

# Machine Learning Report: Electric Vehicle Charging Infrastructure Trends

## 1. Introduction

- This report analyzes trends in electric vehicle (EV) charging infrastructure and sales data from the US Government's Alternative Fuels Data Center.
- The objective is to identify correlations between EV sales and the growth of public and private charging ports, providing insights for strategic planning in the EV charging network sector.
- Data includes yearly records of EV charging port installations, station locations (public and private), and EV sales.

## 2. Data and Methodology

- **Data Sources:**
  - `private_ev_charging.csv`: Private EV charging port and station data.
  - `public_ev_charging.csv`: Public EV charging port and station data.
  - `ev_sales.csv`: EV sales data by vehicle model and year.
- **Methodology:**
  - Data import and inspection using Pandas.
  - Data cleaning and preprocessing (handling missing values).
  - Data aggregation and merging to create a comprehensive dataset.
  - Visual analysis using Matplotlib and Seaborn to identify trends.
  - Trend consistency check.
  - The sales data was grouped by year and summed to create a total yearly sales number.
  - The public and private charging data was merged, and then merged again with the total yearly sales data.
  - Line plots were created to visualize the change in sales and public and private charging ports over time.

## 3. Key Findings and Analysis

- **Positive Correlation:**
  - A strong positive correlation exists between EV sales and the number of both public and private charging ports. As EV sales increase, there's a corresponding growth in charging infrastructure.
  - This is shown in the graphs that were created, as all three lines on the graph trend upwards together.
- **Public vs. Private Infrastructure:**
  - Public charging ports consistently outnumber private ports. This suggests significant public investment in EV charging infrastructure.
  - However, private charging port growth is also evident, indicating increasing private sector involvement.
- **Sales Trends:**
  - EV sales have shown a clear upward trend, particularly notable in recent years.
  - The visualization clearly shows the increase in sales over the years.
- **Trend Consistency:**

- Vehicle sales and the number of private and public ports show the same trend.

#### **4. Visualizations**

- **EV Ports and Sales Over Time:**
  - Line plots illustrating the trends in private ports, public ports, and total EV sales over the years.
  - This visualization highlights the correlation between sales and infrastructure growth.
  - The graph clearly shows the public ports having the highest number of ports, then sales, then private ports having the lowest number. All three trend upwards together.

#### **5. Conclusions and Recommendations**

- The data supports the conclusion that growth in EV sales is closely linked to the expansion of charging infrastructure.
- Continued investment in both public and private charging infrastructure is crucial to support the increasing adoption of EVs.
- Strategic planning should focus on:
  - Maintaining and expanding public charging networks.
  - Encouraging private sector investment in charging infrastructure.
  - Ensuring infrastructure development keeps pace with EV sales growth.
- The trend is the "same" between sales and ports.
- This data shows that EV's are growing in popularity, and that the infrastructure to support them is also growing.

#### **6. Future Work**

- Further analysis could explore regional variations in infrastructure growth and sales.
- Predictive modeling could be used to forecast future infrastructure needs based on sales trends.
- Analysis of the types of charging stations being installed could also be useful.