ANALYSIS OF CAR SALES DATA

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About the dataset:

The dataset was gathered from Kaggle**.** LINK

The dataset contains information about the sale of different cars. To make the dataset more precise we are considering the data for the car year from 2022 – 2023. This information can help study car sales patterns over time. It can also help assess how well each car salesperson in the dealership is doing. The data can be used to predict future sales and understand how different things impact car sales, like the type of car, model, year, and salesperson. Additionally, analyzing metrics like average sale price and commission rates by vehicle provides insights into profitability differences across car types to guide inventory investments. Identifying repeat versus one-time customers informs loyalty program decisions. Examining monthly and yearly sales trends enables better alignment of operations to seasonal volume swings. Together this detailed dataset allows both long-term strategy planning around optimal inventory mix, pricing, and sales team staffing as well as short-term tactical forecasts of demand by car segment. The granular sales data gives a comprehensive 360-degree view of the dealership's true sales productivity, customer value, and market competitiveness.

Attributes	Description
Date	The date of the car sale
Salesperson	The name of the salesperson who made the sale
Customer Name	The name of the customer who purchased the car
Car Make	The make of the car that was purchased
Car Model	The model of the car that was purchased
Car Year	The year of the car that was purchased
Sale Price	The sale price of the car in USD
Commission Rate	The commission rate paid to the salesperson on the sale
Commission Earned	The amount of commission earned by the salesperson on the sale

Problem statement:

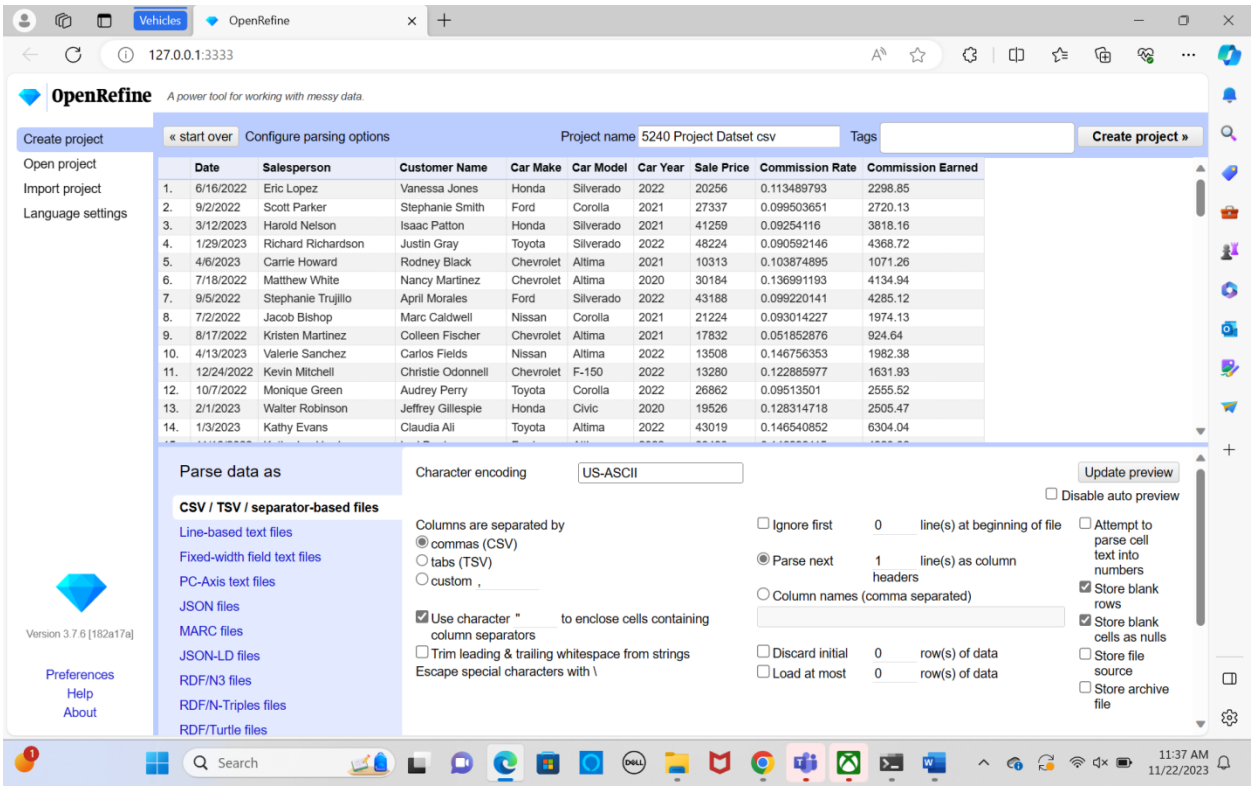
The sales manager aims to conduct a thorough analysis of sales data across multiple dimensions in order to derive insights that can inform better business strategies and incentive programs. Having detailed information on salesperson performance, customer preferences and purchase patterns, and pricing trends by vehicle model will enable more targeted, data-driven decision-making to maximize dealership sales and earnings.

For example, identifying which salespeople generate the highest volume and commission earnings can guide recruiting and training investments in stellar performers. Determining which customers purchase the most frequently or spend the most money could shape customer loyalty and incentive programs to cultivate these valuable patrons. Tracking sales volumes and profit margins over time by vehicle make and model would allow dynamic adjustment of purchasing decisions, pricing policies, and sales team commissions in response to demand trends and profit potential. Diving into metrics across key categories provides focused intelligence to continually optimize operations, sales contests, vehicle stocking plans, and staff rewards relative to current realities. By continuously monitoring this data and response metrics, the dealership will gain the opportunity to experiment, assess results, and evolve their strategies using analysis rather than guesswork.

