CSC 805 - Data Visualization

Visualization Project - Phase 3

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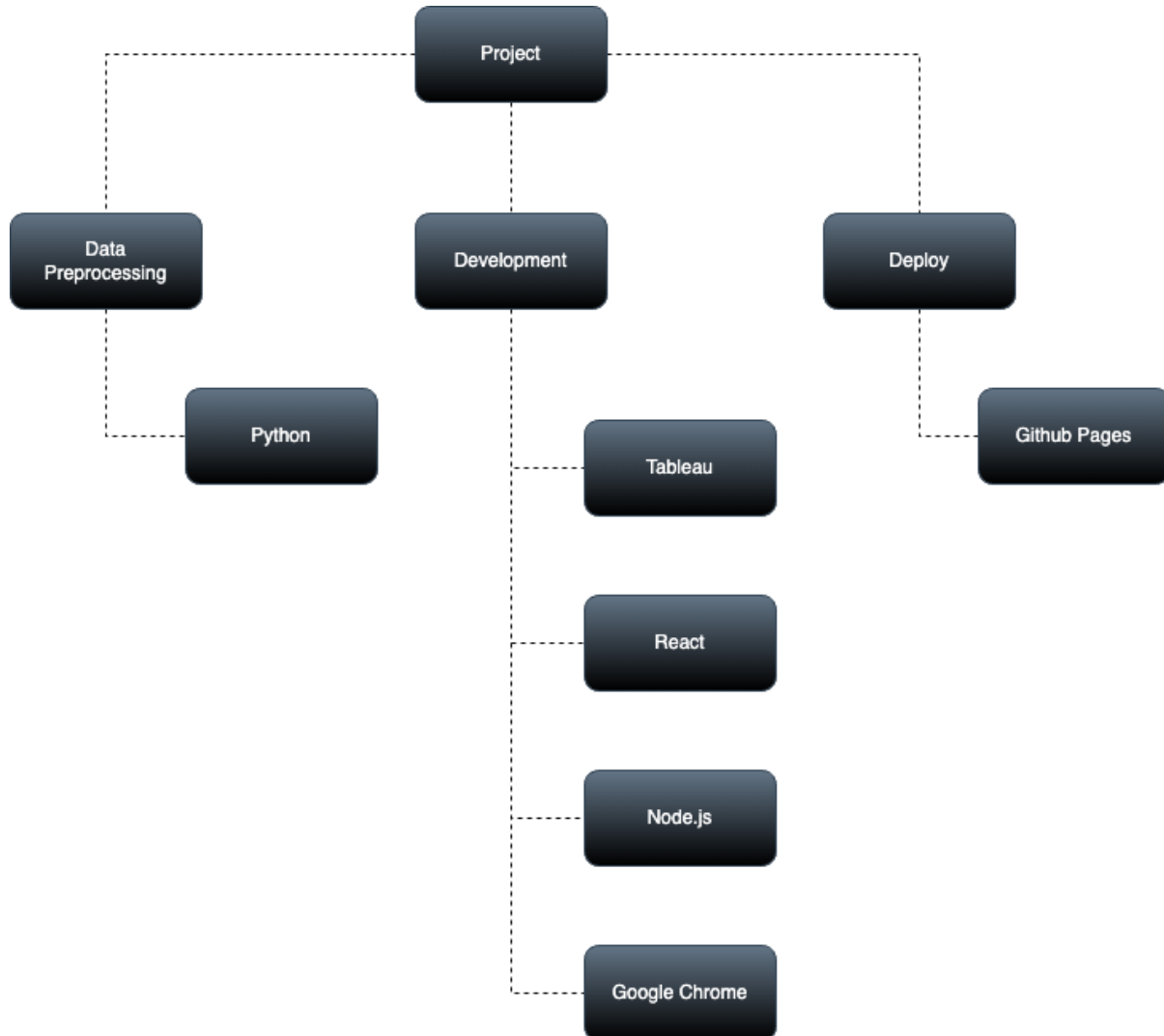
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Contents:

