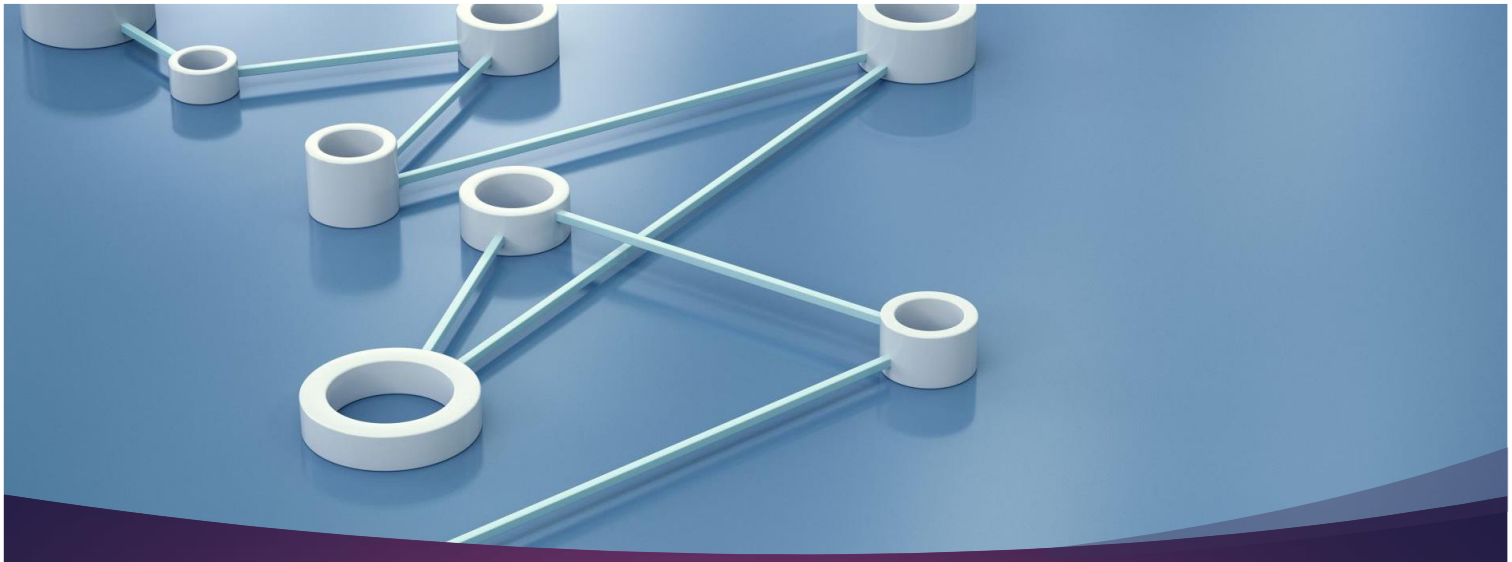


Restoring Connectivity: Addressing Internet Outages

Problem Statement

Consumer complaints provide a rich source of data for businesses.

This data can offer valuable insights into customer satisfaction and areas for improvement.

However, the data is often unstructured and messy, making it difficult to analyze.

Our task is to clean, analyze, and visualize this data to uncover actionable insights.

Business Understanding

Understanding consumer complaints is crucial for businesses.

Analyzing this data can help identify areas that need improvement.

Improvements in these areas can enhance customer satisfaction and loyalty.

Understanding complaints can also lead to product and service innovation.

These actions can increase market share and profitability.

Data Understanding

The dataset we are working with is sourced from the FCC's Consumer Complaints Data.

It contains valuable information about consumer complaints, including the form (TV, Internet, or Phone), method (Cable, Wireless, Wired, Satellite, or Broadcast), and the specific issue of each complaint.

It provides geographical information about the complainants, including their city, state, and zip code. The dataset spans a significant time period, offering a comprehensive view of consumer complaints trends over time. By analyzing this data, we aim to uncover patterns and trends that can provide actionable insights for businesses.

