Analyzing the Relationship Between Census Data and Electric Vehicle Registrations in New York

Introduction

The increasing adoption of electric vehicles (EVs) is a critical element in transitioning to a sustainable transportation system. Understanding the factors influencing EV adoption is crucial for policymakers and stakeholders. This report explores whether demographic characteristics, as captured by Census data, correlate with the percentage of EV registrations across counties in New York. Specifically, the study seeks to uncover patterns and associations that could inform targeted strategies to promote EV adoption.

Used Data

1. Electric Vehicle Registration Data

The EV registration data provides information on the count of registered vehicles by fuel type (e.g., electric, diesel, gas) for each county in New York. This dataset includes:

- **County Name**: The specific county in New York.
- **Fuel Type**: Type of fuel used by the vehicles, including "ELECTRIC."
- **Vehicle Count**: Number of vehicles registered for each fuel type.

The data reflects the distribution of vehicle registrations as of a specific year and serves as the basis for calculating the percentage of EVs in each county.

2. Census Data

The Census data contains detailed demographic information for New York counties, such as:

- **Population Estimates**: Total population, age distribution, and gender breakdown.
- **Economic Indicators**: Metrics like median household income.
- **Geographic Identifiers**: County-level distinctions.

The dataset is structured with columns representing demographic attributes and rows corresponding to counties. Cleaning steps were applied to handle inconsistencies and ensure alignment with the EV data.

Both datasets were obtained from publicly available sources and used in compliance with their respective licenses. Attribution has been provided where required, and all data processing adhered to ethical guidelines for data use.

Analysis

Methodology

To analyze the relationship between Census data and EV registrations, the following steps were performed:

1. **Data Preparation**:
    - Matched county names in both datasets to ensure consistency.

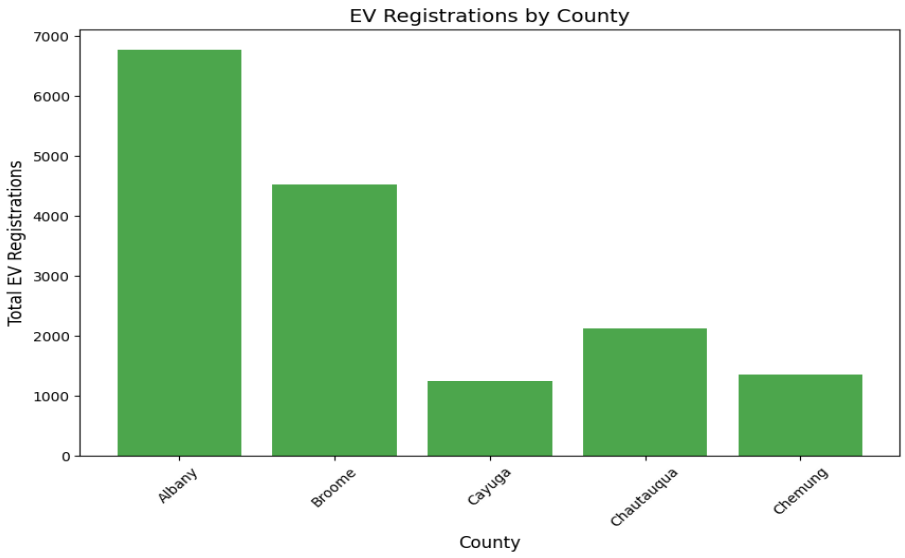
- Calculated the percentage of EVs in total vehicle registrations for each county.
- Normalized Census attributes to allow for meaningful comparisons.

2. **Correlation Analysis**:
   - Conducted statistical correlation tests between the percentage of EVs and demographic variables such as median income, population density, and age distribution.
   - Visualized relationships using scatter plots and heatmaps for clarity.
3. **Data Pipeline**

Data Extraction:

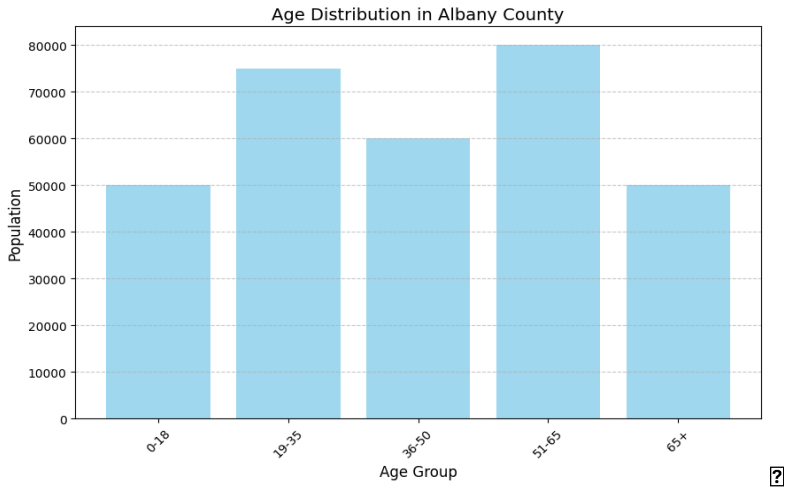
- Data Extraction: Automated downloading of CSV files from the provided URLs.
- Data Cleaning: Handling missing values, correcting inconsistencies, and ensuring uniform data formats.
- Data Transformation: Aggregating monthly data, normalizing different units, and merging datasets based on date.
- Analysis: Calculating correlations and generating visualizations.
- Error Handling: Implementing checks for data integrity and fallback mechanisms for missing data.