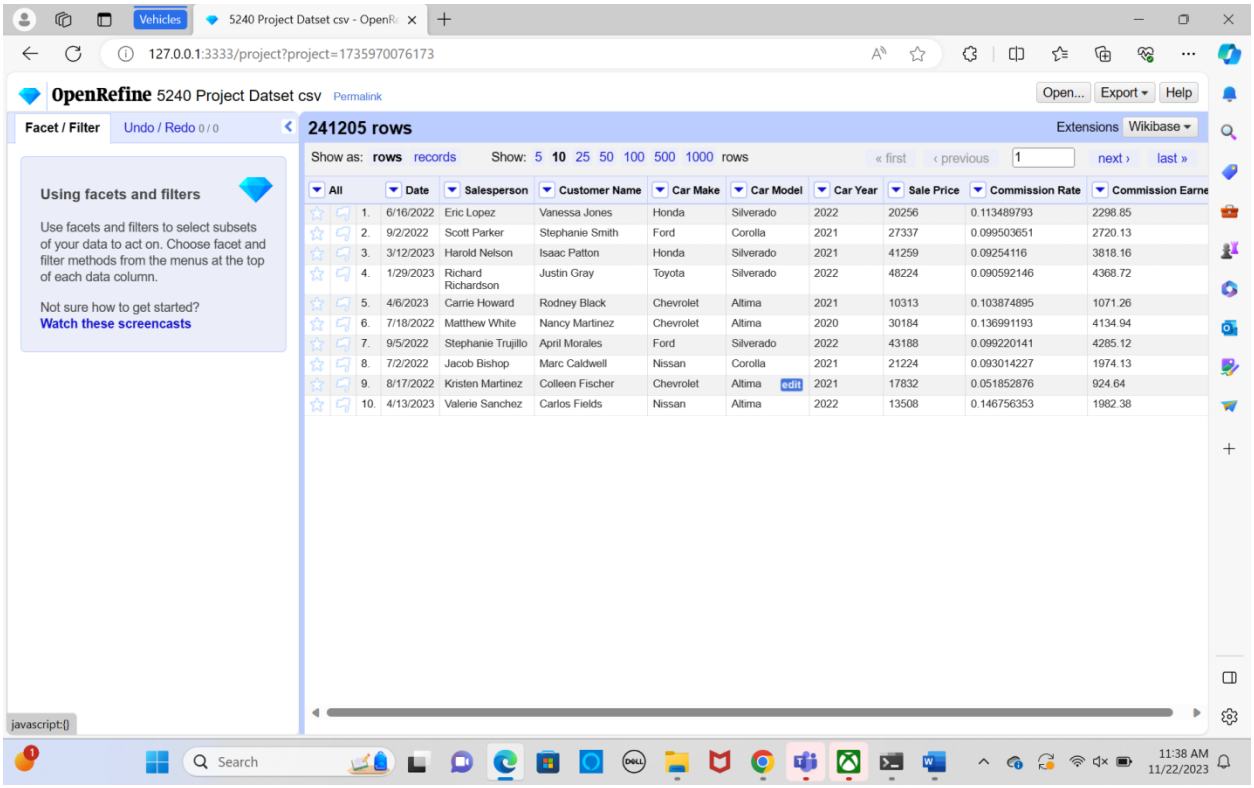
In summary, comprehensive, and ongoing analysis of granular sales data will enable proactive, informed decisions to boost dealership performance.

Data Preprocessing

STEP 1: We loaded the dataset into OpenRefine.

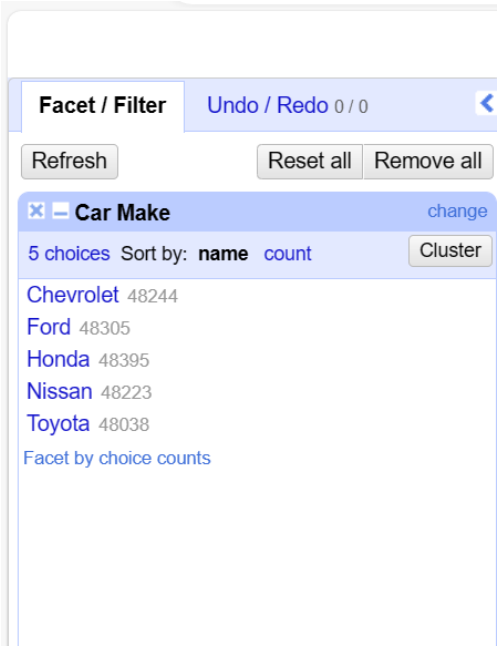


We can then see that a total of 241205 records are loaded.

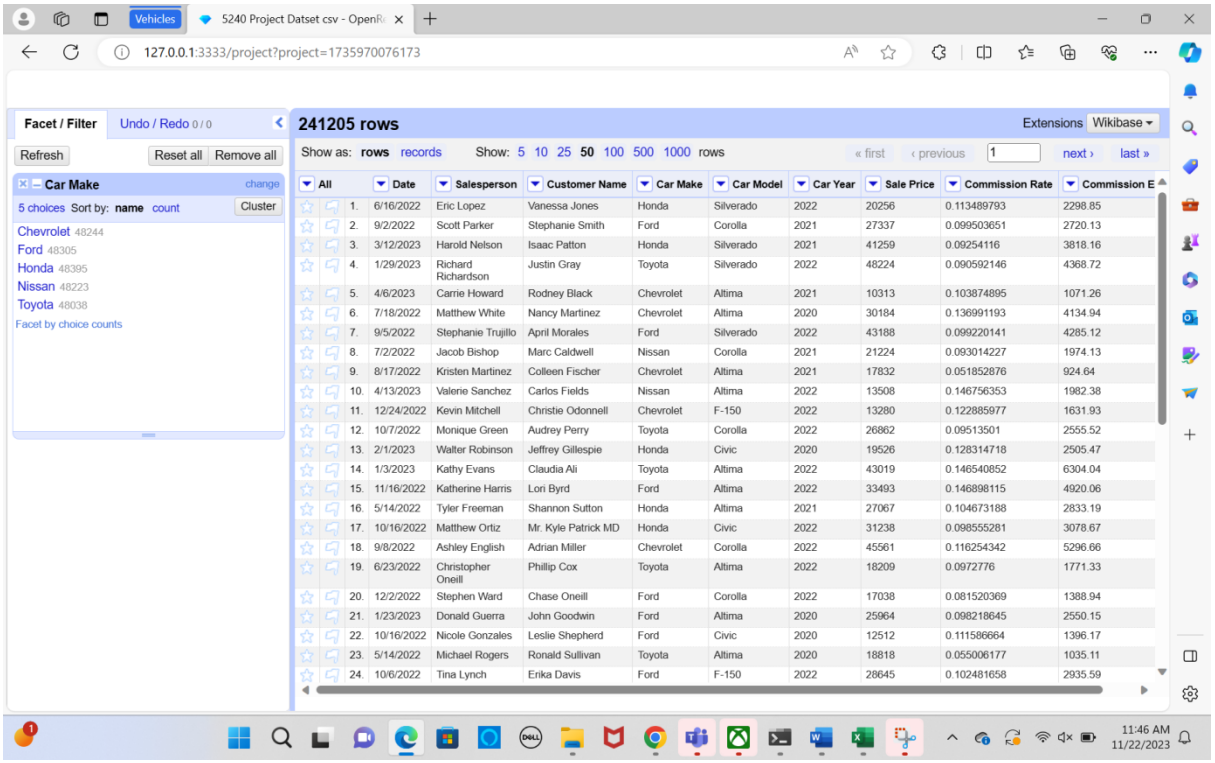


STEP 2: Analyzing the data

- Checking for unique values in Car make using Text Facet.