1. Project Report

1.1 System Architecture

- Tableau
  - This will be used to integrate the graphs & visualizations. All visualizations in this project will come from tableau.
  - Handles reading of csv files
  - Creates the graph visualization and provides filtering options.
- Node.js
  - Used as a development server for linting & fixing.
- React

- ○ Used as a web development platform for frontend.
  - ○ Created different pages for visualizations.
- ● Python
  - ○ Used to preprocess the data.
  - ○ Removed unnecessary columns from the dataset.
  - ○ Pandas - Handles data parsing and processing.
- ● Github Pages
  - ○ Used to host website for free
- ● Google Chrome
  - ○ Used inspection for debugging.
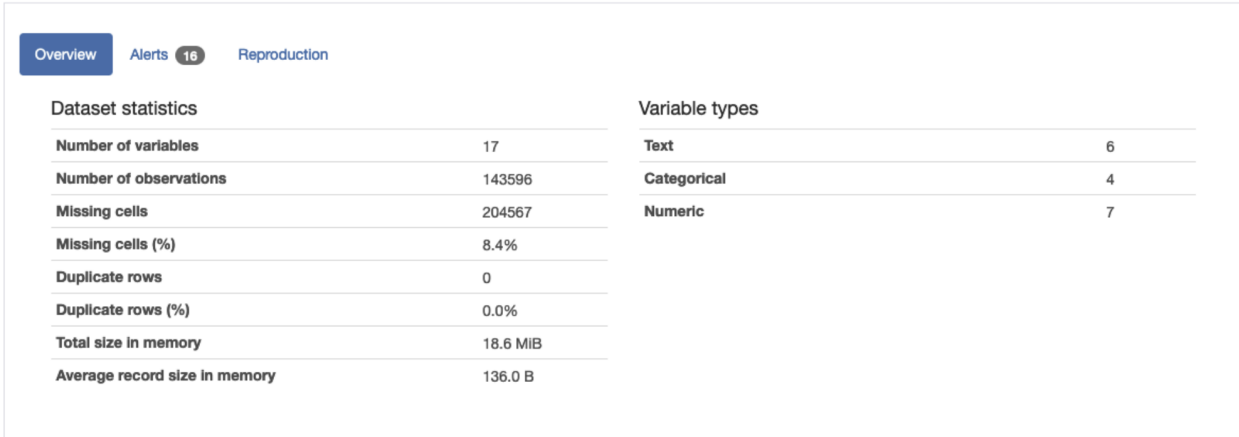 - ○ Used to browse the website to view visualizations.

1.2 Dataset Description

The data set used in this visualization project consisted of:
1. Washington State Electric Vehicle Population Data; and
2. Alternative Fuel Stations By State (Updated 10-12-2023).

1.2.1. Washington State Electric Vehicle Population Data

The Washington State electric vehicle data contains 143596 records with fields that are described below (irrelevant fields omitted). A screenshot of the overview of the data is provided in Figure 1.

Figure 1: WA State EV Data Overview

VIN: the last 10 digits of the vehicle ID number;

Location: the location where the vehicle was registered by:
- county,
- city,
- state,
- postal code,
- latitude,
- longitude, and
- 2020 census tract;

Model Year: the model year of the vehicle;

Make: the make of the vehicle;

Model: the model of the vehicle;

Type: the electric vehicle type (BEV or PHEV);