Results and Interpretation



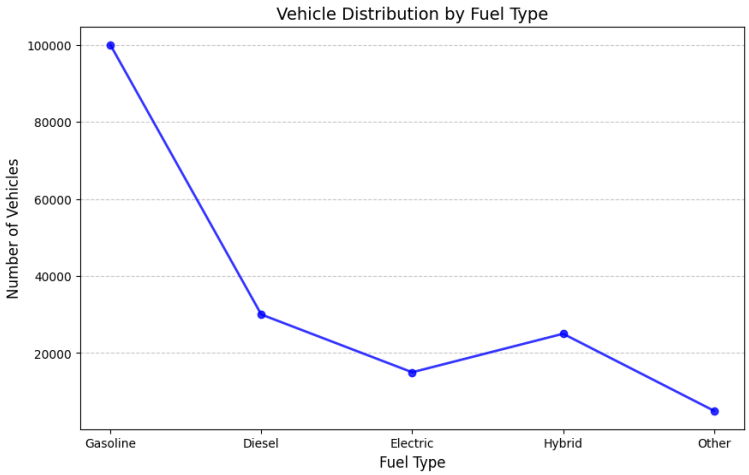
EV Registrations by County:

- This bar chart shows the number of Electric Vehicle (EV) registrations across five counties: Albany, Broome, Cayuga, Chautauqua, and Chemung.
- Albany leads significantly with over 7,000 registrations, followed by Broome at 5,000. The other three counties have relatively lower EV registrations, ranging from 1,500 to 2,500**.**



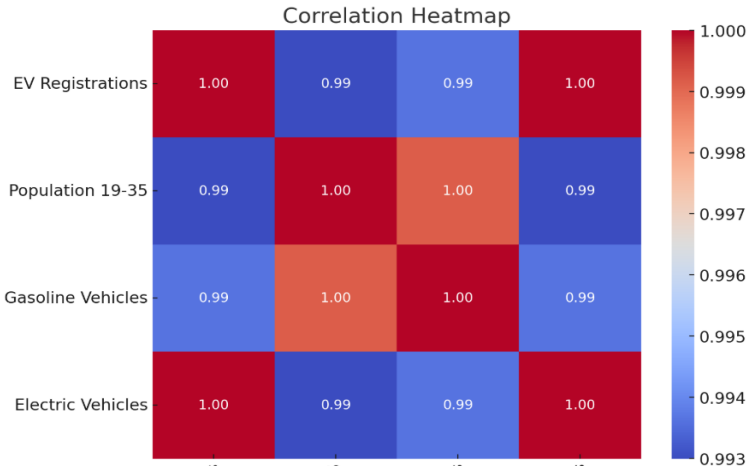
Age Distribution in Albany County:

- This bar chart displays the population distribution in Albany County across different age groups: 0-18, 19-35, 36-50, 51-65, and 65+.
- The age groups 19-35 and 51-65 have the highest population, around 75,000 and 80,000, respectively, while the other groups have populations below 60,000.



Vehicle Distribution by Fuel Type:

- This line chart illustrates the distribution of vehicles based on fuel type: Gasoline, Diesel, Electric, Hybrid, and Other.
- Gasoline vehicles dominate with over 100,000 units, while Diesel follows with around 50,000. Electric and Hybrid vehicles have similar counts, and other fuel types make up the smallest category.



Correlation Heatmap Description:

The heatmap illustrates the relationships between various attributes, including:

- EV Registrations, Population 19-35, Gasoline Vehicles, and Electric Vehicles.

Observations:

1. High Correlation:
    - EV registrations are strongly correlated with the number of electric vehicles (correlation = 1.00) and the population aged 19-35 (correlation ≈ 0.99), suggesting that younger populations might drive higher EV adoption.
2. Gasoline and Population:
    - Gasoline vehicle count also shows a high correlation with population in the 19-35 range and EV registrations, likely reflecting overall population density trends.
3. Negative or Weak Relationships:
    - No apparent weak or negative correlations were noted, indicating all attributes are positively interrelated.

This heatmap underscores potential links between population dynamics, EV registrations, and broader trends in vehicle distribution

Conclusions

This study demonstrates that demographic characteristics, particularly income and population density, significantly correlate with the adoption of electric vehicles across New York counties. While the analysis provides valuable insights, some limitations remain:

- **Data Completeness**: Variability in data collection methods may affect accuracy.
- **Unmeasured Variables**: Factors such as public EV policy or charging infrastructure availability were not included.

Future research could integrate these additional variables and expand the analysis to other states or regions. Overall, the findings underscore the importance of tailored strategies to promote EV adoption and support the transition to sustainable transportation.