

The Adoption Of Electric Vehicles And Their Future Outlook

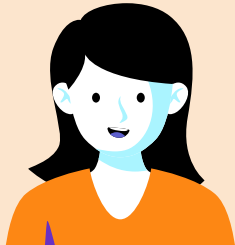
By Shailly Patel & Nagulan Nathan



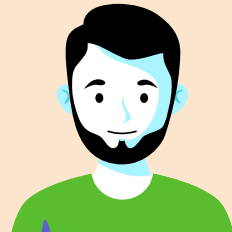
You may wonder... what are we doing again?

Current reports are too technical and focus on a small aspect of EVs

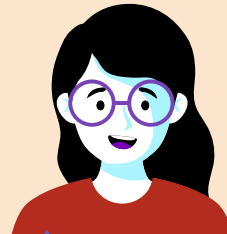
We will bring a broad, well-rounded perspective of EVs and analyze the market with different statistical and visual methods so that the insights gathered will cater to a broad audience, from job seekers in the EV industry to investors.



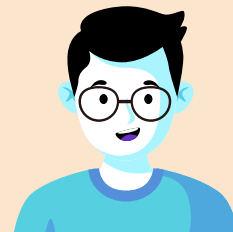
Investor



Job-Seeker



Engineer



Car-Buyer

Our Motivation to take on this problem

Growing pressure to take the greener route

EV Sales in North America, Europe and China have experienced compounding annual growth rates

Curiosity to Learn about the EV market and factors affecting its success



The topics we looked into



Emission



**EV Infrastructure &
Adoption**

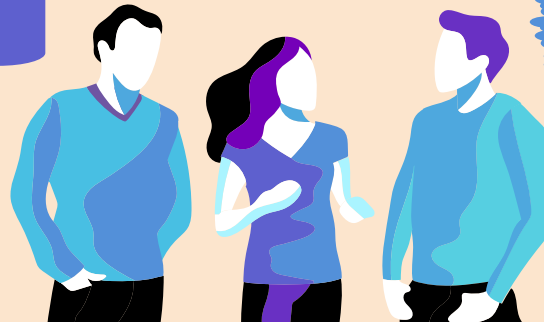
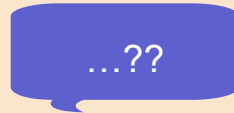


Stock Market Prices



What Industry needs are being addressed?

- Statistical analysis of emissions of conventional vehicles vs EV
- Unbiased perspective of the EV market
- Analysis into factors affecting EV market and building a predictive model



What approaches did we use?

01

Visual Analytics with Tableau

02

Statistical Analysis using R

03

Predictive Modelling using RapidMiner

04

Exploratory Analysis with R



1. What has the growth been like for the major EV companies in the past five years?

STOCK MARKET DATA OF MAJOR EV COMPANIES (USD)

Date Filter (applies to all charts)

2/21/2017 2/17/2022

These are the 5 biggest pure EV companies by Market Cap, with Tesla as the most established company. Lucid and Rivian are based in North America, while XPeng and NIO are based out of China.

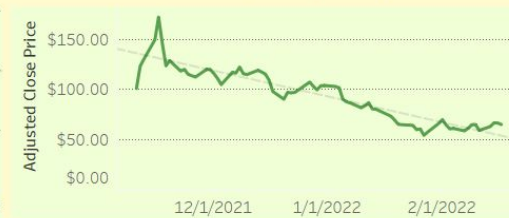
Tesla, Inc. (TSLA)



Lucid Group, Inc. (LCID)



Rivian Automotive, Inc. (RIVN)



XPeng, Inc. (XPEV)