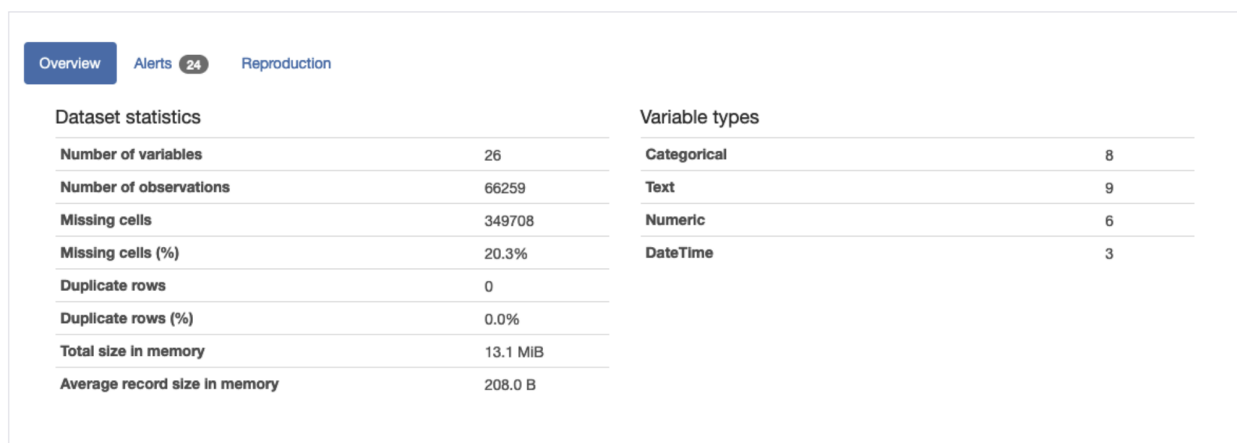**Electric Range:** the electric range in miles;

Base MSRP: the base MSRP of the vehicle;

Legislature District: the legislative district of the vehicle; and

Electric Utility: the electric utility of the location of the vehicle.

1.2.2. Alternative Fuel Stations By State

The Alternative Fuel Station data contains 66259 records with the fields described below (irrelevant fields omitted). A screenshot of the overview of the data is provided in Figure 2.

Dataset statistics		Variable types	
Number of variables	26	Categorical	8
Number of observations	66259	Text	9
Missing cells	349708	Numeric	6
Missing cells (%)	20.3%	DateTime	3
Duplicate rows	0		
Duplicate rows (%)	0.0%		
Total size in memory	13.1 MiB		
Average record size in memory	208.0 B		

Figure 2: Charging Station Data Overview

Station Name: the name of the station;

Location: the location of the charging station by:

- street address,
- city,
- State,
- postal code,
- latitude, and
- longitude;

EVSE Num: the number of charging outlets by type:

- Level 1,
- Level 2, and
- DC Fast;

EV Network: the charging network that the station belongs to; and

Open Date: when the station opened.

Although we initially planned on using vehicle population for the entire US, we finally decided to abandon that effort for two reasons:

1. the sheer size of the dataset (over 5 Gb) would require compute resources that we did not have; and
2. the integration of the datasets required many lookups and conversions that were rate-limited (geoid, county, and/or zip-code conversions, etc).

Each state provided data in formats that were not standardized with each other, and location data was stored in ways that made data integration near impossible with the time frame that we had. One example of this was where registration data for vehicles was being stored as congressional districts and/or county name. Although we found a free API capable of making these conversions, the request rates are throttled to one request per second. With this conversion model, we could make only 86400 requests per day, so with over 1 million records, this was not viable.
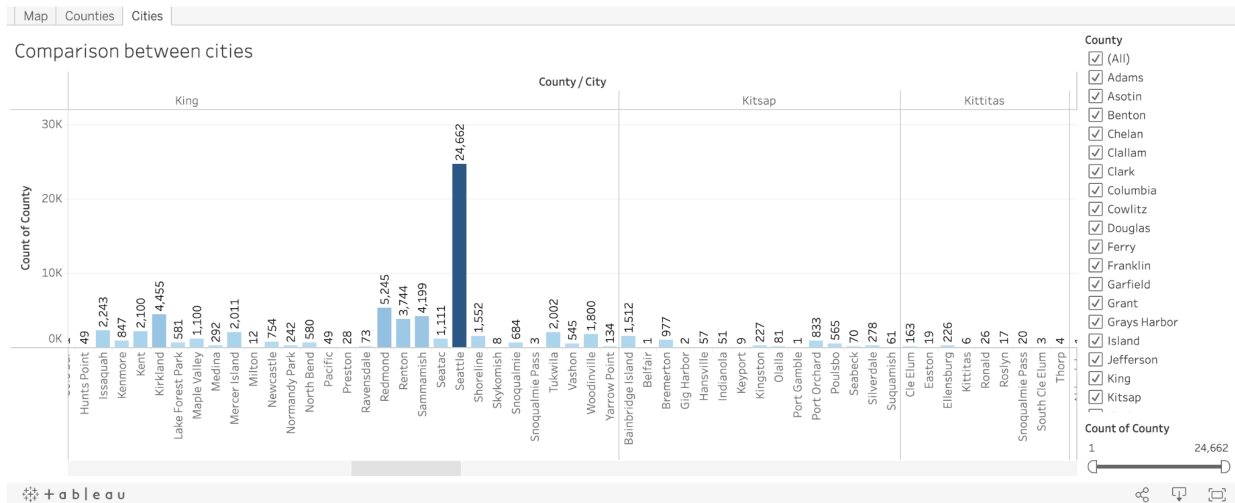
1.3. System Description