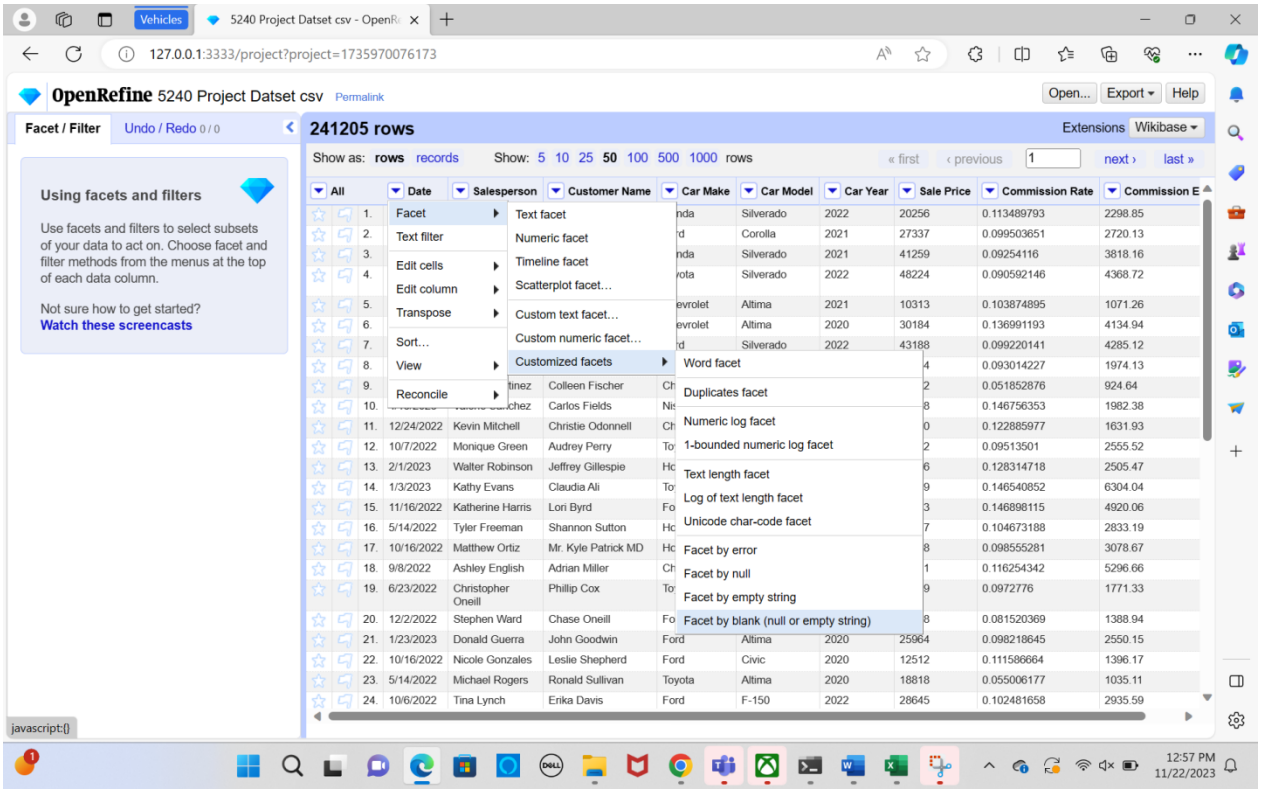


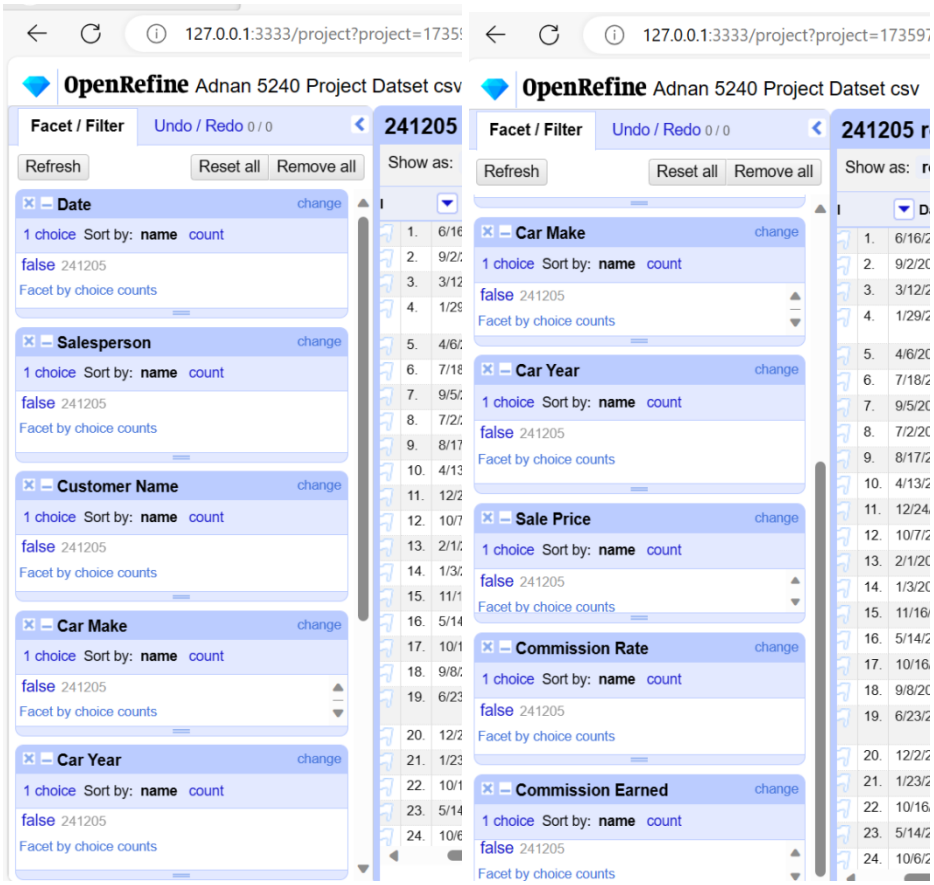
- You can see there are 5 different car makes in the dataset



