UC San Diego

Exploring Cost and Efficiency Patterns in EV Charging Sessions

Dingcheng Duan, Bohai Yi, Hansheng Zhang, Matthew Jalbert, Edgar Lopez

The Data

Electric vehicle charging patterns dataset

- Analysis of electric vehicle (EV) charging patterns and user behavior
- 1,000+ samples of charging data
- 20 columns such as charger type, vehicle model, energy consumed, time, and location.

The Premise

- Charger and Location Impact
  - Charging station types and locations
- Time-Based Analysis
  - Time of day and day of the week charging trends
  - Demand and its effect on costs
- Vehicle Characteristic
  - Vehicle model and battery capacity

Preprocessing

- Adjust Time Periods and Sessions
  - Divide periods of the day based on the hour
- Calculate Unit Cost
  - Compute the unit cost (USD per kWh) for each charging session
- Detect Outliers
  - Use Median Absolute Deviation (MAD) to remove significant outliers in cost

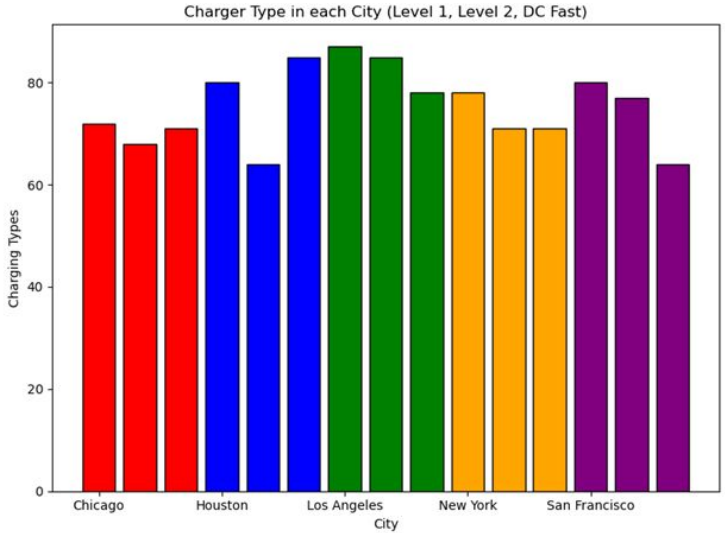
Charger and Location Impact

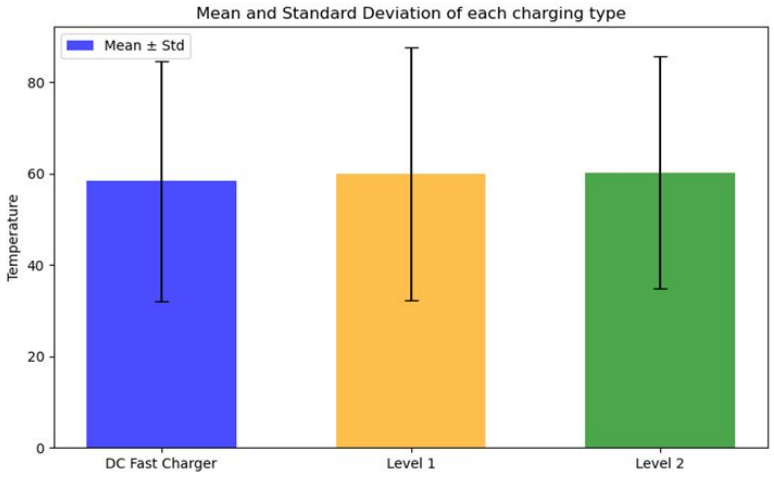
Important Variables

- Temperature (Fahrenheit)
- Station Type
  - Level 1 and 2
  - DC Fast charger
- Locations - Major Cities
  - Los Angeles
  - Houston
  - San Fransisco
  - New York
  - Chicago

