ReDI School of Digital Integration

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ReDI School of Digital Integration

Analyzing EV Adoption Trends

This project compares global and U.S. EV adoption patterns using data analysis and visualization techniques.

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Motivation: Why this project/ Idea / Datasets?

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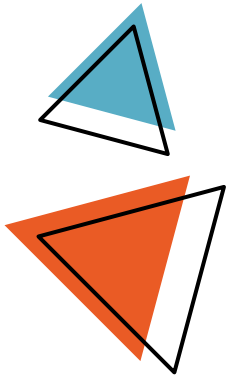
Topics Covered

The project encompassed the following major topics:

1. **Problem Definition and Dataset Selection**
2. **Data Cleaning & Preprocessing [Global & U.S. EV Datasets]**
3. **Exploratory Data Analysis – EDA**
    - Trend Comparison – Global vs U.S. EV Adoption over Time
    - Regional Distribution of U.S. EV Uptake
    - Differences in EV Types and Technologies Across U.S. Regions
4. **Ethical Considerations and Limitations**
5. **Conclusion and Future Work**



1. Problem Definition and Dataset Selection

Problem Definition

- ❑ EVs are pivotal in the global transition toward sustainable transport.
- ❑ This project investigates **EV adoption trends** from two perspectives:
  - ✓ **Global growth trajectory** (2010–2024)
  - ✓ **U.S.-specific distribution and characteristics**

Analytical Approach

- ❑ **Top-Down Analysis** *(Global)*
  - ✓ Based on IEA Global EV Data (2010 – 2024)
  - ✓ Covers EV stock, sales, and market share across regions
- ❑ **Bottom-Up Analysis** *(U.S.)*
  - ✓ Based on EV Population Data (230,000+ records)
  - ✓ Includes model details, location, type, range, and more

Datasets Used

- ❑ **IEA Global EV Data (2010 – 2024)**
  - ✓ Source: Kaggle
  - ✓ Key Columns: *region, year, parameter, powertrain, value*
- ❑ **Electric Vehicle Population Data (U.S.)**
  - ✓ Source: Kaggle
  - ✓ Key Columns: Model Year, Make, Model, State, EV Type, Electric Range, Location

2. Data Cleaning & Preprocessing *[Global & U.S. EV Datasets]*

Objective

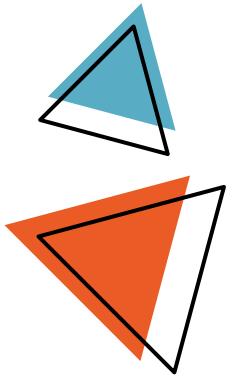
Ensure data quality, consistency, and readiness for analysis by cleaning both global and U.S. EV datasets.

Key Preprocessing Steps

- Handled missing or null values
- Removed duplicate entries
- Renamed ambiguous or unclear columns
- Standardized column formats (e.g., year, location names)
- Verified value ranges and column data types
- Performed basic exploratory checks