STEP 3: Checking for missing values

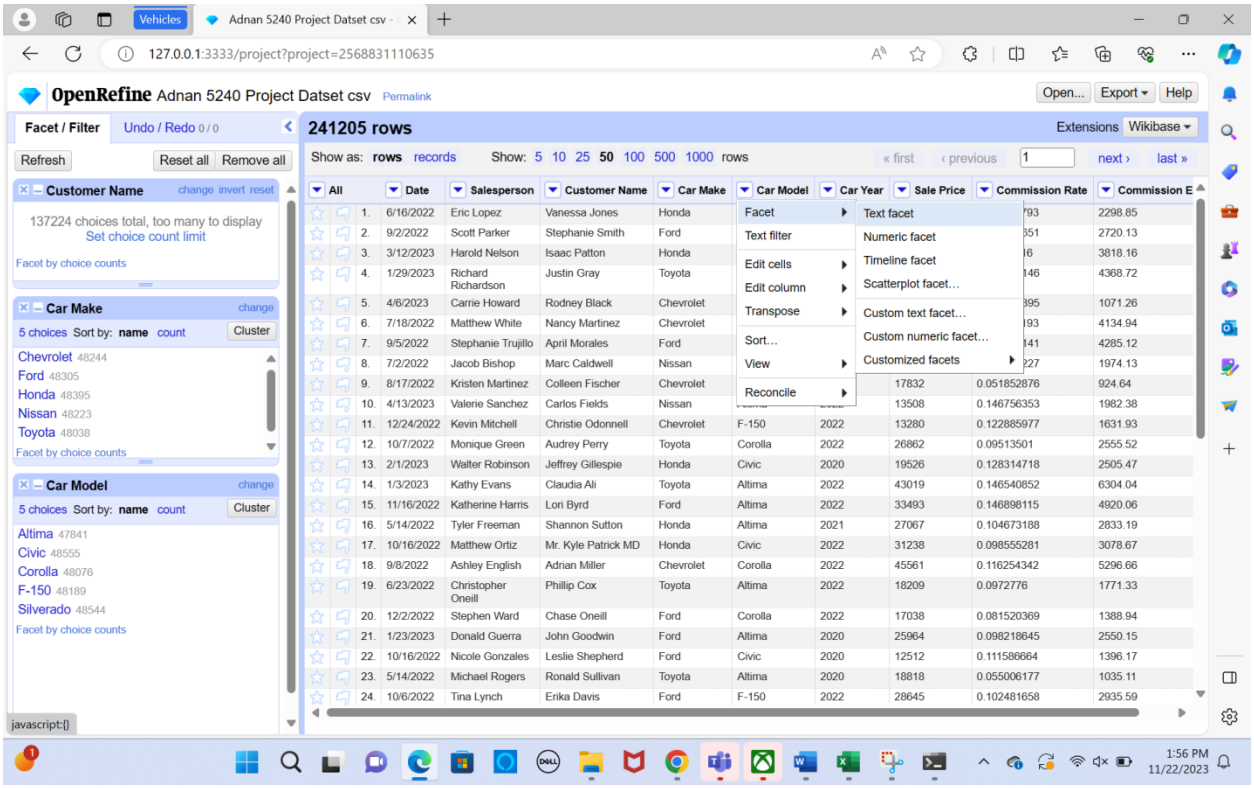
- We've used the Facet Panel from the drop-down arrow next to the column header to check the missing values.
- In the facet menu, I've selected the "Customized facets" option and selected "Facet by Blank". I've checked all the columns.
- On the left side, you can see that the facet will now display the number of blank or missing values in that column. You can see the number of missing values for each facet as shown below for all columns. As we can see there are no missing values.


OpenRefine 5240 Project Datset csv
Facet / Filter
Undo / Redo 0 / 0
241205 rows
Using facets and filters
Use facets and filters to select subsets of your data to act on. Choose facet and filter methods from the menus at the top of each data column.
Not sure how to get started?
Watch these screencasts
Facet
Text facet
Numeric facet
Timeline facet
Scatterplot facet…
Custom text facet…
Custom numeric facet…
Customized facets
Word facet
Duplicates facet
Numeric log facet
1-bounded numeric log facet
Text length facet
Log of text length facet
Unicode char-code facet
Facet by error
Facet by null
Facet by empty string
Facet by blank (null or empty string)


OpenRefine Adnan 5240 Project Datset csv
Facet / Filter
Undo / Redo 0 / 0
Refresh
Reset all
Remove all
Date
Salesperson
Customer Name
Car Make
Car Year
Sale Price
Commission Rate
Commission Earned
1 choice Sort by: name count
false 241205
Facet by choice counts

STEP 4: Checking for Duplicate values

- We've checked for any spelling mistakes and unique words, that may be spelled wrong through the Facet and Text Facet option.



Type of Storage Used

Google Cloud Platform's (GCP) BigQuery was used to analyze the car sales data. BigQuery would be an optimal data warehouse solution for analyzing this automotive sales dataset to uncover actionable insights. Specifically, BigQuery is a serverless, highly scalable cloud data warehouse that enables running SQL queries over enormous datasets, in the petabyte range and beyond (Bhaumik, 2022). This makes it ideally suited for performing fast, complex analysis on large volumes of granular sales transaction information aggregated over time to guide data-driven business strategy decisions through a user-friendly SQL interface (Ali et al., 2021). It enables running SQL queries on huge amounts of data quickly and cost-effectively.

Reasons BigQuery is well-suited for the dealership's needs:

Performance - Advanced capabilities ensure fast SQL queries, even on billions of rows of granular sales transactions over time(Cheng, 2022). This allows rapid analysis.

