted the data.

Daily Fuel Usage Prediction



Residential Percent Change Prediction



# Conclusion: Impact on U.S. Industries

**Curfews and stay-at-home order influenced mobility most.** As confirmed cases kept increased, some states issued stay-at-home order and curfews during April and May, which affected activities and hurt the U.S. economy. **Large amount of relocations due to panic increase the demand of warehouse.**

**All industries experienced downturn growth in March and April,** some industries were hit as early as on February 17<sup>th</sup>.

Covid has negatively impacted the Healthcare, Insurance, Energy & Utility, Media & IT, Transportation, and Residential industries. Without Covid, we would have seen a much higher growth in these industries. For example, Media & IT industry experienced a **61%** decline in growth because of Covid. On the other hand, Covid didn't stop positive growth in Agriculture, Retail and recreation, Parks, and Transit. However, these industrial performances could have been better if Covid didn't happen. For example, Agriculture industry was one of the industries that experienced positive impacts due to Covid, but Covid still caused a **24.56%** decline in growth to the industry.