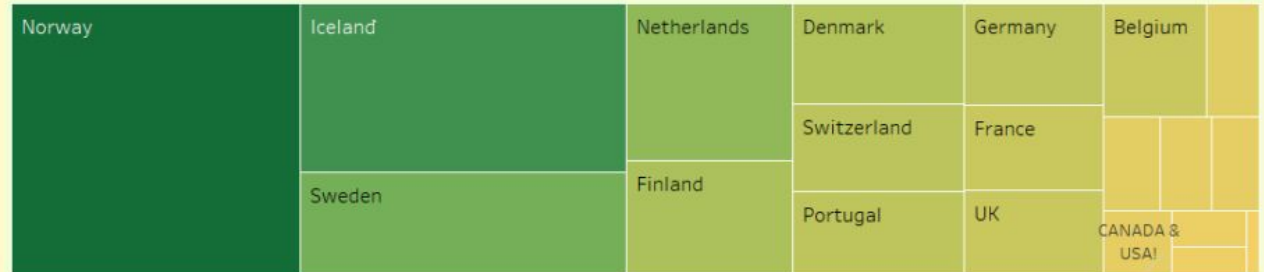
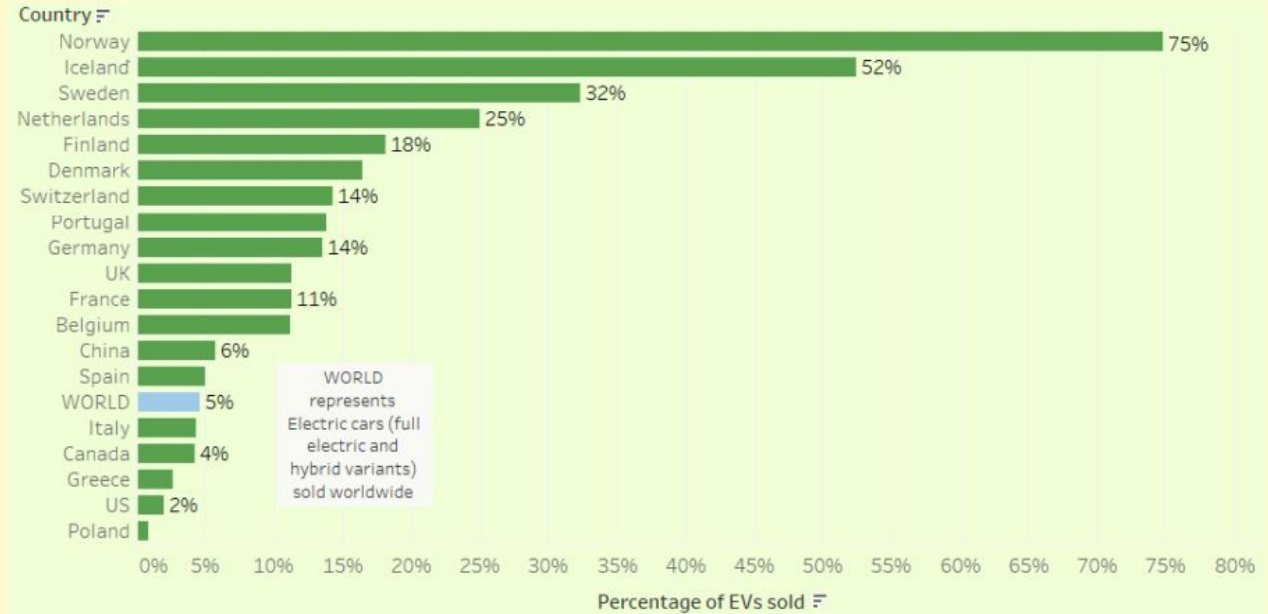


NIO, Inc. (NIO)