Applied On

- IEA Global EV Dataset ✓
- U.S. Electric Vehicle Population Dataset ✓



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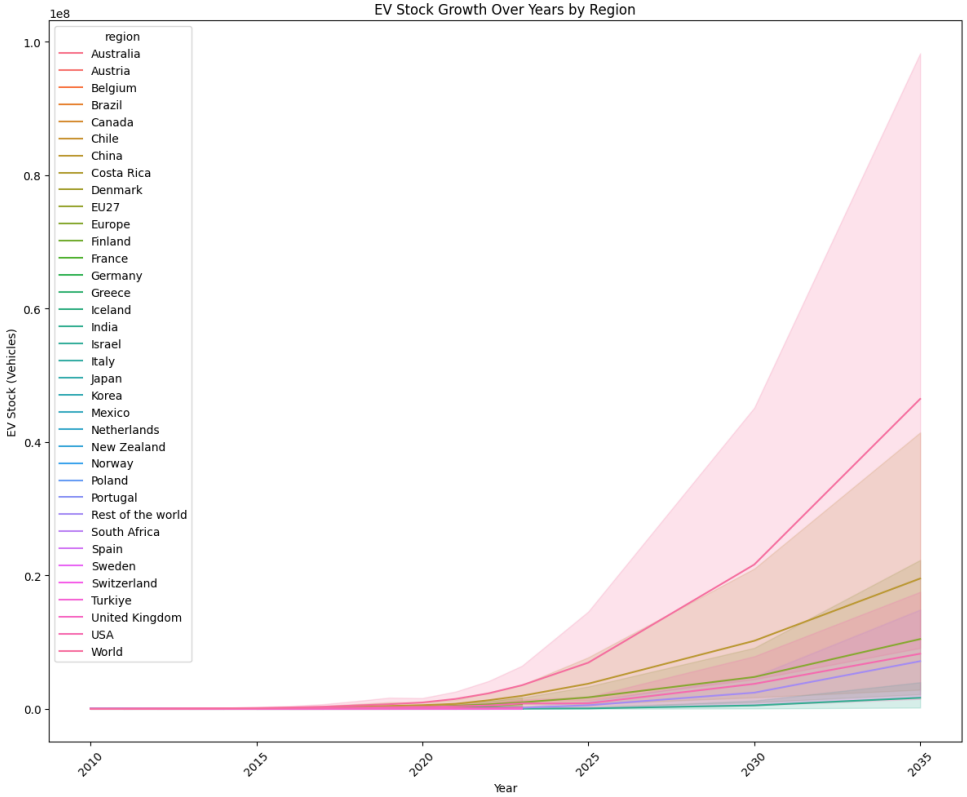
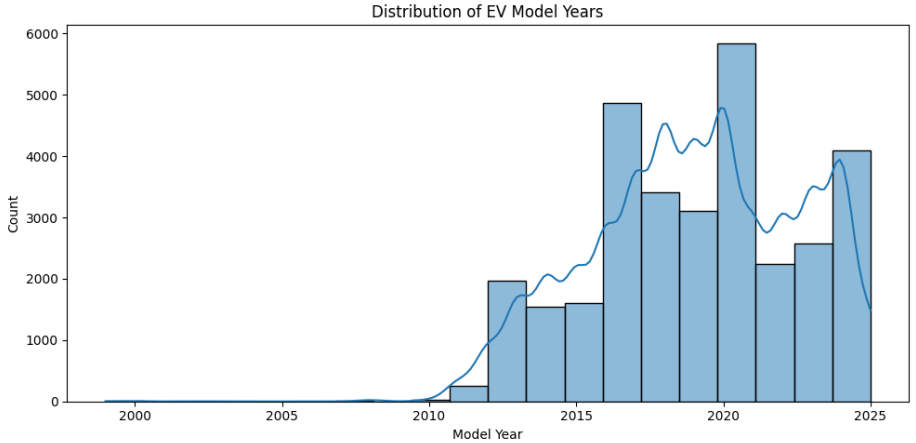
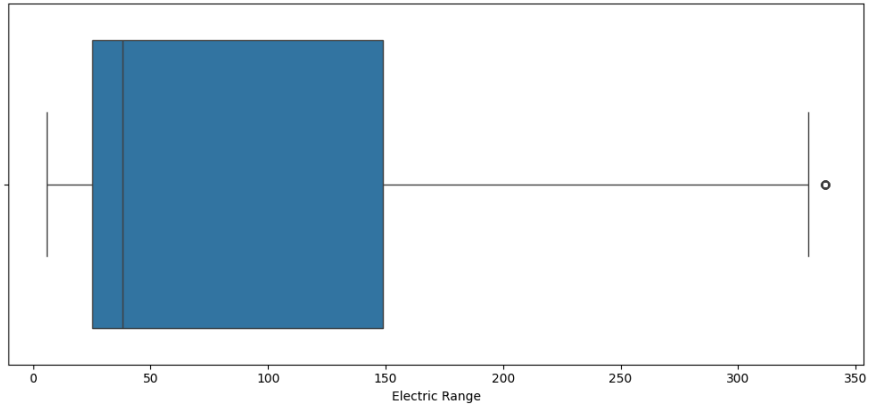