Devendra Bupathi Rapolu

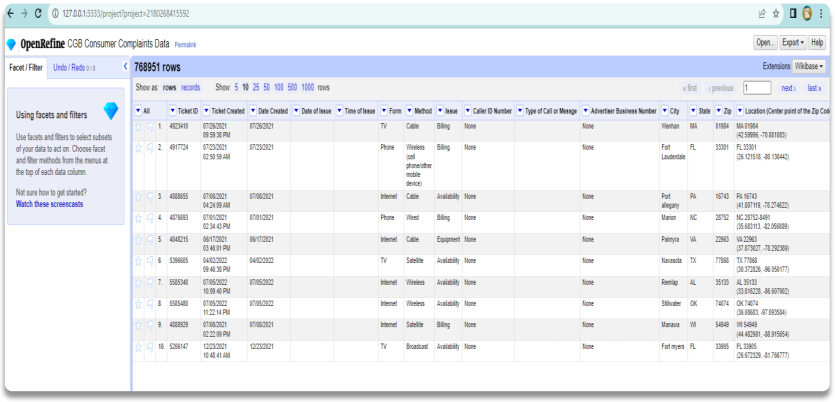
Data Dictionary

Column Name	Description	Type
Ticket ID	A unique identifier for each ticket or customer service request.	Number
Ticket Created	The date and time when the ticket or customer service request was created.	Date and time (With Timezone)
Date Created	The date when the ticket or customer service request was created (without the timestamp).	Date and time
Form	The method or channel through which the customer submitted the request (e.g., TV, Phone, Internet, Radio, Emergency, Accessibility and Request for Dispute Assistance).	Plain Text
Method	The type of service or technology related to the issue (e.g., Cable, Wireless, Satellite).	Plain Text
Issue	The nature of the problem or reason for the customer service request (e.g., Billing, Availability, Equipment).	Plain Text
City	The city associated with the customer's location or the service issue.	Plain Text
State	The state associated with the customer's location or the service issue (using the two-letter state abbreviation).	Plain Text
Zip	The postal code (ZIP code) associated with the customer's location or service issue.	Plain Text
Location (Center point (	The center point coordinates (latitude and longitude) of the ZIP code, representing the approximate geographic location of the	Plain Text

Devendra Bupathi Rapolu

Data Preprocessing

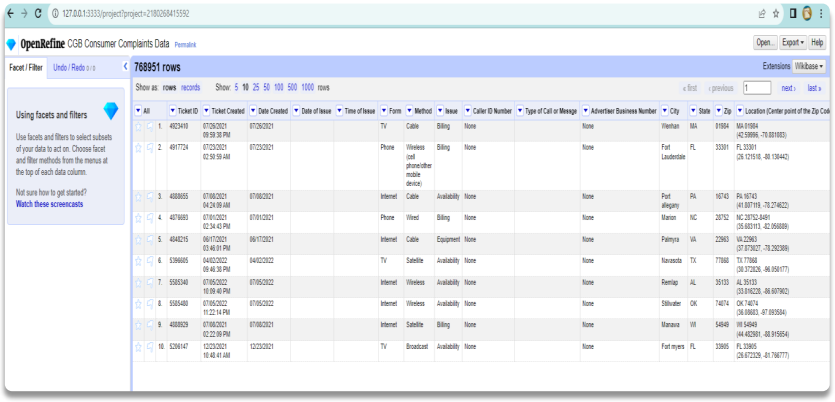
- Embarking on our data analysis journey, we first address data cleaning and transformation.
- We utilize OpenRefine, a powerful tool designed to work with messy data.
- This step is crucial to ensure the accuracy and reliability of our subsequent analysis.



Devendra Bupathi Rapolu

Trimming Whitespace

- Our initial step in the cleaning process is to trim leading and trailing spaces from the data.
- This is an essential step as extra spaces can lead to issues during analysis and can result in inaccurate results.
- By ensuring our data is free from unnecessary spaces, we lay a clean foundation for further steps.



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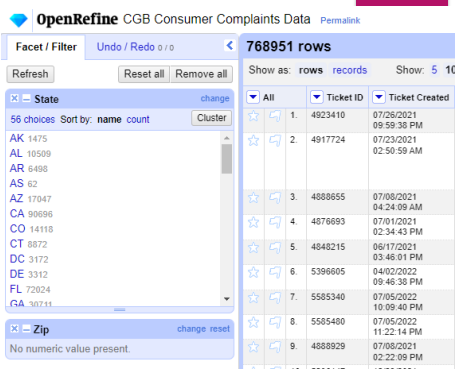
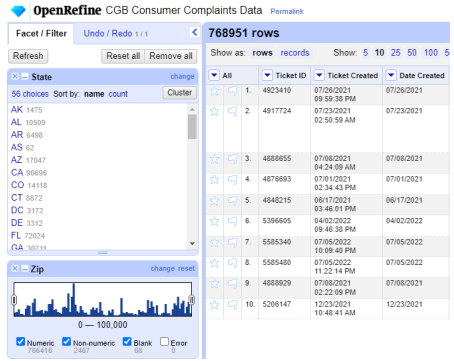
Transforming Data Types