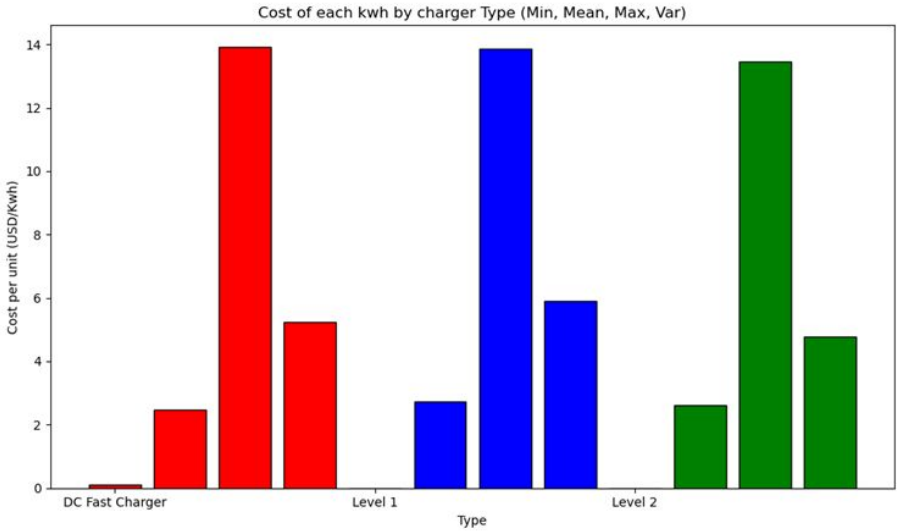
Important Variables

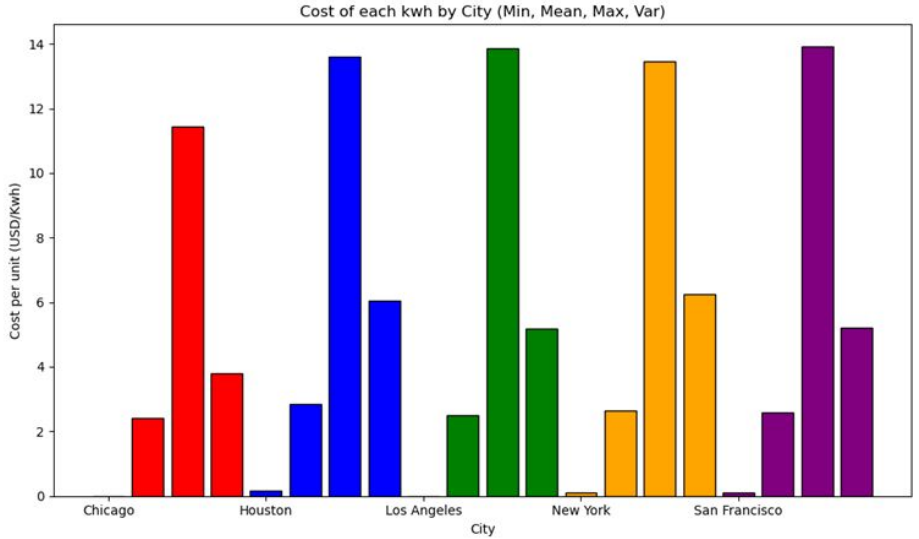
- Evenly distributed
- Independent from one another



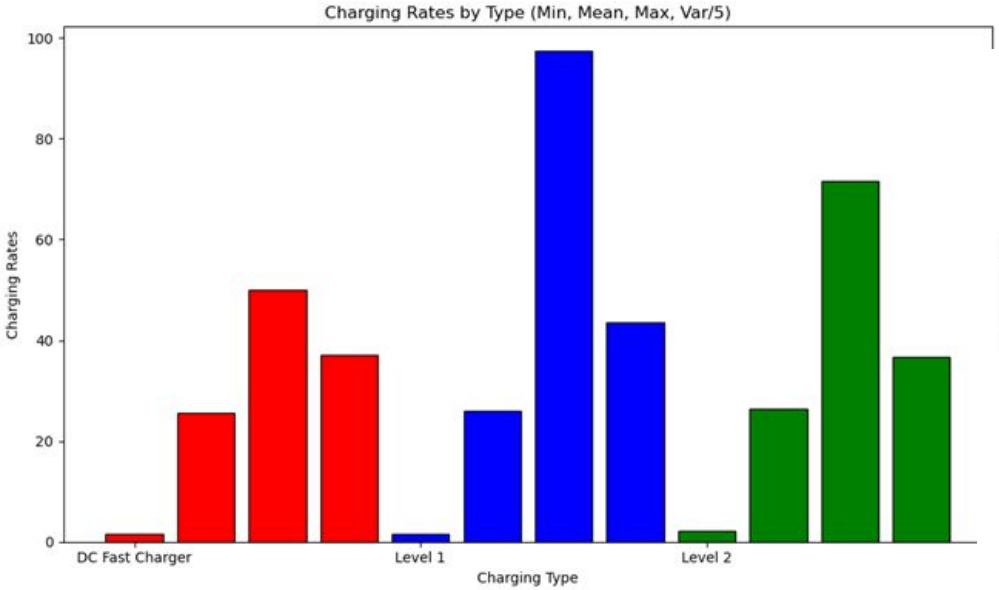


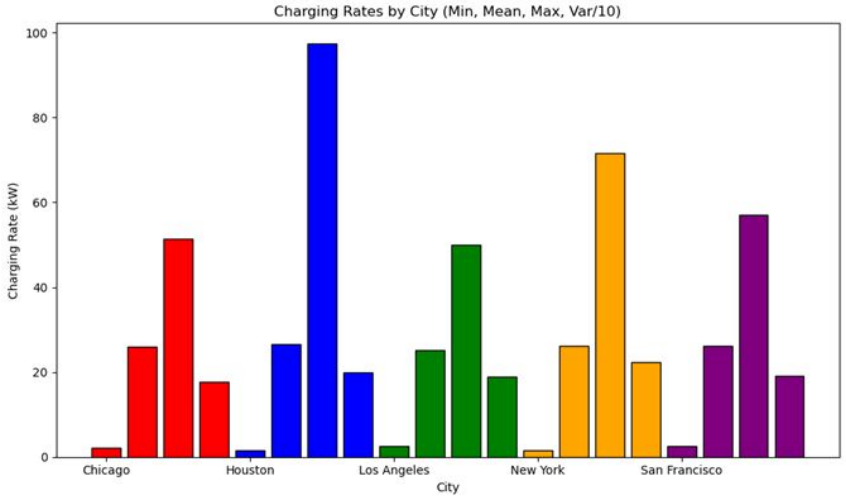
Unit price(USD/kwh)