Cost - As a serverless platform, BigQuery is very cost efficient compared to traditional data warehouses because you only pay for what you use (Masmoudi, 2021). This saves money for the analysis.

Security - GCP meets major compliance standards like HIPAA for data privacy assurance when dealing with sensitive customer sales data (Ignyte Team, 2020).

Accessibility - The SQL interface facilitates complex sales analytics without advanced data science expertise. Integrations with data visualization tools also enable interactive dashboards.

In summary, BigQuery grants the dealership a flexible, affordable way to generate data-driven insights on inventory needs, customer trends, and sales team effectiveness to enhance strategic planning in a secure cloud platform. The savings and performance make it simpler than traditional warehouse approaches. Therefore GCP's BigQuery would be an optimal data warehouse solution for analyzing this automotive sales dataset to uncover actionable insights. This makes it ideally suited for performing fast, complex analysis on large volumes of granular sales data to guide data-driven strategy decisions to improve inventory management, pricing structure, sales compensation, and promotional initiatives in a secure and compliant cloud environment.

QUERIES

Query 1: Total Sales and Commissions by Salesperson

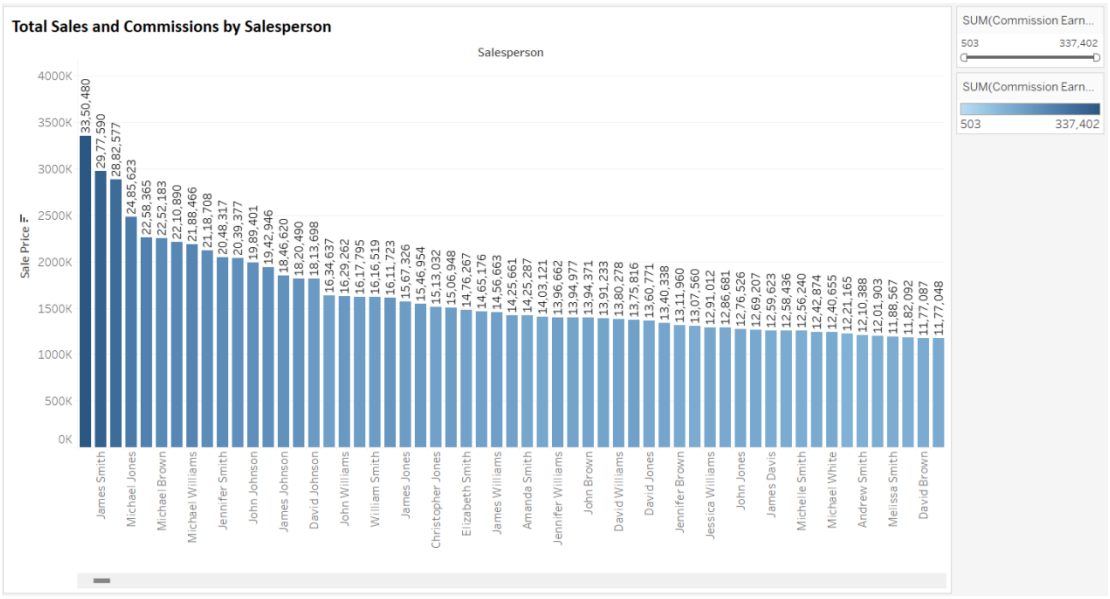
In order to evaluate how effectively each individual sales representative converts opportunities into sales and commissions earned, we will write a query to aggregate performance data by representative over a set time period. By selecting the salesperson's name, summing the total dollar amounts of their closed sales, and summing the total commissions they have earned across all transactions, we can view both total sales revenue generated and total commissions made for each person. Comparing these totals relative to their peers allows sales management to quickly identify top performers to replicate success as well as lower performers who may require additional training, mentoring, or transition to other roles to optimize the overall output of the sales organization. This data is pivotal for informing critical management decisions.

```
1  SELECT Salesperson, SUM(Sale_Price) AS TotalSales, SUM(Commission_Earned) AS TotalCommission
2  FROM `adta5240nishithmannuru.carsales.carsales`
3  GROUP BY Salesperson
```

Query results

JOB INFORMATION | RESULTS | CHART PREVIEW | JSON | EX

Row	Salesperson	TotalSales	TotalCommission
1	Brent Brown	32887	3370.59
2	Kathleen Fuentes	23768	2995.74
3	John Ross	284949	25085.95
4	Scott Lopez	270643	27458.04
5	Linda Gardner	77750	7344.049999999...
6	Craig Ross	40869	4717.2
7	Kimberly Walker	209021	25154.3
8	Daniel Wong	104256	8462.67
9	Amy Black	34456	2592.76
10	David Cross	88986	6818.18
11	Suzanne Peck	22792	1547.44
12	Emily Cole	171224	18004.44000000...
13	Ricky Dean	41059	3193.4
14	Rebecca Rivera	81827	8234.9
15	Mr. Christopher Molina	25050	3322.32
16	Katherine Alexander	146725	12497.65999999...
17	Ryan Daniel	42847	4420.25



Query 2: Average Sale Price and Commission Rate by Car Make

The goal of this query is to analyze differences in sale prices and commission rates by vehicle make. Grouping sales data by car make allows calculating the average sale price and average commission rate per make. This reveals pricing and profit trends across different vehicle types sold by the dealership. Some makes likely allow for higher sale prices and commissions. Understanding which makes currently