- Next, we focus on the 'Zip' column, which was initially in text format.
- We transform this column into a numeric format, a crucial step for any subsequent numerical operations or analyses that we might need to perform.
- This transformation enhances the versatility of our dataset, allowing for more complex analyses.

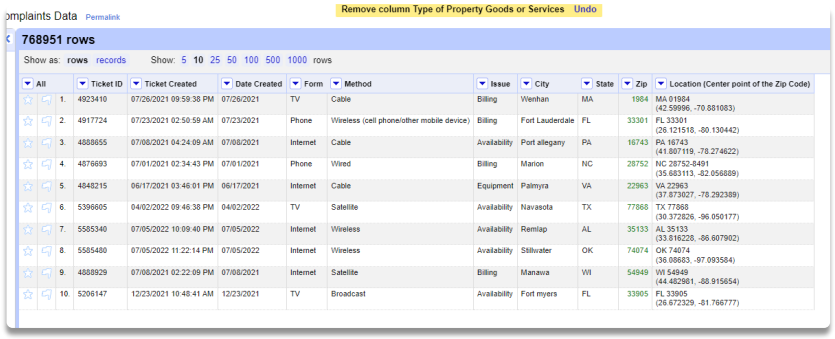




Santhoshi Indrakanti

Removing Redundancies

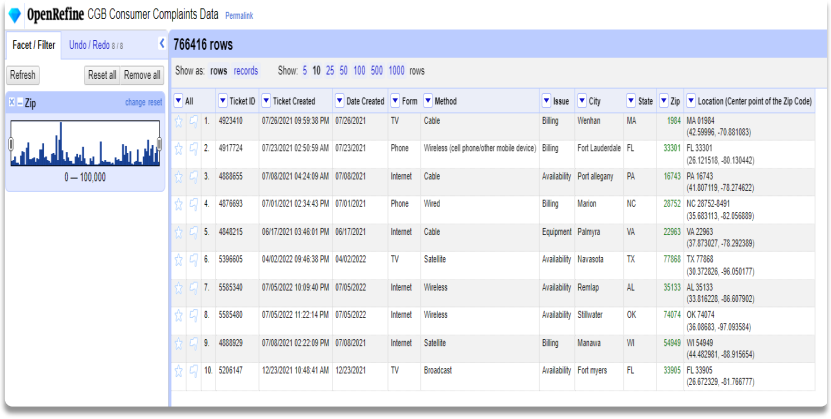
- We then proceed to remove columns that are mostly null or not necessary for our intended analysis.
- These include 'Date of Issue', 'Time of Issue', 'Caller ID Number', 'Type of Call or Message', 'Advertiser Business Number', and 'Type of Property Goods or Services'.
- This step helps us to focus on the relevant data and reduces the dimensionality of the dataset, making subsequent analysis more manageable and efficient.