2. What has the adoption of EVs looked like in major regions?

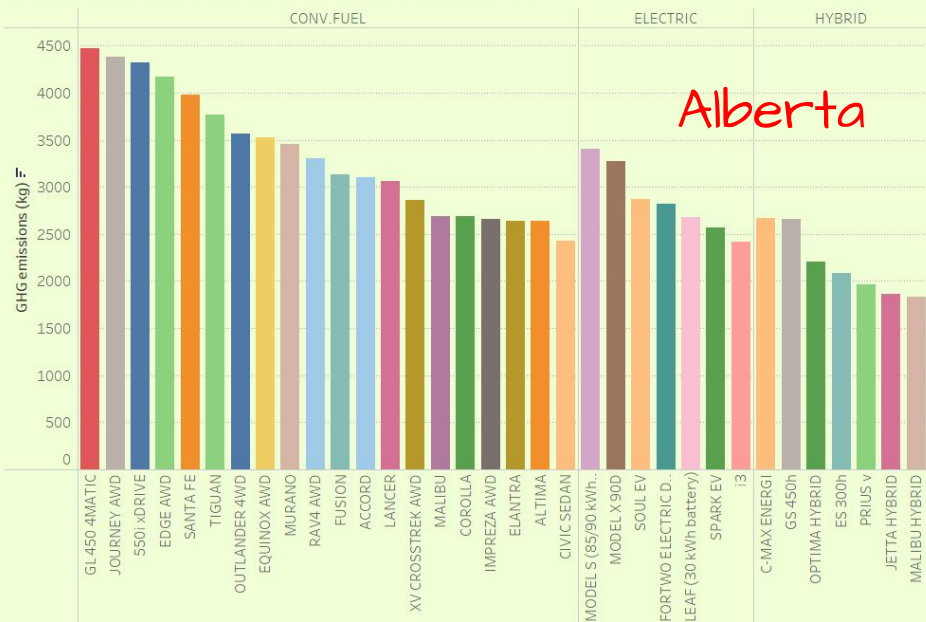
Electric Cars as Share of Automobile Sales Globally in 2020



3. Is there a significant difference in emissions between EV and gasoline vehicles?

EMISSIONS RELEASED BY VARIOUS 2016 MODEL YEAR CONSUMER VEHICLES

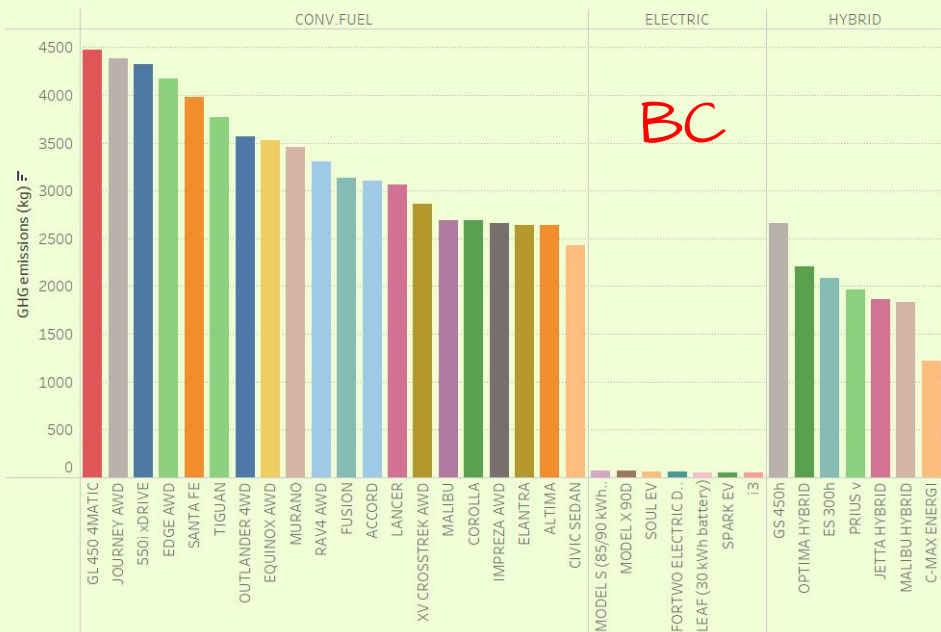
Assuming 15000km annual mileage. Note varying emissions for EVs depending on province



Vehicle Type: (All) Province: AB Fuel Type: (All)