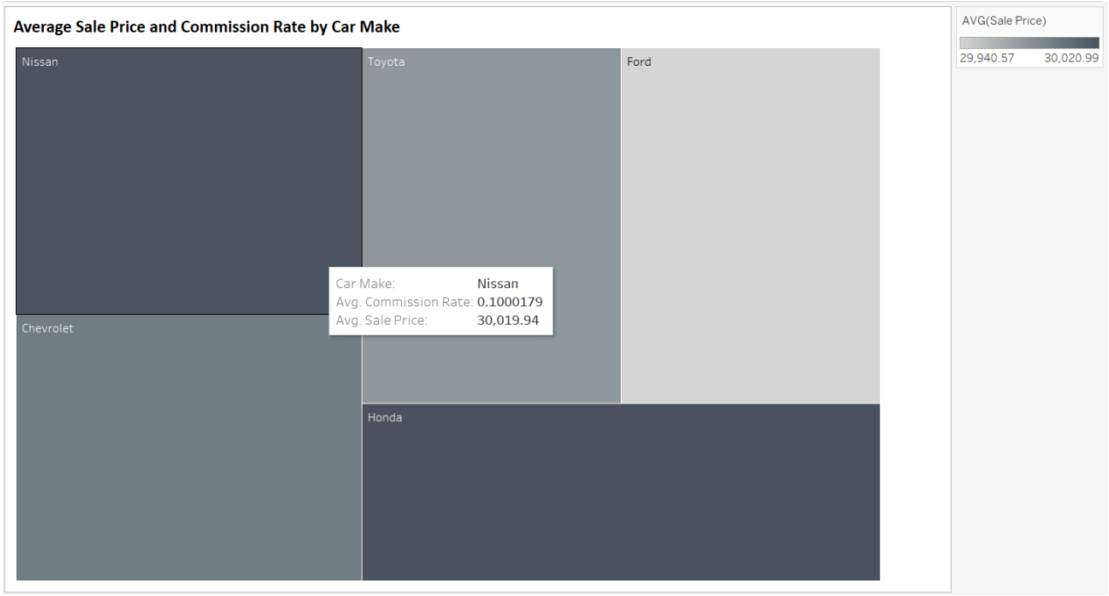
perform better allows making data-driven decisions to improve future profitability. This includes optimizing inventory purchases to focus on high-selling makes and models, adjusting pricing and incentives on certain vehicle types, and negotiating improved manufacturer commission rates on top-selling makes. The analysis helps maximize profits by aligning sales, inventory, and manufacturer relationships with customer vehicle preferences and purchasing trends.

```
1  SELECT Car_Make, AVG(Sale_Price) AS AverageSalePrice, AVG(Commission_Rate) AS AverageCommissionRate
2  FROM `adta5240nishithmannuru.carsales.carsales`
3  GROUP BY Car_Make
4
```

Query results

JOB INFORMATION | RESULTS | CHART PREVIEW | JSON | EXECUTION DETAILS | EXECUTION GRAPH

Row	Car_Make	AverageSalePrice	AverageCommissionRate
1	Ford	29940.572756443416	0.099929883220163107
2	Chevrolet	29994.171316640557	0.0999764128906391
3	Honda	30020.987333402398	0.099870016566132216
4	Toyota	29978.043299055051	0.099942150312273492
5	Nissan	30019.93548721588	0.10001785990548123



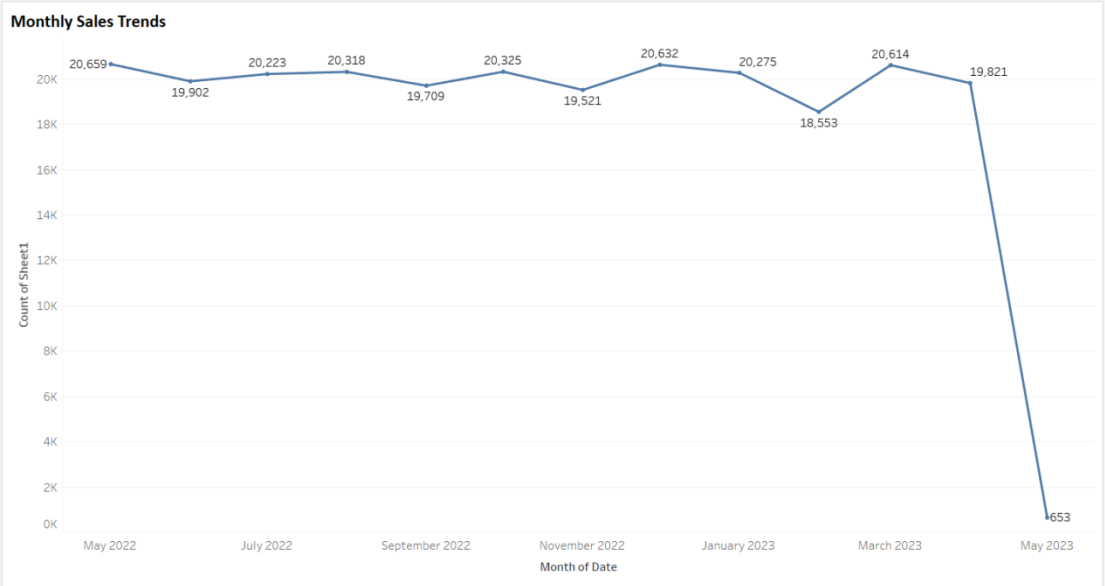
Query 3: Monthly Sales Trends

This query will break down the last 12 months of sales data by month to reveal trends over the 1-year period. Extracting the month attribute from the date field enables segmenting records into monthly buckets. Counting total monthly sales shows if there are cyclical demand swings - certain months may see recurring spikes or dips. For a single year, this specifically highlights seasonality around summer driving, holidays, or year-end clearances. The granular month-by-month analysis tracks volumes to

uncover why sales rise or fall at certain times annually. Visualizing these demand cycles and understanding unique monthly factors allows better inventory planning, sales staffing, promotions, and manufacturer ordering to align operations with predicted volumes. Even a year of historical data reveals seasonality potentials to optimize the business for the upcoming summer surge or year-end wind down based on last year's trends.

```sql
SELECT EXTRACT(YEAR FROM Date) AS Year, EXTRACT(MONTH FROM Date) AS Month, COUNT(*) AS TotalSales
FROM `adta5240nishithmannuru.carsales.carsales`
GROUP BY Year, Month
ORDER BY Year, Month
```

Row	Year	Month	TotalSales
1	2022	5	20659
2	2022	6	19902
3	2022	7	20223
4	2022	8	20318
5	2022	9	19709
6	2022	10	20325
7	2022	11	19521
8	2022	12	20632
9	2023	1	20275
10	2023	2	18553
11	2023	3	20614
12	2023	4	19821
13	2023	5	653