Santhoshi Indrakanti

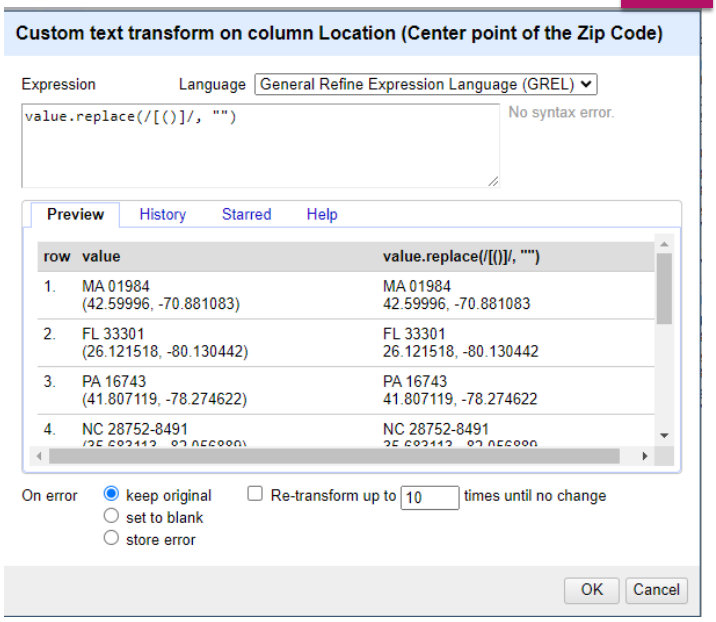
Handling Missing Values

- Our next step is to handle missing data, specifically focusing on the 'Zip' column.
- Any rows with blank values in this column are removed from the dataset.
- Handling missing data is important as they can skew the results and often lead to inaccurate analysis.



Data Extraction for Latitude and Longitude

- We then turn our attention to the 'Location (Center point of the Zip Code)' column, which contains both latitude and longitude information.
- We extract and split this data into two new columns, 'Latitude' and 'Longitude', for easier analysis.
- This step simplifies the data structure and allows for more precise geographical analysis, enhancing the depth and accuracy of our insights.



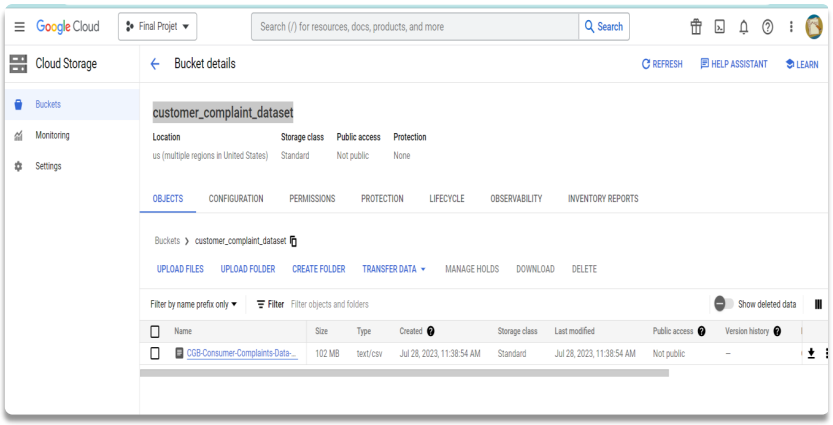
Exporting Cleaned Data

- Having completed these preprocessing steps, we are ready to export our cleaned data.
- The cleaned data is exported into a new CSV file, ready for in-depth analysis and visualization.