For this project we will try to understand the trend and gain insights on the EV Adoption, EV Charging Infrastructure as well as the regional insights for Electric Vehicles. For this we use different types of visualizations like the bar chart, maps, line chart, pie charts, heatmap visualizations, etc. All of these visualizations are also accompanied by useful filters to gain additional insights on the data.

In order to achieve the above goals, we implemented a web application for this data visualization system. The application has a straightforward and user-friendly home page and navigation bar to explore the different comparisons: 1) Regional Detail, 2) Ev Trends, 3) Charging Infrastructure. These three topics are divided into their own page.

In the Regional details page. This page will contain comparison information between different regions. Furthermore, one will be able to see a ranking of different cities. The user will also be able to compare infrastructure growth and EV adoption timelines with other cities and the mean adoption rates.

EV adoption trends page will show a comparison of car brands and models for certain time frames. Users will be able to filter according to the city, county, state as well as the model year range & the electric vehicle type. Which will provide a useful insight to the user regarding the adoption of different car brands.

The third visualization page will provide a much deeper look into charging infrastructure. On this page the user will be able to compare the evolution of the charging infrastructure in the US.. Similar to the EV Trends page, correlations between different states will be able to be seen. Firstly the overview tab will show info about the available outlets and newly opened one with useful filters. Secondly, the charging network tabs will showcase different brand's charging market share as well as growth by year and network. Lastly, on the EV & charging tab the EV to charger ratio is visualized.

1.4. Screenshots & Descriptions

1.4.1. Regional Detail Page

This map shows the count of EV's in different counties of Washington state, as we observe Snohomish has the most number of EV's showcasing its popularity. There's also an option to filter counties based on their count of EV.

This stacked bar chart compares the count of EV's in each county further categorized by the city. Hence you can hover on a tower to get insights on the count of EV in each city, moreover there is a filter for the count of city, to quickly find the counties and cities with most and least EVs.

This bar chart compares the count of EVs across all cities in Washington, with the option to filter based on the county. Hence the user can quickly visualize counts of EVs for each city for a particular county.

1.4.2. EV Trends
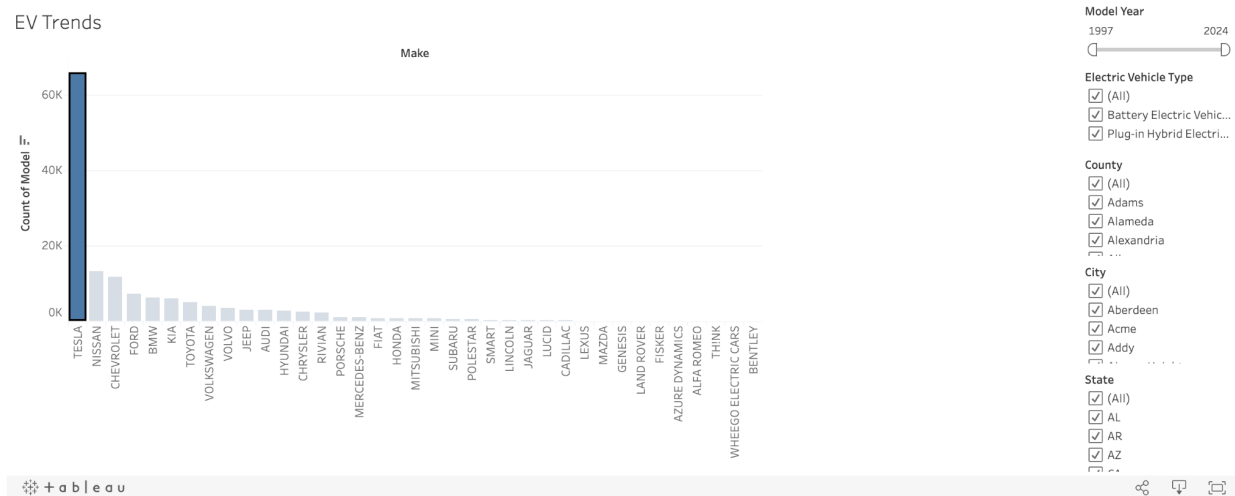
This bar chart provides insights on the count of EV across the United States, categorized by make of the car. This is helpful to understand how the car market is shaping up. Moreover there is a filter to select the year range, which helps the user to better understand the trend. There's also filters for the county, city and state which makes it easy to gain precise insights for the location, which can be helpful for both the law decision makers as well as companies expanding to new market locations.