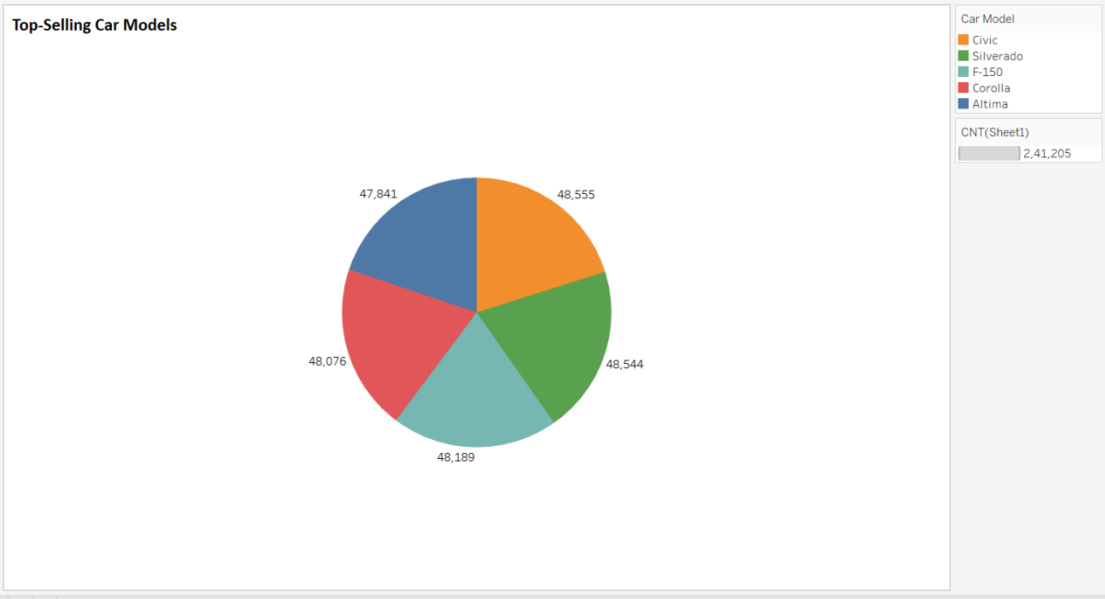


Query 4: Top-Selling Car Models

Analyzing which specific car models sell the most units can optimize future inventory investments. Grouping sales records by model and counting total sales per model reveals model-level demand. Ordering models descending by sales volume ranks models from best to worst sellers. Taking the top 5 highest-volume models shows the most popular purchases. Increased access to hot sellers boosts both customer satisfaction from model availability and business revenue from inventory aligned to proven sales trends. Tracking which model variants are fastest-moving improves cash flow by ensuring displayed inventory expediently converts to sales.

```
1  SELECT Car_Model, COUNT(*) AS ModelCount
2  FROM `adta5240nishithmannuru.carsales.carsales`
3  GROUP BY Car_Model
4  ORDER BY ModelCount DESC
5  LIMIT 5
6
```

Row	Car_Model	ModelCount
1	Civic	48555
2	Silverado	48544
3	F-150	48189
4	Corolla	48076
5	Altima	47841



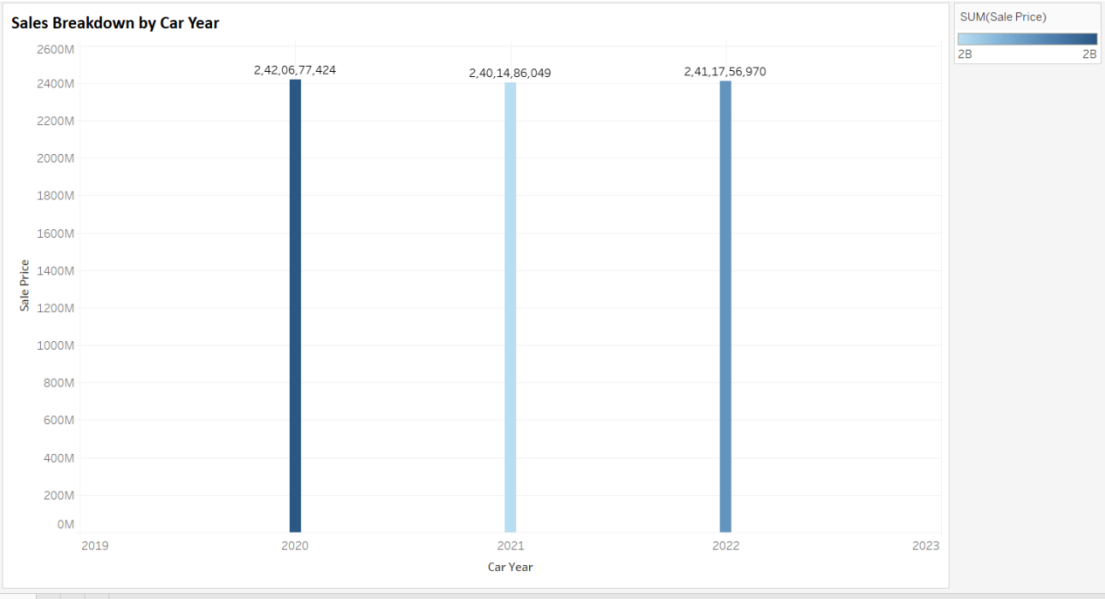
Query 5: Sales Breakdown by Car Year

Analyzing sales performance by model year reveals trends in the relative demand for new versus used vehicles. Grouping sales records by model year and summing total sale price per group shows the sales contribution of each vehicle age segment. The comparison could reveal that brand new model year

vehicles command the highest total sales revenue due to higher pricing. Or alternatively used vehicles contribute greater overall profit if the pricing difference exceeds volume gains from new cars. Understanding preferences for vehicle age guides trade-in offers, pre-owned vehicle acquisition at auction, and new model year inventory purchasing to optimize cash investments against validated sales demand across the age spectrum.

```
1  SELECT Car_Year, SUM(Sale_Price) AS TotalSales
2  FROM `adta5240nishithmannuru.carsales.carsales`
3  GROUP BY Car_Year
4
```