A	B	C	D	E	F	G	H	I	J	K	L
Ticket ID	Ticket Created	Date Created	Form	Method	Issue	City	State	Zip	Location (Center point of the Zip Code)	Latitude	Longitude
4923410	7/26/2021 21:59	7/26/2021	TV	Cable	Billing	Wenhan	MA	1984	42.59996, -70.881083	42.59996	-70.881083
4917724	7/23/2021 2:50	7/23/2021	Phone	Wireless (c	Billing	Fort Laude	FL	33301	26.121518, -80.130442	26.121518	-80.130442
4888655	7/8/2021 4:24	7/8/2021	Internet	Cable	Availability	Port allega	PA	16743	41.807119, -78.274622	41.807119	-78.274622
4876693	7/1/2021 14:34	7/1/2021	Phone	Wired	Billing	Marion	NC	28752	35.683113, -82.056889	35.683113	-82.056889
4848215	6/17/2021 15:46	6/17/2021	Internet	Cable	Equipment	Palmyra	VA	22963	37.873027, -78.292389	37.873027	-78.292389
5396605	4/2/2022 21:46	4/2/2022	TV	Satellite	Availability	Navasota	TX	77868	30.372826, -96.050177	30.372826	-96.050177
5585340	7/5/2022 22:09	7/5/2022	Internet	Wireless	Availability	Remlap	AL	35133	33.816228, -86.607902	33.816228	-86.607902
5585480	7/5/2022 23:22	7/5/2022	Internet	Wireless	Availability	Stillwater	OK	74074	36.08683, -97.093584	36.08683	-97.093584
4888929	7/8/2021 14:22	7/8/2021	Internet	Satellite	Billing	Manawa	WI	54949	44.482981, -88.915654	44.482981	-88.915654
5206147	12/23/2021 10:48	12/23/2021	TV	Broadcast	Availability	Fort myers	FL	33905	26.672329, -81.766777	26.672329	-81.766777
4958362	8/12/2021 21:09	8/12/2021	Phone	Wireless (c	Equipment	Evansville	IN	47711	38.011217, -87.5379	38.011217	-87.5379
5206170	12/23/2021 12:50	12/23/2021	Internet	Cable	Availability	District hei	MD	20747	38.85327, -76.887155	38.85327	-76.887155
5396203	4/2/2022 16:44	4/2/2022	Internet	Cable	Availability	Fomtana	CA	92335	34.087599, -117.458229	34.087599	-117.458229
4935164	8/1/2021 13:56	8/1/2021	Internet	Cable	Billing	Shelbyville	IN	46176	39.526012, -85.773612	39.526012	-85.773612
4917318	7/22/2021 23:30	7/22/2021	TV	Cable	Billing	Lebanon	PA	17042	40.304366, -76.426501	40.304366	-76.426501
4883372	7/5/2021 23:26	7/5/2021	Internet	Cable	Availability	Pickens	SC	29671	34.92527, -82.714369	34.92527	-82.714369
5583586	7/5/2022 14:09	7/5/2022	Phone	Wireless (c	Billing	Oklahoma	OK	73162	35.581462, -97.641081	35.581462	-97.641081
5583912	7/5/2022 15:56	7/5/2022	TV	Broadcast	Availability	Sherman	TX	75090	33.620647, -96.571184	33.620647	-96.571184
4957792	8/12/2021 18:58	8/12/2021	Emergency		Interference	Algonquin	IL	60102	42.161844, -88.309945	42.161844	-88.309945
4932150	7/30/2021 9:38	7/30/2021	Phone	Wireless (c	Billing	Waterford	PA	16441	41.951558, -79.990381	41.951558	-79.990381
4954346	8/11/2021 12:09	8/11/2021	Phone	Wireless (c	Billing	Oceanside	CA	92054	33.193155, -117.358567	33.193155	-117.358567

Setting up Google Project and Storage

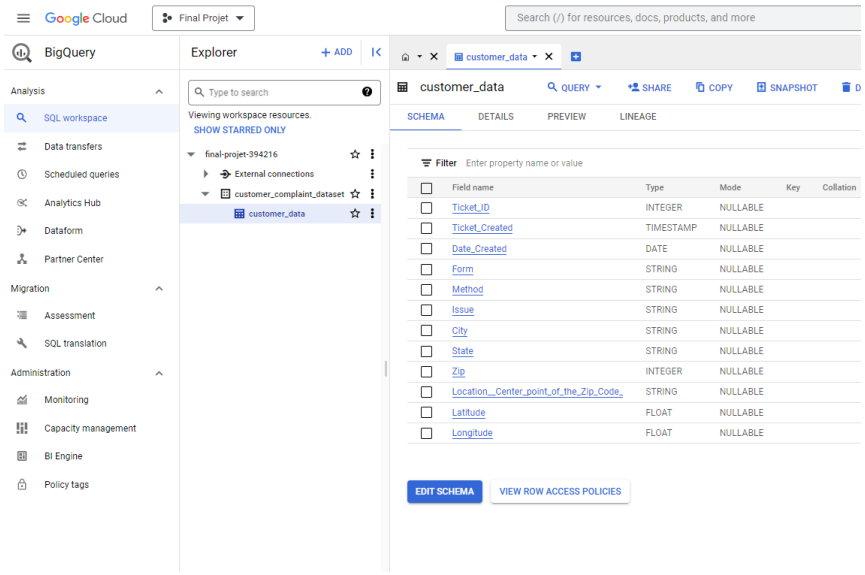
- To kickstart our analysis, we create a new Google Cloud project named 'Final_Project'.
- We then set up a Google Cloud Storage bucket named 'customer_complaint_dataset'.
- The cleaned dataset is uploaded to this bucket, marking the first step in our cloud-based data analysis journey.