1.4.3. Charging Infrastructure
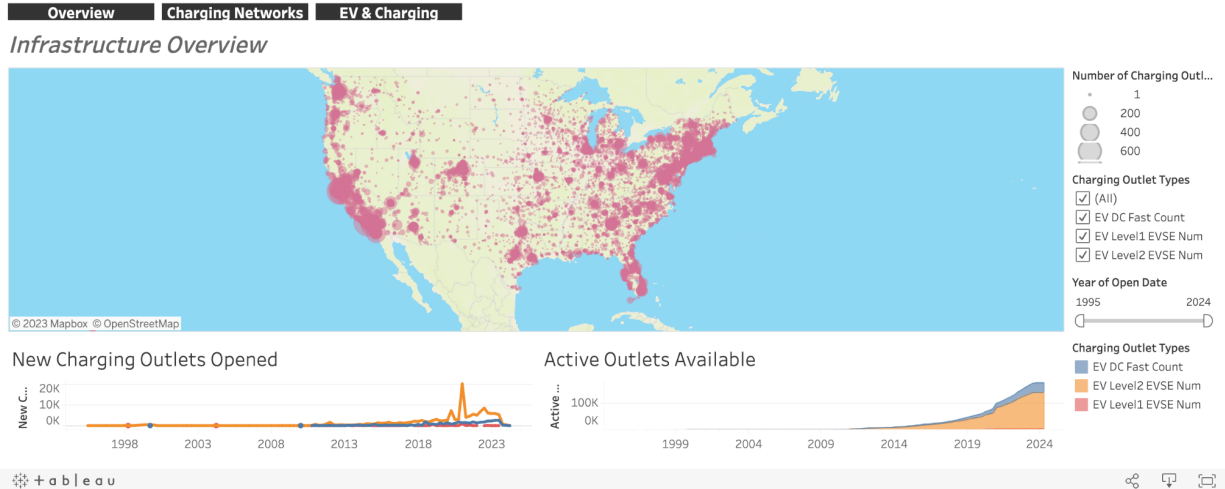
This map visualizes the distribution of charging stations across the United States, along with line chart and area chart to provide insights on new charging outlets opened as well as the Active outlets available. There are also multiple filter options like Number of charging outlets, Charging Outlet types & The year of open date. This visualization is useful for a lot of stakeholders including car users, new buyers, EV companies, energy companies, etc.
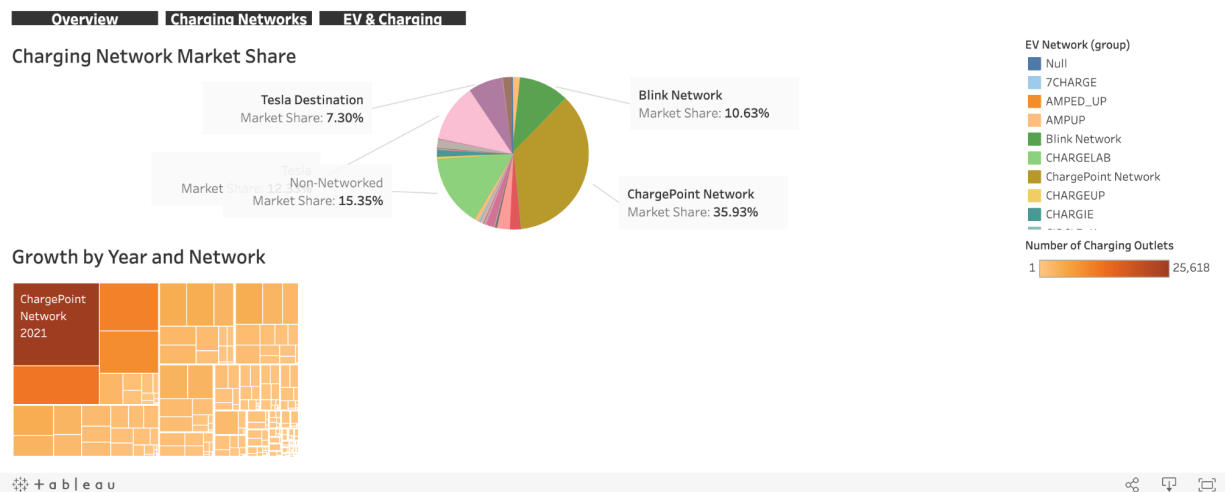
This Pie chart visualizes the network market share of different Charging station provider whereas the heatmap provides info regarding growth of charging station where each square represents total number of charging stations per year.