Row	Car_Year	TotalSales
1	2022	2411756970
2	2021	2401486049
3	2020	2420677424



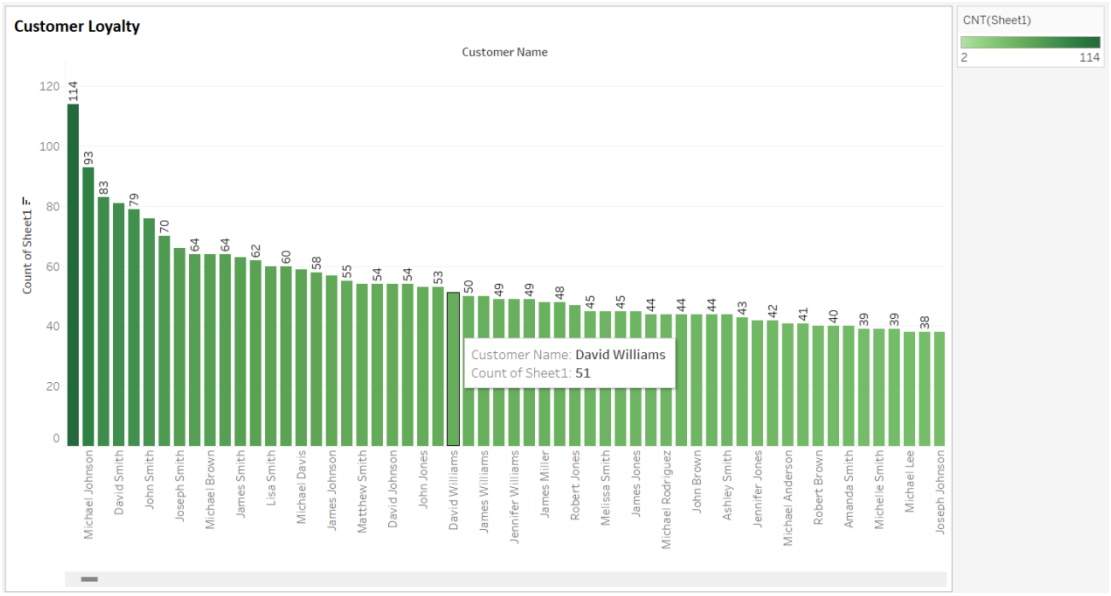
Query 6: Customer Loyalty

Analyzing sales data to identify instances where the same customer has purchased multiple vehicles over time reveals loyal repeat buyers. These customers likely enjoy their ownership experience, have ongoing vehicle needs, or remain brand devotees. Understanding who our best customers are who continuously return allows for creating targeted loyalty programs with special perks for continued patronage. Additional retention tactics like service discounts and trade-in bonuses could incentivize further repeat purchases. Idealizing this viral cycle of repeat sales & rewards boosts customer lifetime value. Retaining loyal buyers is more profitable long term than constantly acquiring new customers.

```sql
SELECT `Customer_Name`, COUNT(*) AS TotalPurchases
FROM `adta5240nishithmannuru.carsales.carsales`
GROUP BY `Customer_Name`
HAVING TotalPurchases > 1

```

Row	Customer_Name	TotalPurchases
1	Lisa Smith	60
2	David Williams	51
3	Kevin Brown	23
4	Matthew Brown	27
5	Mark Thomas	19
6	David Brown	53
7	Andrew Jackson	13
8	Jason Jones	18
9	Sarah Smith	35
10	Robert Rivera	14
11	Robert Taylor	25
12	Ashley Taylor	16
13	Laura Miller	12
14	Heather Garcia	12
15	Elizabeth Brown	17
16	Jennifer Martinez	25

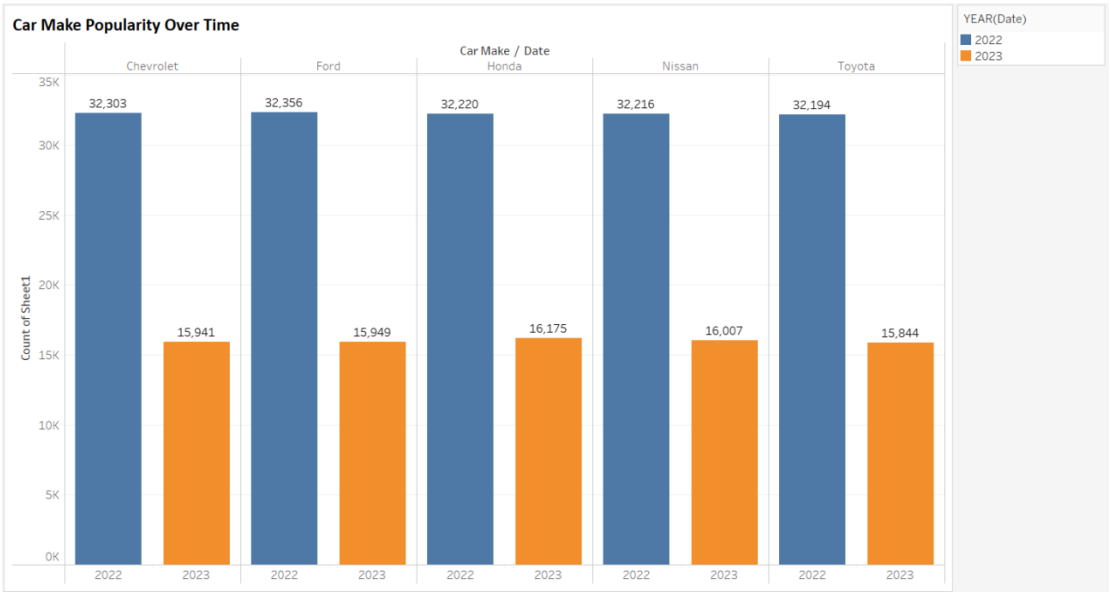


Query 7: Car Make Popularity Over Time

Tracking vehicle preference shifts by customers over the years guides business strategy adaptations and future decision-making. The query groups total sales records by both car make and year extracted from the sale date. This structures data to analyze make-level demand annually. Identifying consistent high sales validates further development of dealer relationships and incentives with their manufacturers. Adapting operations based on popularity changes driven by consumer preference shifts ensures showroom inventory, technician training, manufacturer ties, and sales efforts align with ever-evolving market dynamics for sales growth.

```
1  SELECT Car_Make, EXTRACT(YEAR FROM Date) AS Year, COUNT(*) AS TotalSales
2  FROM `adta5240nishithmannuru.carsales.carsales`
3  GROUP BY Car_Make, Year
4
```

Row	Car_Make	Year	TotalSales
1	Ford	2022	32356
2	Chevrolet	2022	32303
3	Honda	2022	32220
4	Toyota	2022	32194
5	Nissan	2022	32216
6	Nissan	2023	16007
7	Chevrolet	2023	15941
8	Honda	2023	16175
9	Toyota	2023	15844
10	Ford	2023	15949



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