3. Exploratory Data Analysis – EDA

Objective

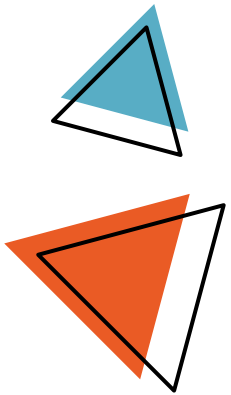
To uncover key trends, regional disparities, and technological patterns in global and U.S. EV adoption.

Overview of Analysis Steps

- **3.1 Trend Comparison – Global vs. U.S. (2010–2024)**
  - → Analyze EV stock and sales growth globally and in the U.S.
  - → Identify alignment and divergence in adoption patterns.
- **3.2 Regional Distribution of U.S. EV Uptake**
  - → Total EV Count by State
  - → Choropleth Map – Visualizing adoption intensity across the U.S.
- **3.3 EV Types & Technologies Across U.S. Regions**
  - → BEV vs PHEV distribution in top 10 states
  - → Most Popular EV Models by Region
  - → State-wise % share of BEVs and PHEVs

Approach

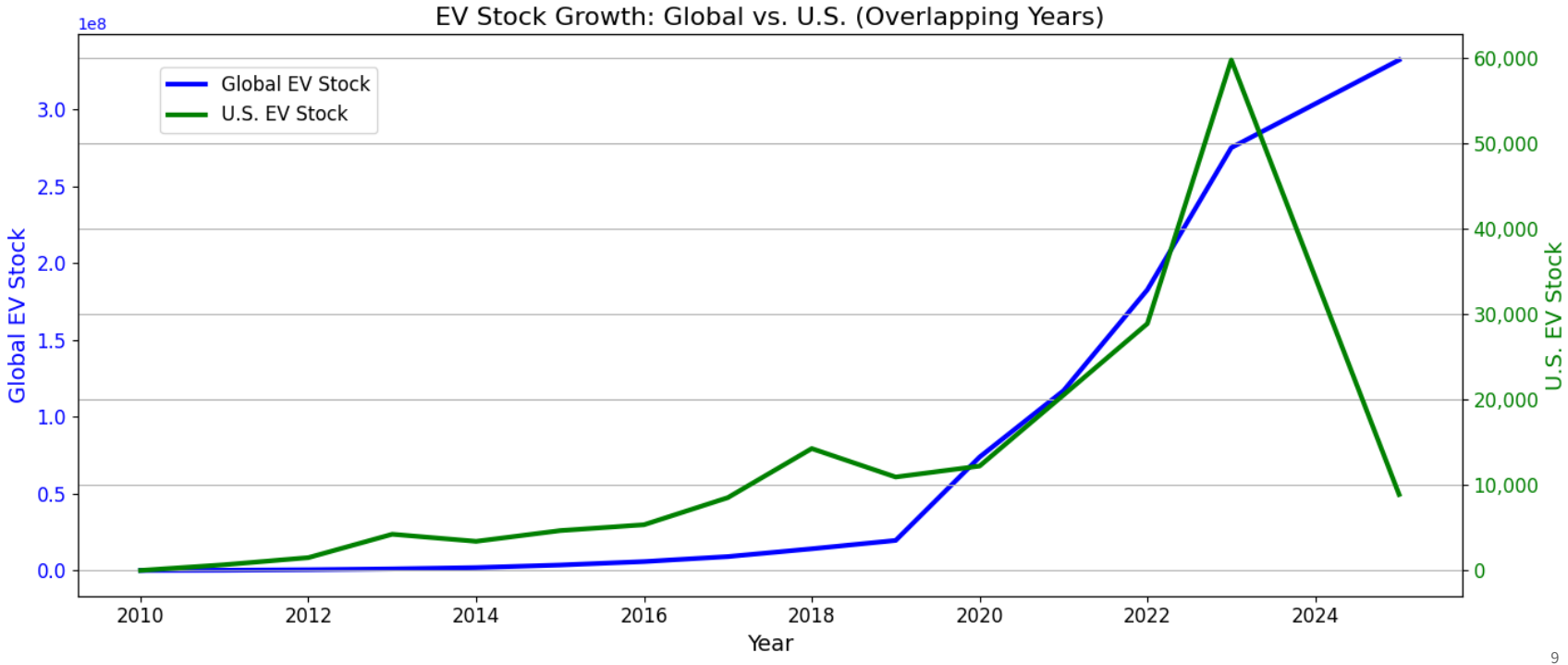
Combines visualizations and statistical summaries to build a comprehensive narrative of EV adoption trends.