Pratyusha Nalamothu

Creating a Table in BigQuery

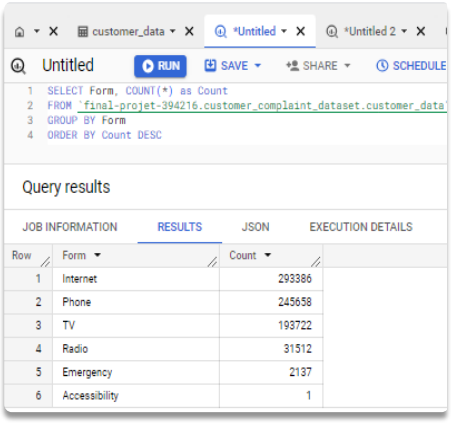
- Next, we move to Google BigQuery, a web service from Google that is used for handling and analyzing big data.
- We create a table in BigQuery to store our cleaned dataset.
- With our data now in BigQuery, we are ready to perform fast, SQL-like queries against our multi-terabyte datasets.



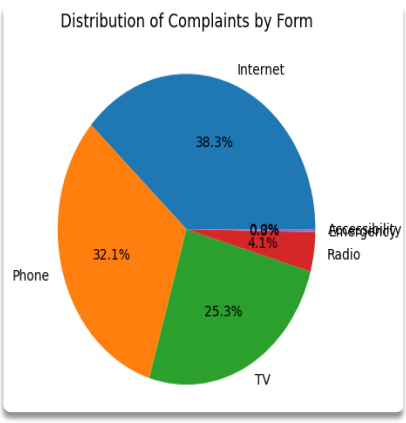
Pratyusha Nalamothu

Distribution of Complaints by Form

- Query: Count of complaints by form
- Description: This pie chart shows the distribution of complaints by form, revealing that TV, Phone and Internet are the most common forms of complaints.



Row	Form	Count
1	Internet	293386
2	Phone	245658
3	TV	193722
4	Radio	31512
5	Emergency	2137
6	Accessibility	1



Pratyusha Nalamothu

Distribution of Complaints by Method

customer_data *Untitled *Untitled 2

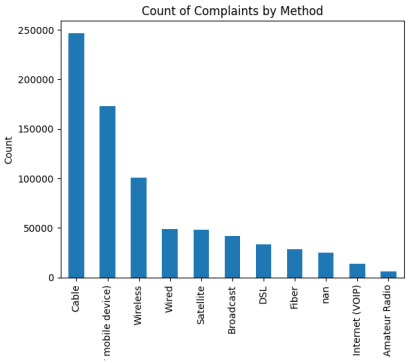
Untitled 2 RUN SAVE SHARE SCHED

```
SELECT Method, COUNT(*) as Count
FROM `final-projet-394216.customer_complaint_dataset.customer_dat
GROUP BY Method
ORDER BY Count DESC
```

Query results

JOB INFORMATION | RESULTS | JSON | EXECUTION DETAILS

Row	Method	Count
1	Cable	246760
2	Wireless (cell phone/other mo...	172950
3	Wireless	100795
4	Wired	49048
5	Satellite	48274
6	Broadcast	41901
7	DSL	33937
8	Fiber	28584
9	nan	25071
10	Internet (VOIP)	13863
11	Amateur Radio	5833



- Query: Count of complaints by method
- Description: This bar chart displays the distribution of complaints by method, indicating that Cable and Wireless are the most common methods associated with complaints.

Sai Preetham Saini

Count of complaints by form and method

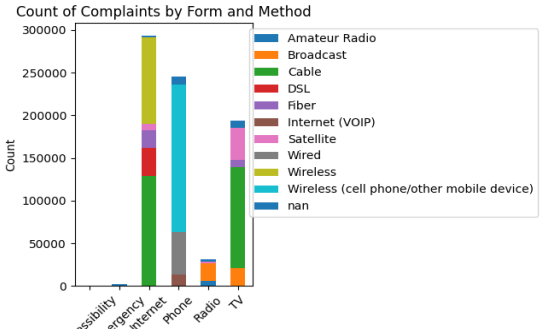
- **Description:** This stacked bar chart shows the distribution of complaints by form and method, revealing which combinations are most common

```
SELECT Form, Method, COUNT(*) as Count
FROM `final-projet-394216.customer_complaint_dataset.customer_data`
GROUP BY Form, Method
ORDER BY Form, Count DESC
```

Query results

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

Row	Form	Method	Count
1	Accessibility	nan	1
2	Emergency	nan	2137
3	Internet	Cable	128580
4	Internet	Wireless	100795
5	Internet	DSL	33337
6	Internet	Fiber	20432
7	Internet	Satellite	7949
8	Internet	nan	2293
9	Phone	Wireless (cell phone/other mo...	172950



Sai Preetham Saini

Top Issues in Complaints

- Query: Top issues in complaints
- Description: This bar chart highlights the top issues in complaints, with Billing and Availability being the most frequent issues.