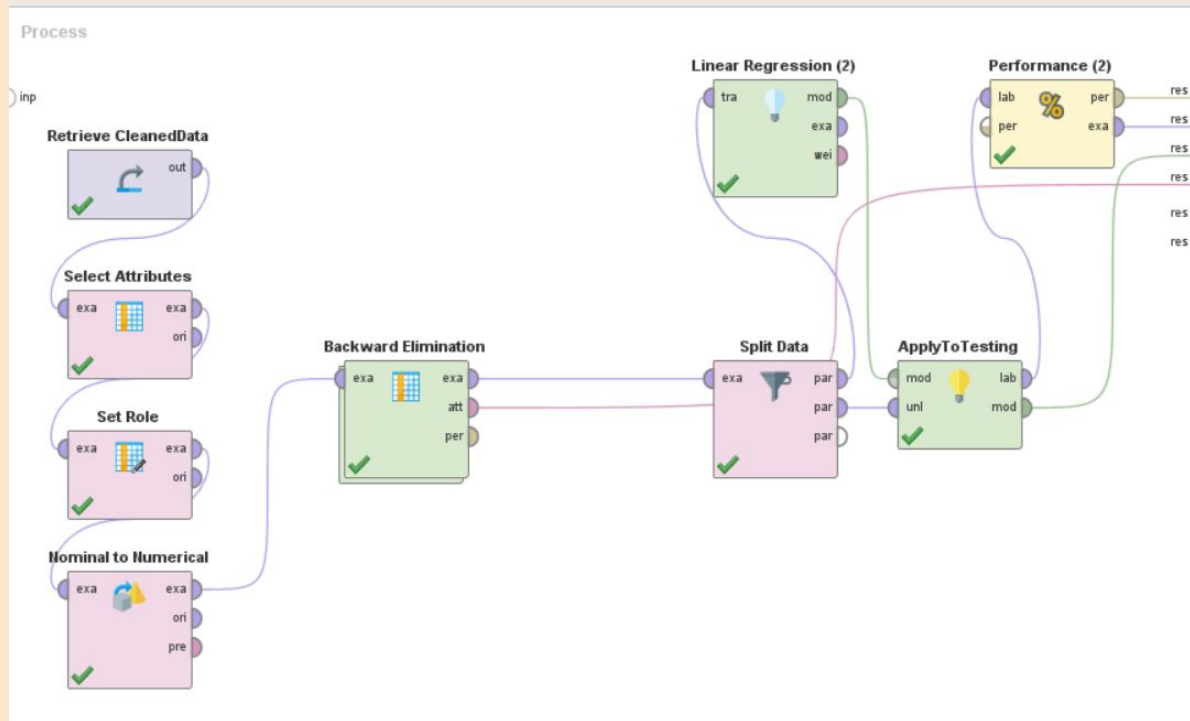
EMISSIONS RELEASED BY VARIOUS 2016 MODEL YEAR CONSUMER VEHICLES

Assuming 15000km annual mileage. Note varying emissions for EVs depending on province



Vehicle Type: (All) Province: BC Fuel Type: (All)