3. Exploratory Data Analysis – EDA

Research Question 1

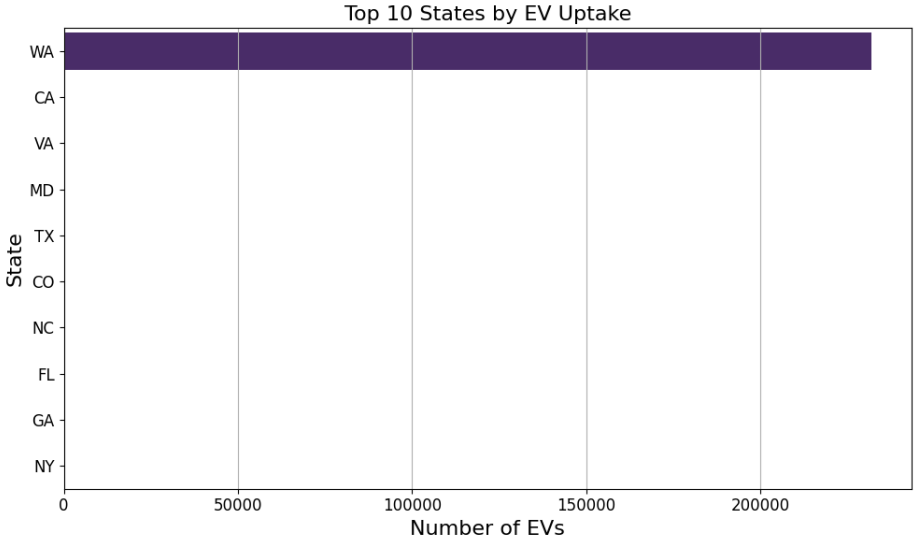
To what extent do U.S. EV adoption trends align with global patterns?

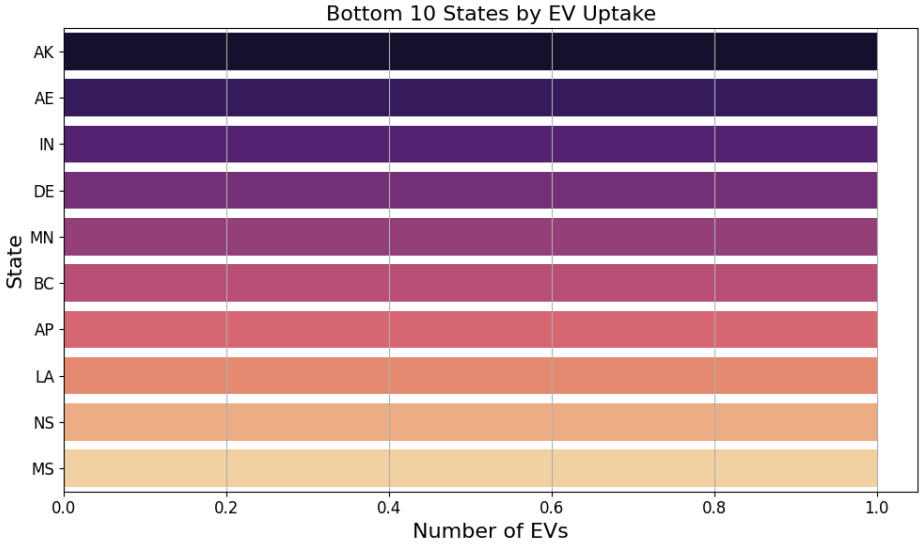


3. Exploratory Data Analysis – EDA

Research Question 2

Which regions in the U.S. are leading or lagging in EV uptake?