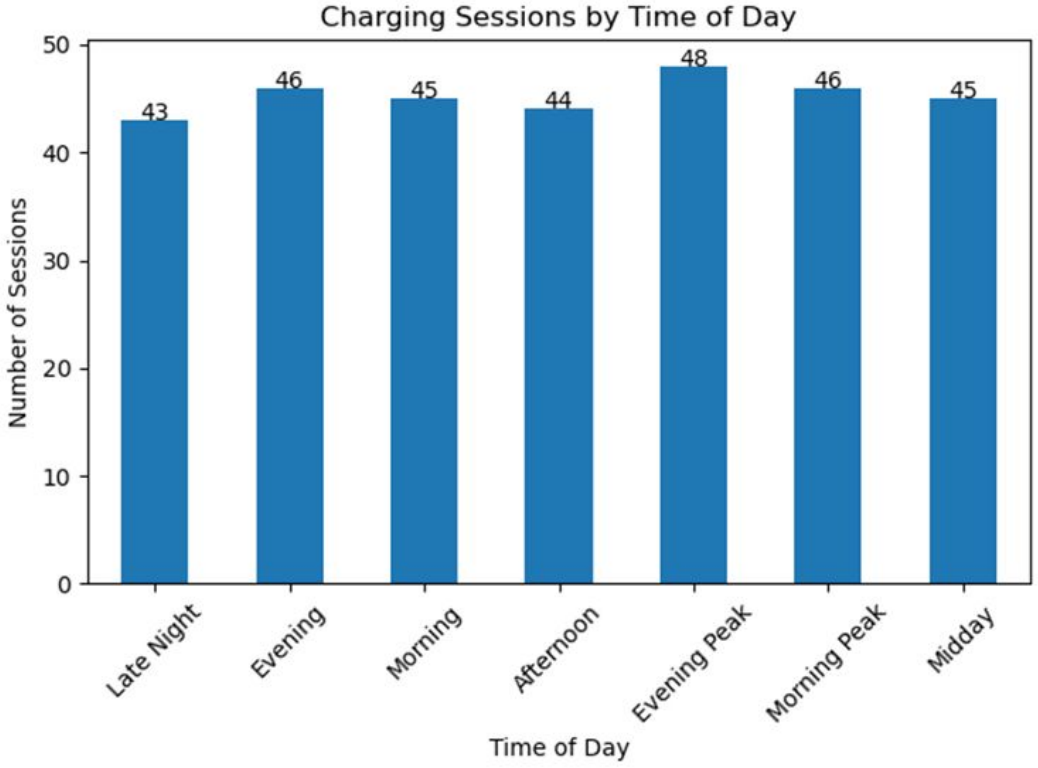
Charging Rates(kw)