4. Create a regression model for predicting Tesla Stock Prices using commodities and evaluate its performance.

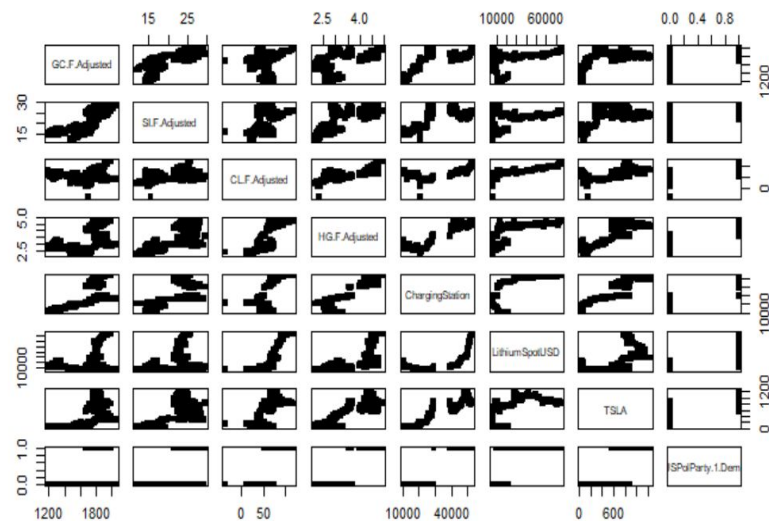
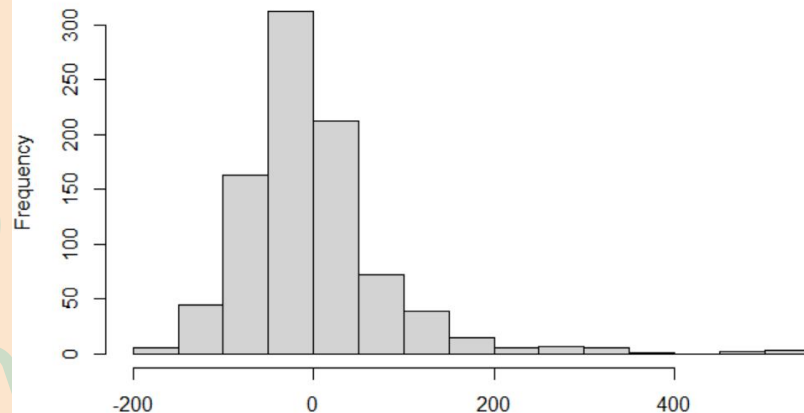


RMSE: 66.238

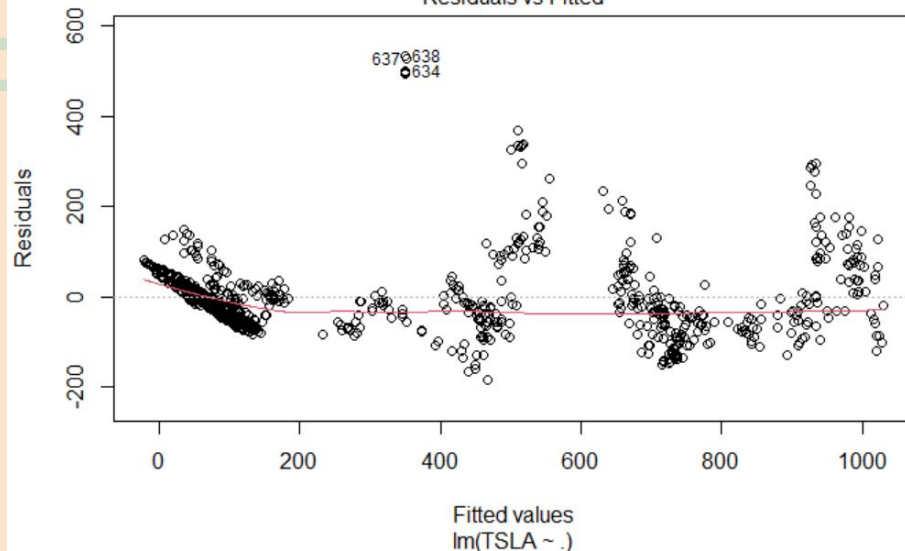
```
#checking multicollinearity - our VIFs are way too high
vif(reg_model)
```

| | | | |
|-----------------|----------------|-------------------|---------------|
| PalladiumPrice | CobaltPrice | NickelPrice | ZincPrice |
| 9.451137 | 3.804493 | 6.420662 | 19.001880 |
| GC.F.Adjusted | SI.F.Adjusted | CL.F.Adjusted | HG.F.Adjusted |
| 37.375429 | 19.243816 | 7.316477 | 56.558527 |
| ChargingStation | LithiumSpotUSD | USPolParty.1.Dem. | |
| 55.245912 | 9.709112 | 23.722966 | |