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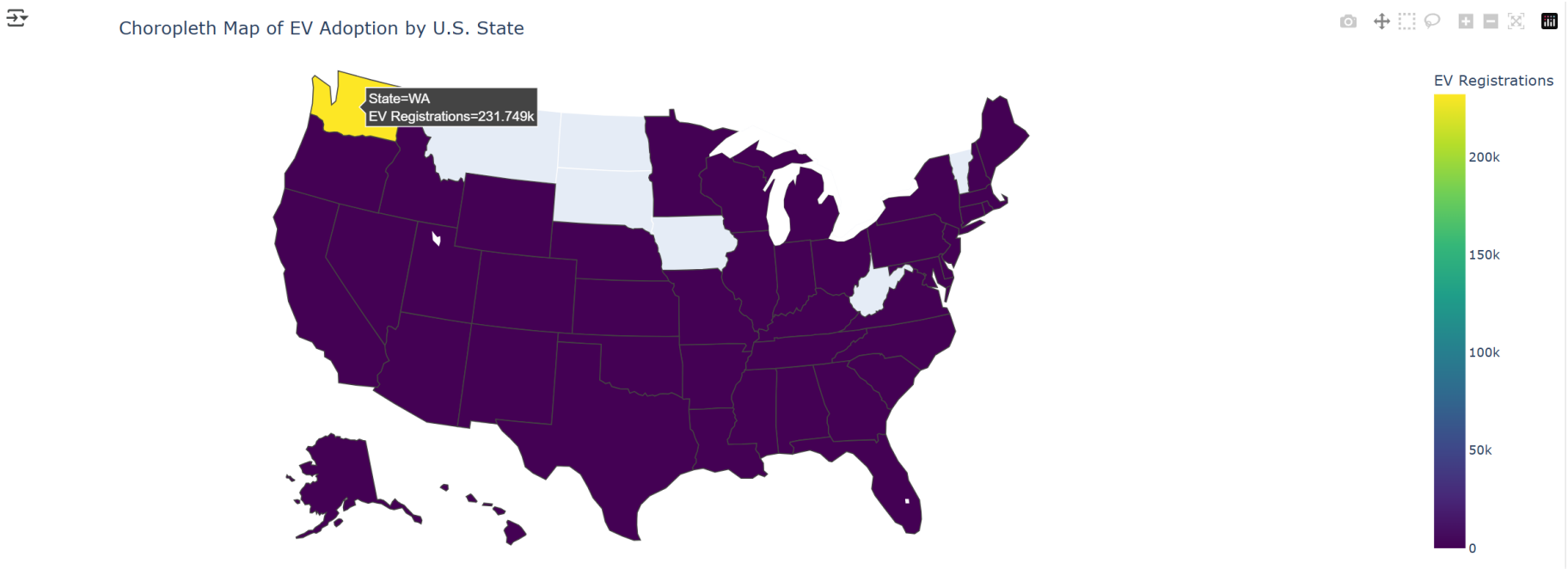