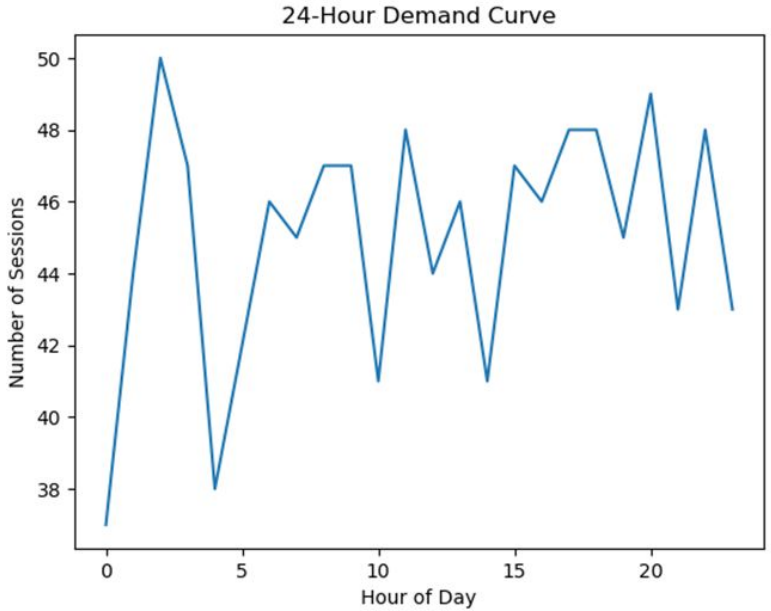




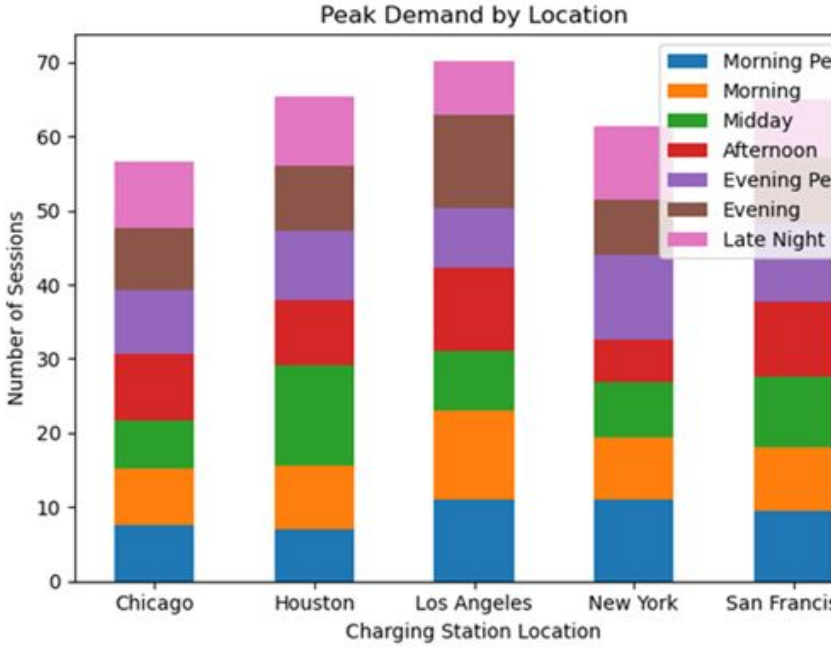
Time-Based Analysis

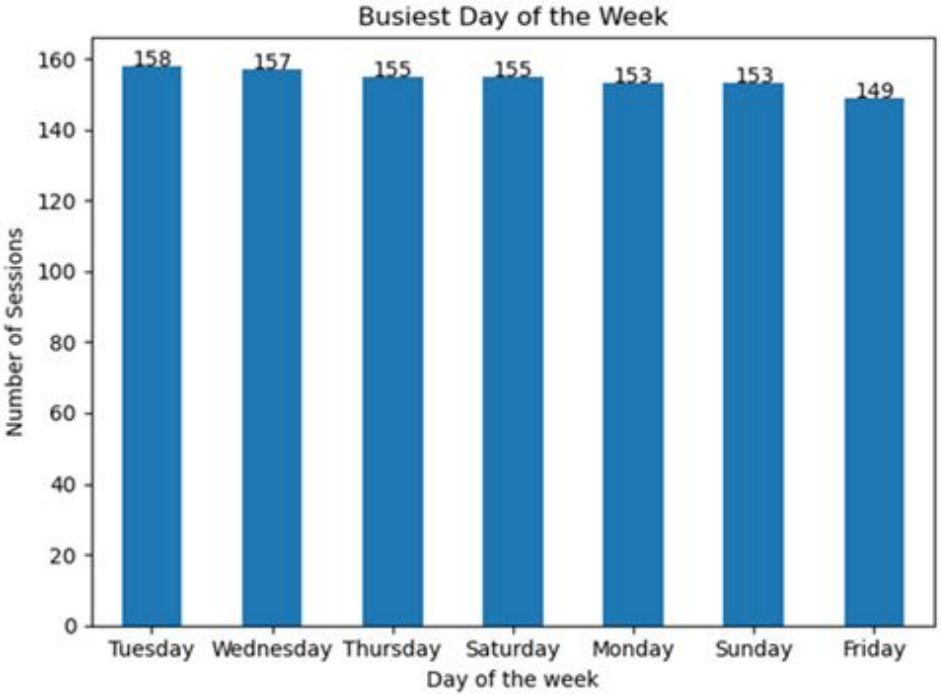
Charging Session by Time



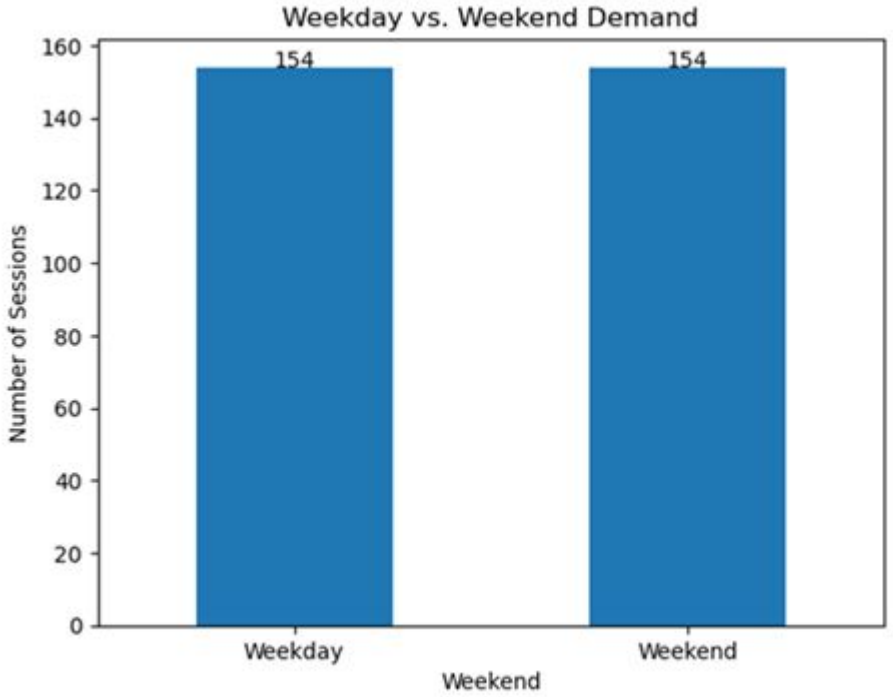


