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Project Documentation: Finding Electric Vehicle Clusters and Dead Zones

Introduction

I created this project because I graduate next year and will move to downtown Chicago, where I plan on buying a car. I've always been fascinated by electric vehicles (EVs) because they're eco-friendly and represent the future of transportation. Initially, I made this project to help myself figure out how practical owning an EV would be, like understanding how far I could drive without worrying about finding a charger. But as I worked on it, I realized many people probably have similar questions, especially those considering switching to electric vehicles. So, I expanded my idea into this dashboard, hoping it can help others make informed decisions about driving electric.

Data Management

- **All Source Data Included or Properly Linked via URL:**

  The dashboard uses EV data provided by Washington State's open data portal, which is clearly linked and documented. If real data isn't available, the dashboard automatically uses a small set of dummy data.

- **Data Cleaning Process Thoroughly Documented:**

  I documented every step of how I cleaned the data. First, I removed any entries that didn't include clear location information. Then, I converted the location data from text (WKT format) into geographic points that could easily be displayed on a map using the GeoPandas library. This ensures the data is accurate and ready for mapping.

- **Sampling Methodology Explained (if applicable):**

  For this project, I didn't need to sample the data since I was able to manage and analyze the entire dataset. The full data was manageable and provided more accurate insights.

Methodology Explanation

- **Clear Rationale for Visualization Selection:**

  I chose a map as my primary visualization because EV movement patterns are easiest to understand visually. Seeing clusters on a map quickly shows busy areas and clearly highlights places where chargers might be missing. Bar charts and pie charts were also added to summarize information in a simple way, making it easy to compare clusters and types of EVs.

- **Explanation of Data Preparation Decisions:**

  To show realistic EV travel ranges, I calculated how far each EV could travel based on its battery range. I then used a clustering algorithm (DBSCAN) to group destinations so the results would be meaningful and easy to interpret. I set specific clustering parameters to ensure clusters were clear and useful for identifying high-traffic areas and dead zones.

Critical Analysis

- **Self-critique Identifying Limitations of Current Approach:**

  While the dashboard provides useful insights, it has some limitations. Right now, it assumes all EVs drive straight eastward, which isn't realistic because vehicles typically drive in many different directions. Another limitation is that the clustering depends heavily on the set parameter "eps," so if this parameter isn't adjusted carefully, clusters may not accurately represent actual patterns.

- **Discussion of Potential Improvements and Future Directions:**

  To improve this project, I could make the simulation more realistic by considering actual driving routes or allowing multiple directions of travel. Adding real-time charger station locations would also be valuable, as users could directly see where new chargers are needed. In the future, I'd like to expand the project to include other cities beyond Washington State, especially Chicago, since that's where I'll live next. This could make the tool even more helpful for many more EV drivers.