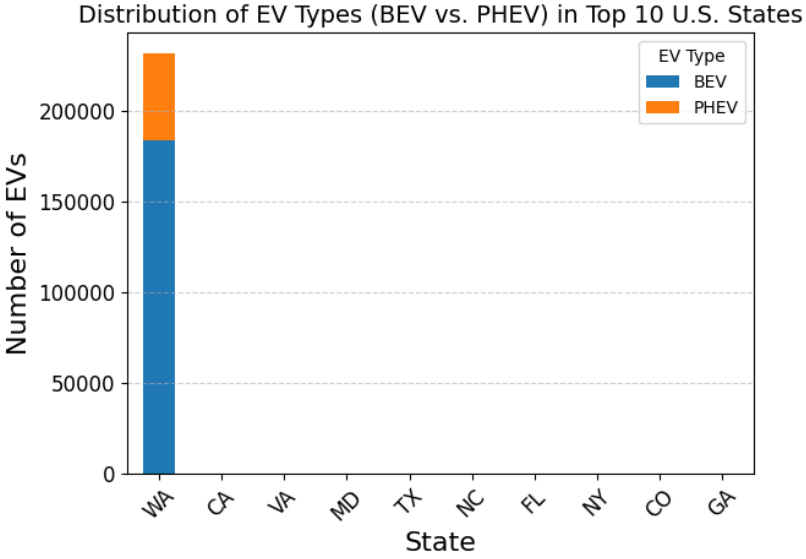
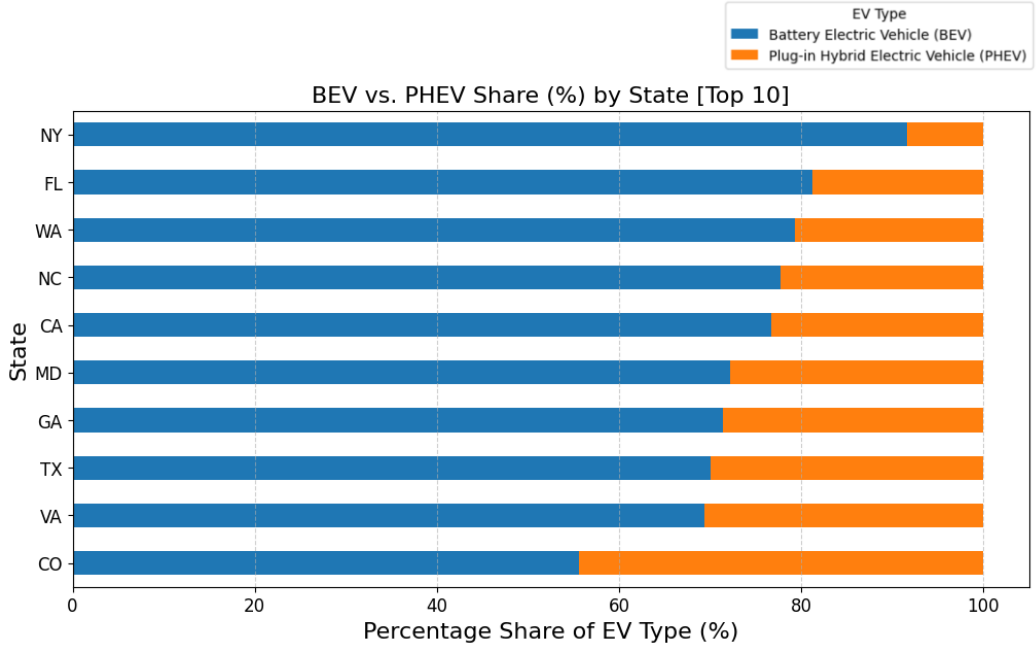