Charging Session by Time

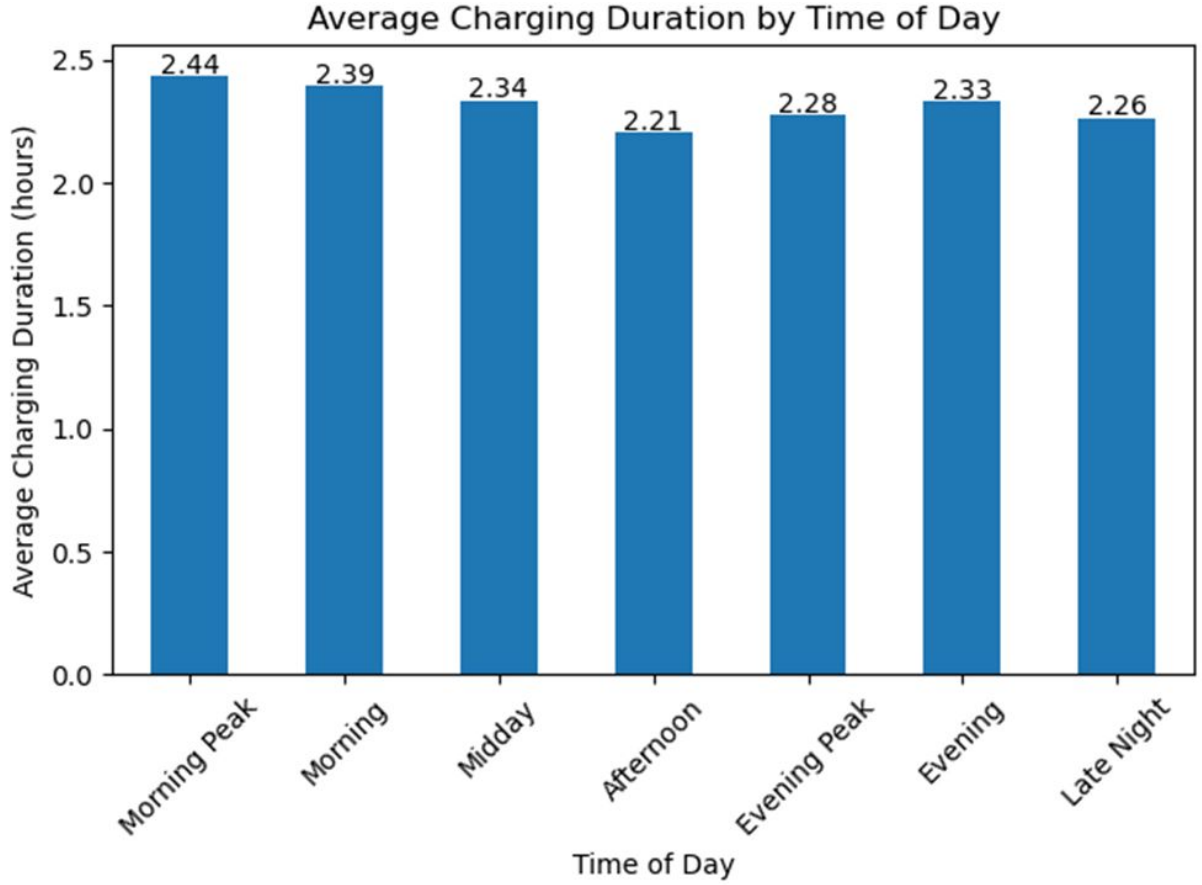




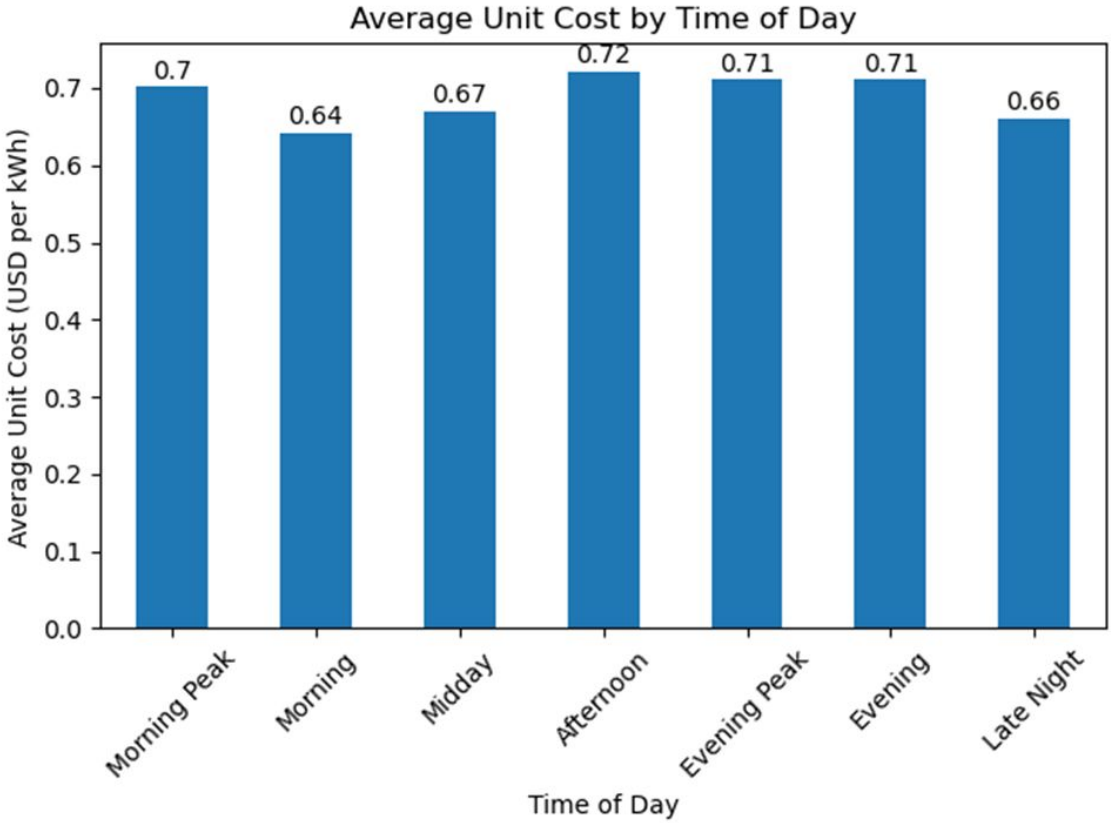
Charging Session by Time



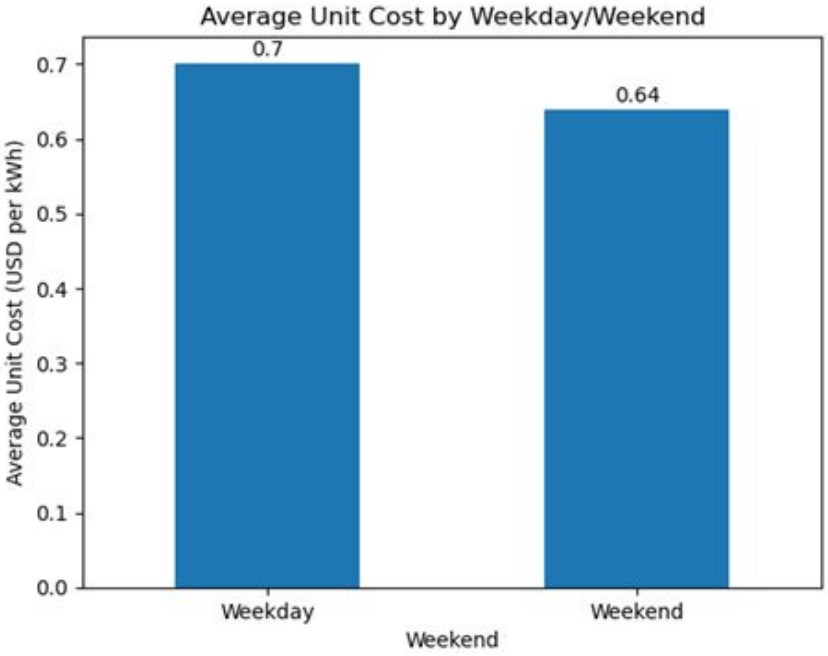