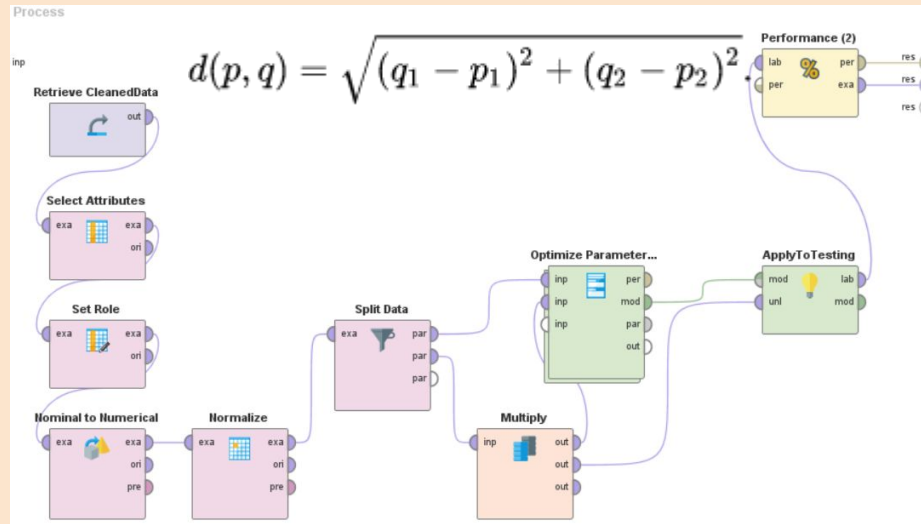
Histogram of reg_model\$residuals



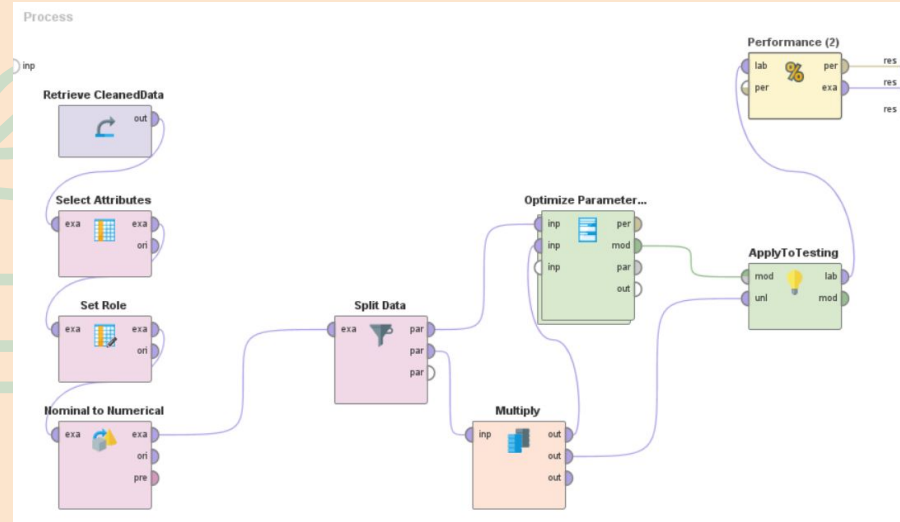
Residuals vs Fitted



5. Compare different predictive models using different algorithms to find the one with the best predictive power.



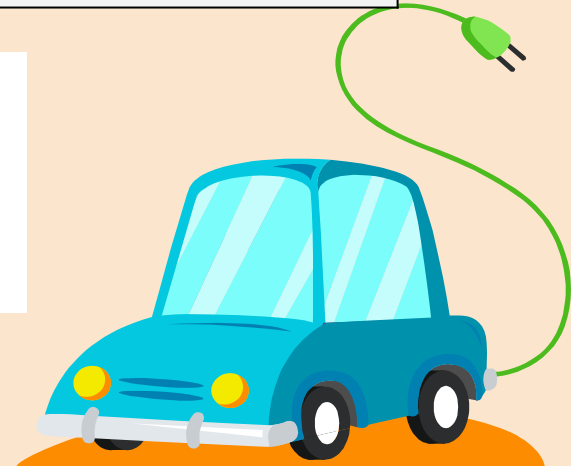
Process for k-NN



Somewhat Similar Process for
Decision Tree & Random
Forest

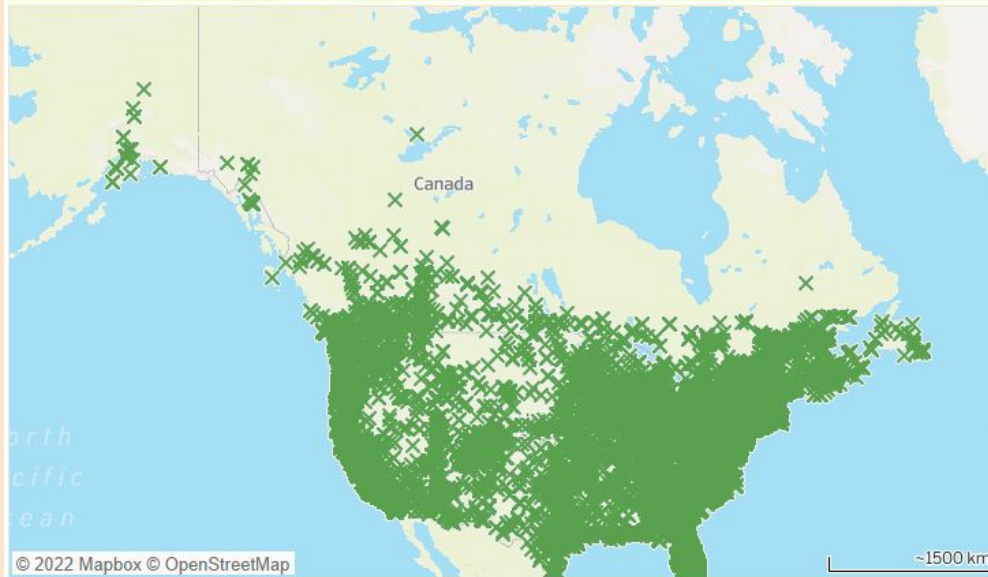
| Technique | RMSE (Descending Order) |
|-------------------|-------------------------|
| Linear Regression | 66.238 |
| Decision Tree | 30.516 |
| k-NN | 25.294 |
| Random Forest | 19.838 |

$$RMSE = \sqrt{\frac{\sum_{i=1}^N (Predicted_i - Actual_i)^2}{N}}$$



6. Explore Charging Station Growth in North America

Distribution of Electric Vehicle Charging Stations



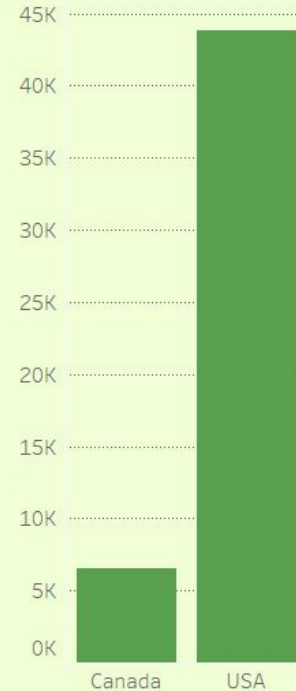
YEAR(For Map and Bar)