3. Exploratory Data Analysis – EDA

Research Question 3

What are the key differences in EV types and technologies across US regions?





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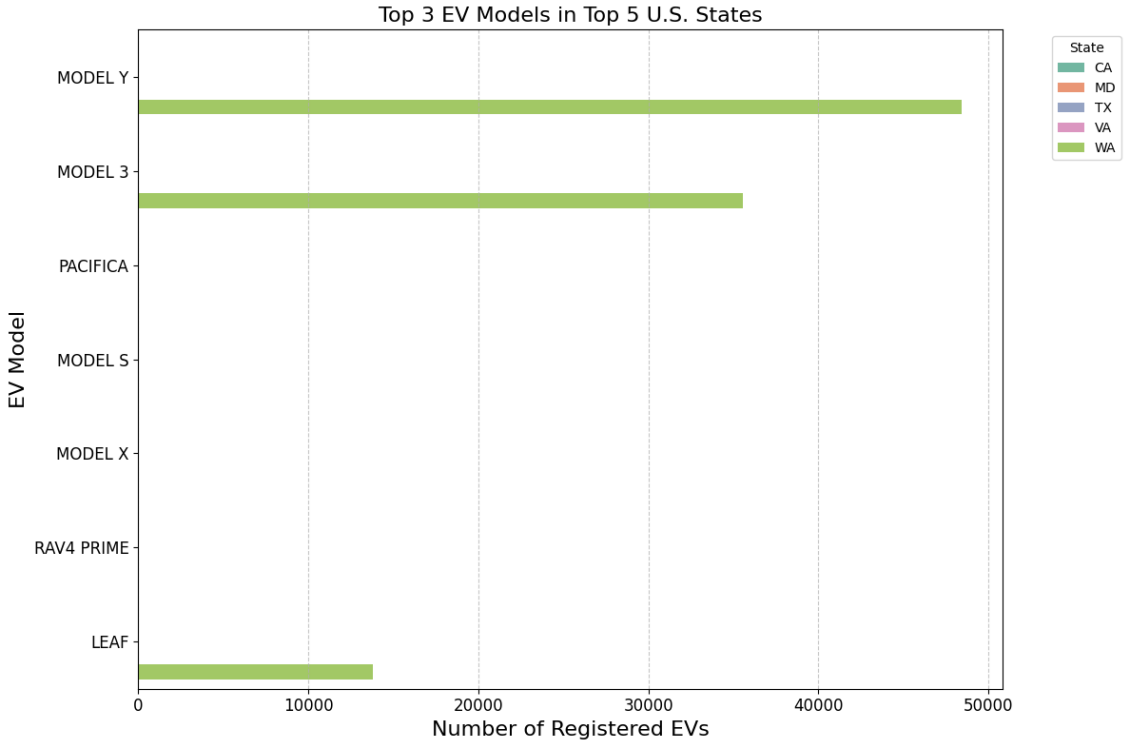


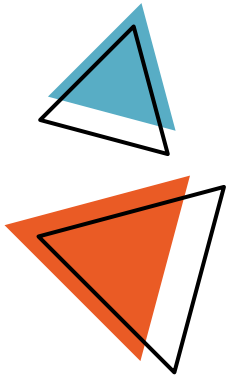
4. Ethical Considerations and Limitations

Ethical Considerations

- Used **public, anonymous datasets** — no personal or identifiable information.
- Maintained objectivity and fairness in interpreting results.

Key Limitations

- **Limited Coverage**: Some U.S. states or global regions may be underrepresented.
- **Bias Risk**: States like California and Washington might skew national-level insights.
- **Outdated Data**: May not capture latest EV models, market shifts, or policy updates.
- **Global Reporting Variations**: Definitions and EV classification differ across countries.



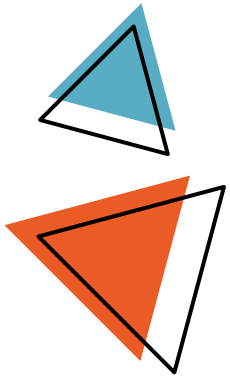
5. Conclusion & Future Work

Conclusion

- **Global and U.S. EV adoption** has accelerated significantly between 2010 and 2024.
- **Washington** leads U.S. EV uptake; many other states lag behind in adoption and infrastructure.
- **Battery Electric Vehicles (BEVs)** dominate in both global and U.S. markets, but regional preferences vary.

Future Improvements

- Integrate **more diverse datasets** for a broader, more inclusive perspective.
- Explore **social, policy, and environmental factors** influencing EV adoption.
- Include **predictive modelling** to forecast future EV trends across different regions.



Bibliography

- Electric Vehicle Population Data (U.S.)
  https://www.kaggle.com/datasets/yashdogra/ev-bhebic-c

- IEA Global EV Data (2010 – 2024)
  https://www.kaggle.com/datasets/patricklford/global-ev-sales-2010-2024/data

- GitHub link to the project repository
https://github.com/SyedHussnainHaiderKazmi/EV-Adoption-Trends-Global-vs-US

Thanks a lot!

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