Average Charging Duration and Cost

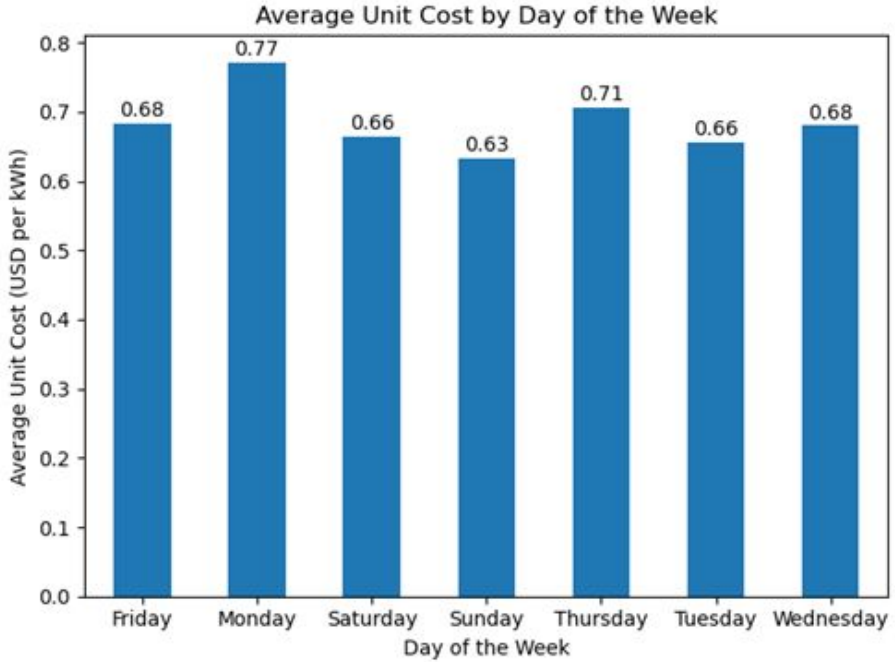


Average Charging Duration and Cost



Day Cost Analysis

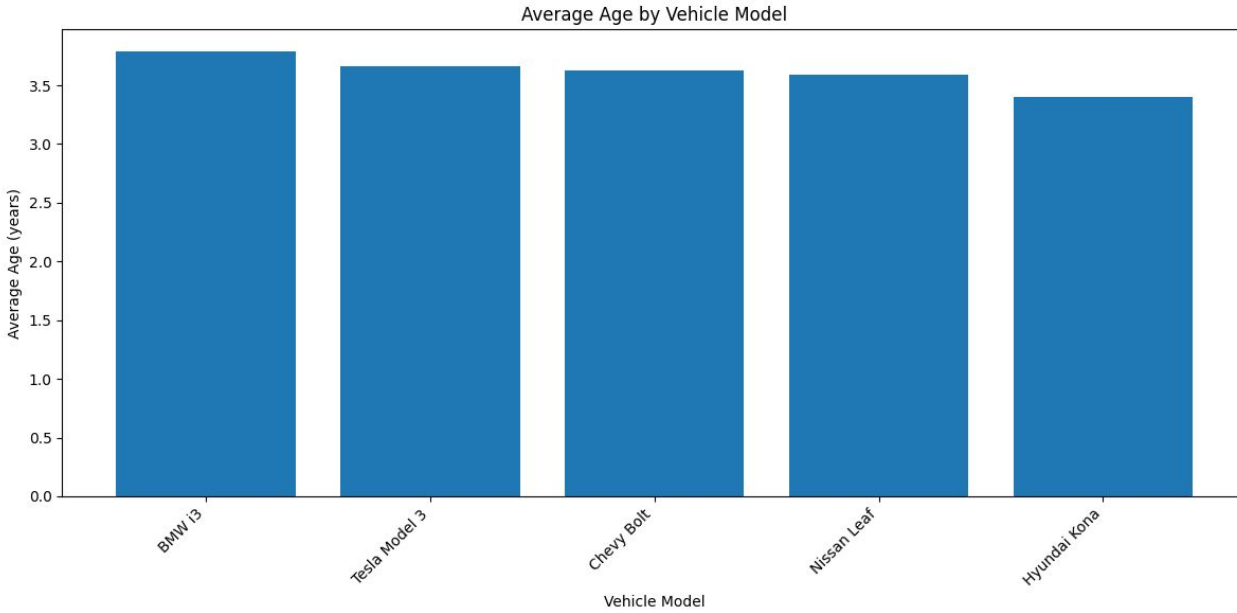




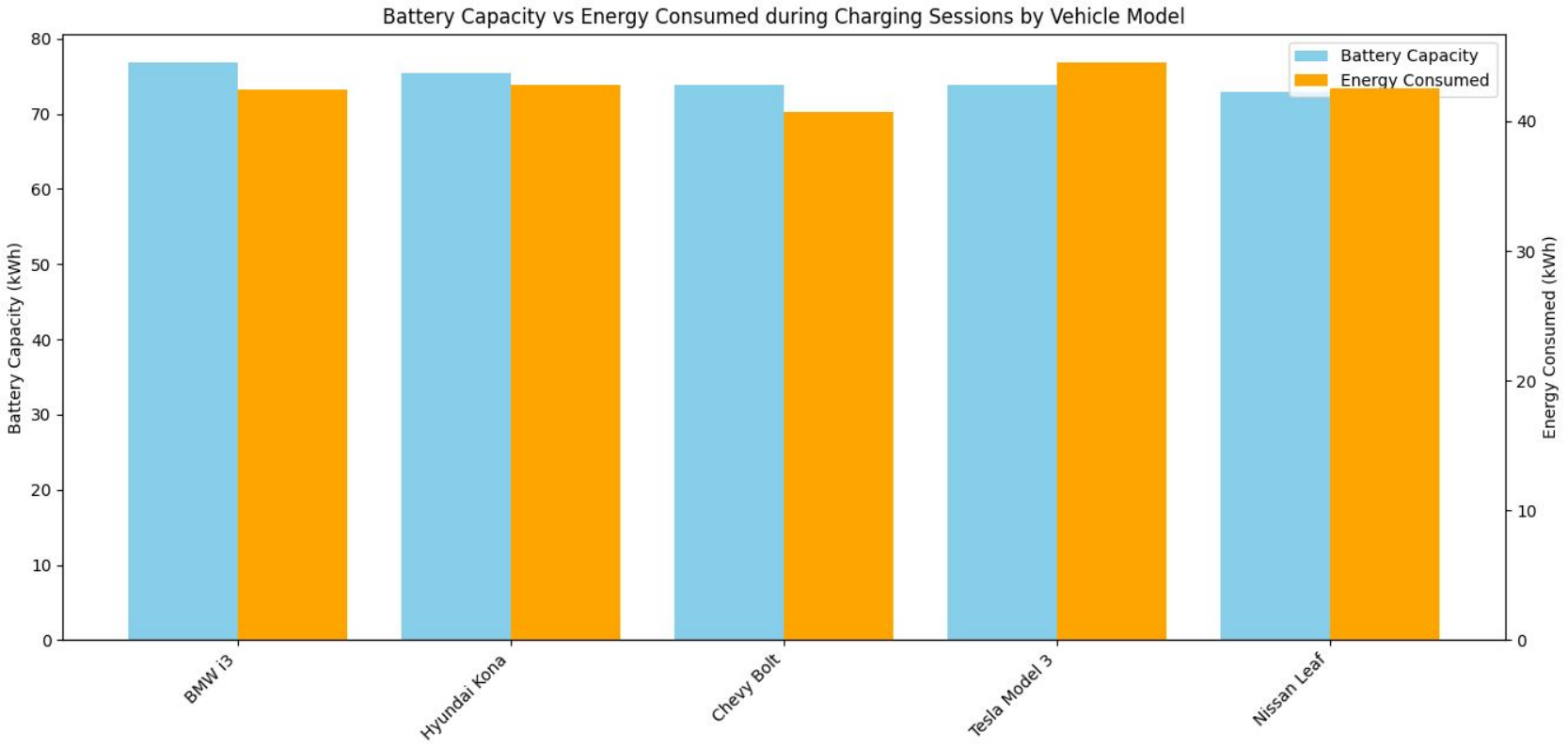