1995 2021

Country

- ☒ (All)
- ☒ Canada
- ☒ USA

EV Charging Station Totals



Growth in EV Charging Stations in North America

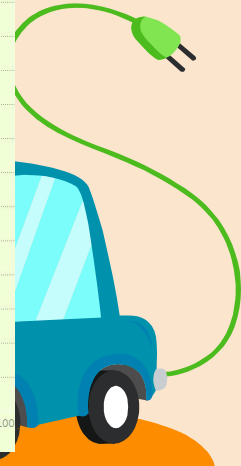
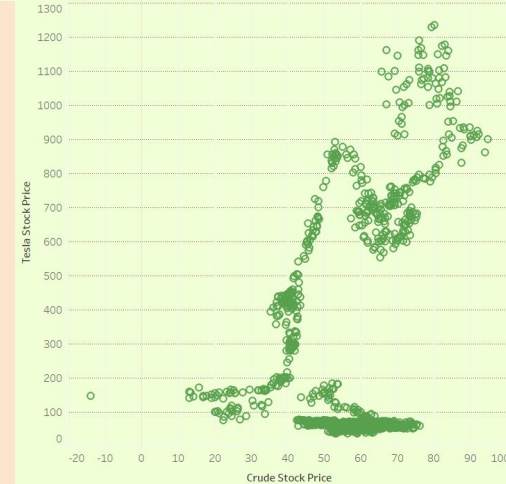
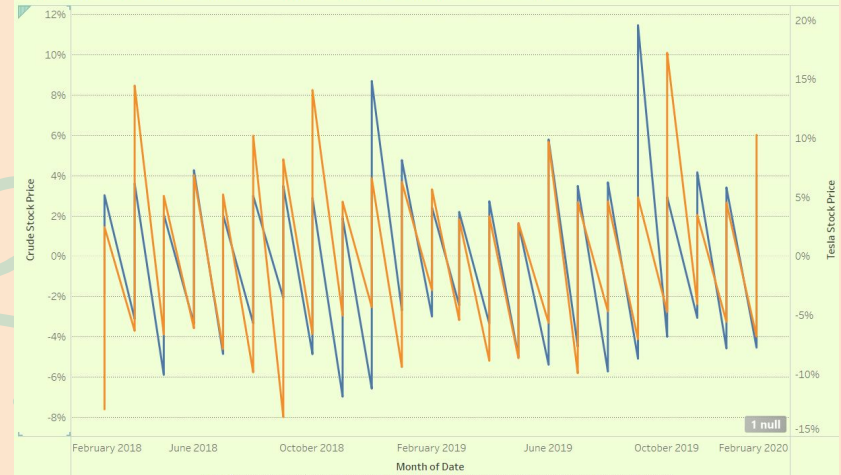


7. What does the relationship between Tesla stock prices and oil price/barrel look like?

Crude Oil and Tesla Stock Price % Fluctuations Over the Last Five Years



Crude Oil and Tesla Stock Price % Fluctuations Over the Last Five Years



Follow-up
work
aka
"what we
wish we
could've
done"

01

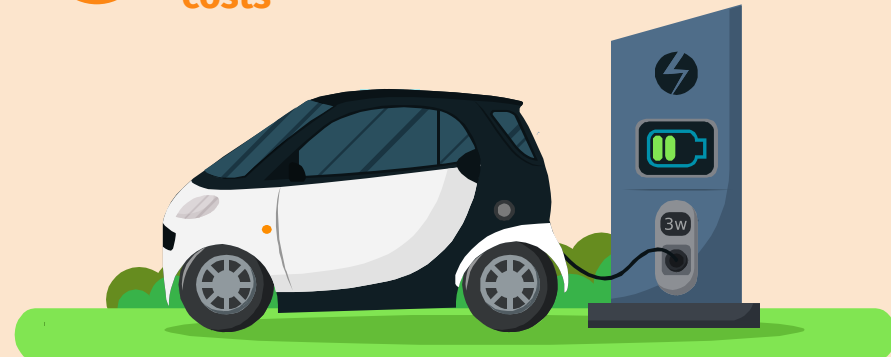
Investigate
distribution of
charging stations

02

Work on the
Regression Model to
be able to explain
predictors

03

Find data on
maintenance and fuel
costs



We've come to the end of our presentation

Thank You For Listening!