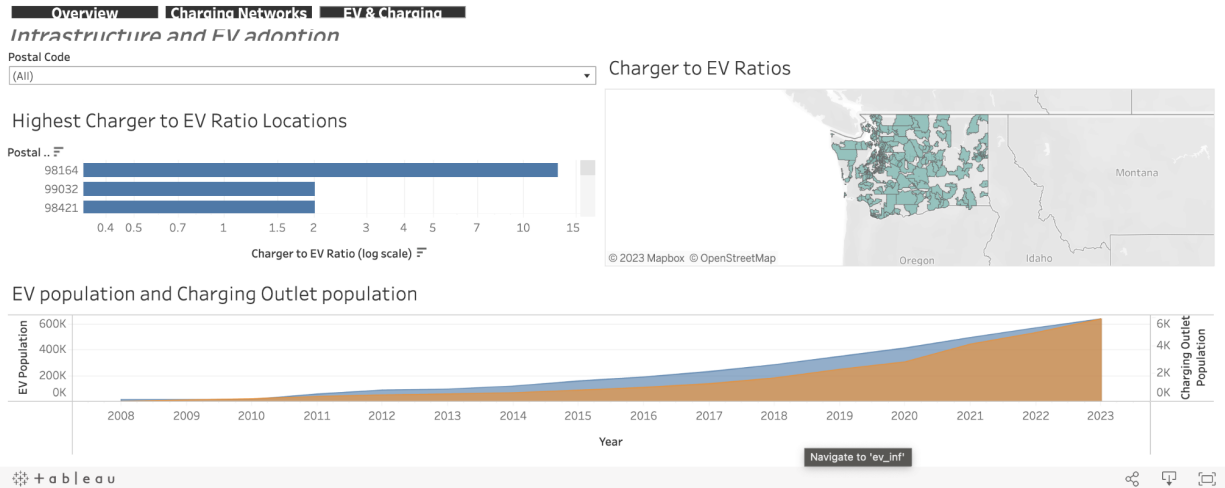
This Bar chart provides info of number of chargers per postal code for the state of Washington, the map visualization provides important information regarding charger to EV ratios that can be very useful to make decisions regarding buying an EV, installing a charging station as well as the trend of EV. Lastly the area chart provides comparison between the number of EV along with charging outlet population on different scales for y axis to better understand the data.

1.5. Link to Demo Video

Youtube link to the demo video: https://www.youtube.com/watch?v=AmQlykM6P6k

1.6. Link to system source

1. Github Repository: https://github.com/mk-imagine/csc805g5/tree/main
2. Website: https://jiji14.github.io/ev-insight-iq/