Vehicle Characteristics

Important Variables

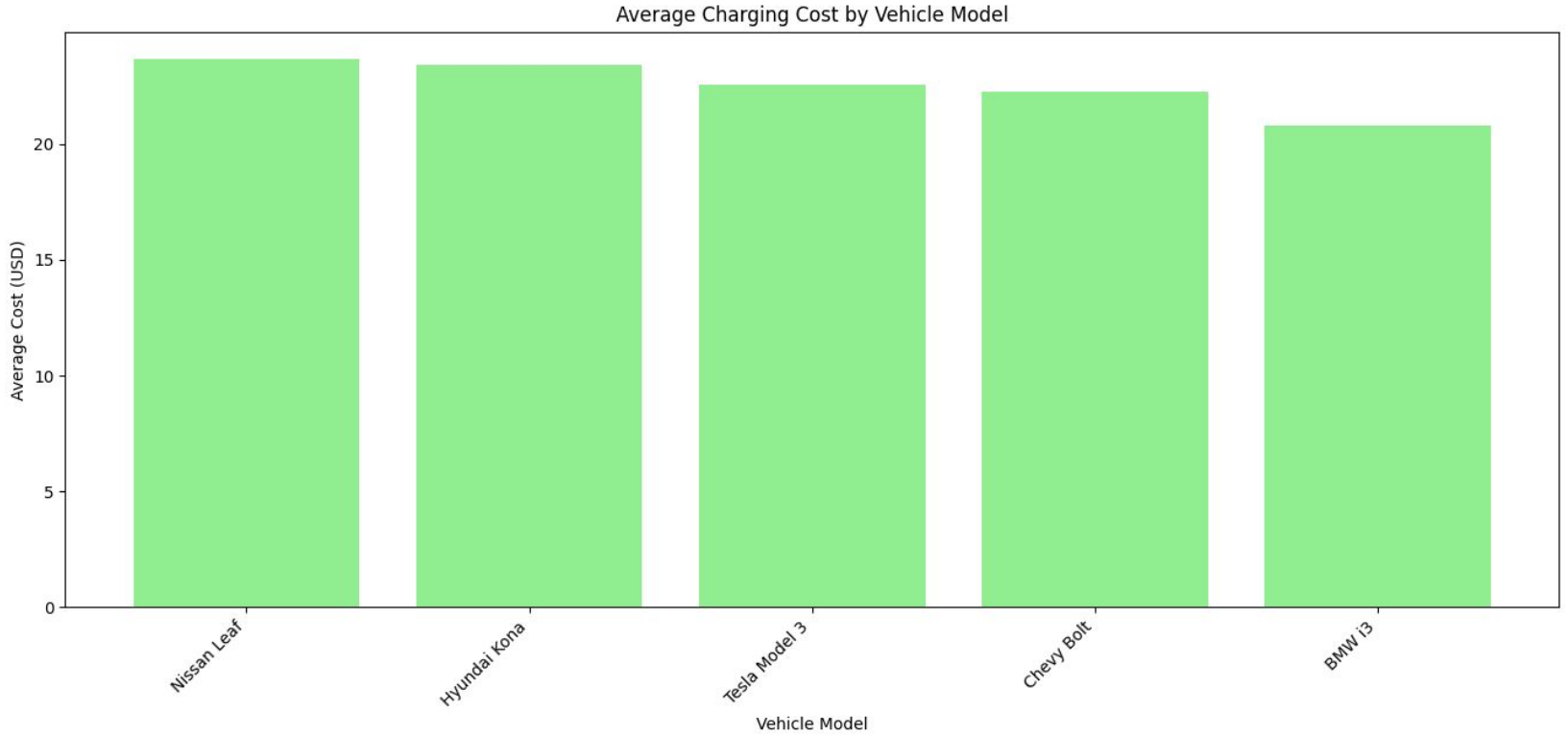
- Model Data
  - BMW i3
  - Hyundai Kona
  - Chevy Bolt
  - Nissan Leaf
  - Tesla Model 3
- Average age



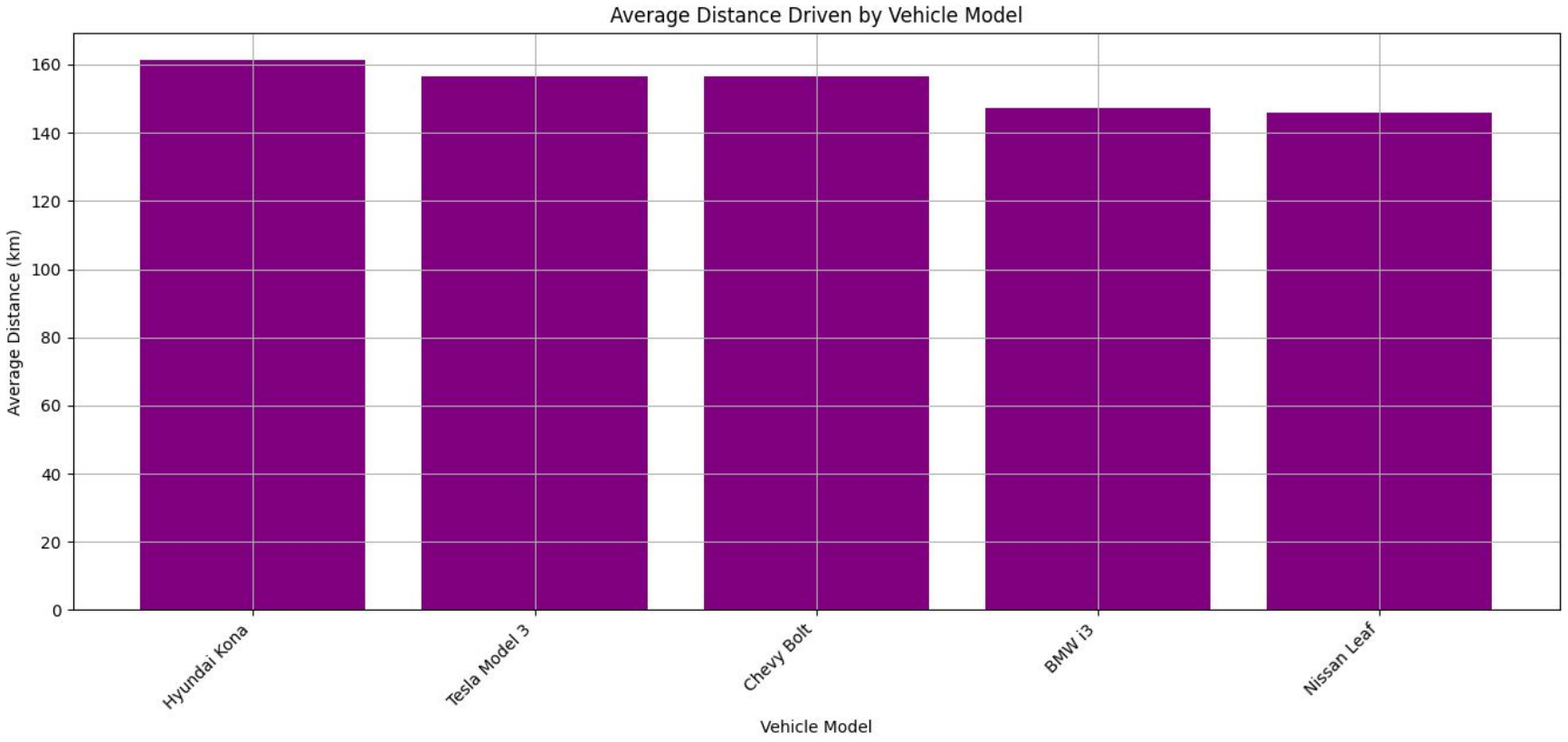
Energy Consumption and Capacity



Charging Cost



Distance Driven



Conclusion

Charger and Location Impact

- Temperature, city and charger type do not have significant impact on both cost and efficiency
- Data shows that the unit price and charging efficiency are a lower in Los Angeles and Chicago compared to the other 3 cities

Time-Based Analysis

- Evening and morning are the times in which cars are being charged the most
- Power grid usage causes charging prices to fluctuate, in particular in the afternoon and peak hours
- Weekday charging is more expensive than weekends

Vehicle Characteristics

- Vehicle cost and charging efficiency varies for each vehicle and is statistically significant