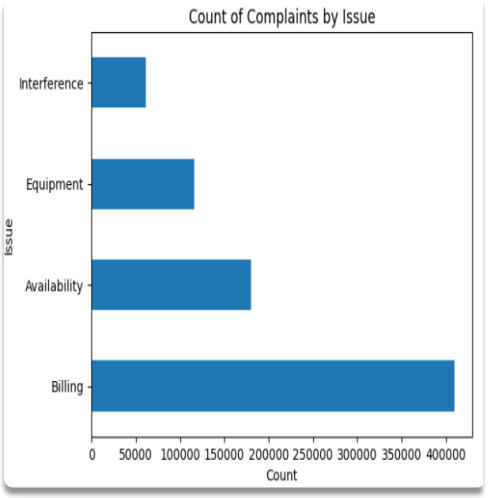
Untitled 3 RUN SAVE SHARE SCHEDULE MORE

```
SELECT Issue, COUNT(*) as Count
FROM `final-projet-394216.customer_complaint_dataset.customer_data`
GROUP BY Issue
ORDER BY Count DESC
```

Query results

JOB INFORMATION | RESULTS | JSON | EXECUTION DETAILS | EXECUTION GI

Row	Issue	Count
1	Billing	409520
2	Availability	179854
3	Equipment	116023
4	Interference	61019



Top 10 Cities with the Highest Number of Complaints

- Query: Top 10 cities with the highest number of complaints
- Description: This bar chart identifies the top 10 cities with the highest number of complaints, providing insights into geographical patterns in the data.

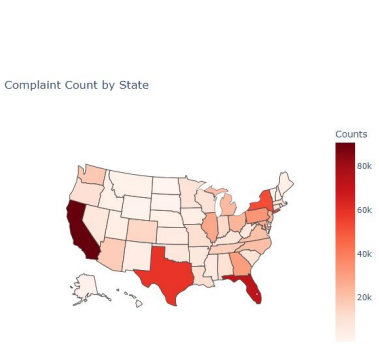
Untitled 4 RUN SAVE SHARE

```
SELECT State, COUNT(*) as Count
FROM `final-projet-394216.customer_complaint_dataset.cust
GROUP BY State
ORDER BY Count DESC
```

Query results SAVE RESULT

JOB INFORMATION | RESULTS | JSON | EXECUTION DET

Row	State	Count
1	CA	90671
2	FL	72004
3	TX	58598
4	NY	52163
5	PA	32972
6	GA	30708
7	IL	27821
8	MD	25912
9	OH	24180
10	NJ	23915



Rakesh Reddy Thurpu

Monthly Trend of Complaints

- **Query:** Count of complaints by month
- **Description:** This line chart shows the monthly trend of complaints, indicating whether complaints have been increasing or decreasing over time.

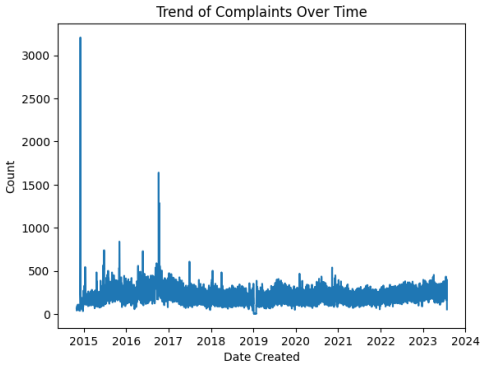
Untitled 6 RUN SAVE SHARE SCHEDULE

```
SELECT Date_Created, COUNT(*) as Count
FROM `final-projet-394216.customer_complaint_dataset.customer_data`
GROUP BY Date_Created
ORDER BY Count DESC
```

Query results

JOB INFORMATION | RESULTS | JSON | EXECUTION DETAILS

Row	Date_Created	Count
1	2014-12-03	3207
2	2016-10-07	1640
3	2016-10-12	1289
4	2016-10-14	1104
5	2014-12-02	860
6	2015-11-04	840
7	2016-10-11	807
8	2015-06-25	740
9	2016-05-24	729
10	2015-11-05	607

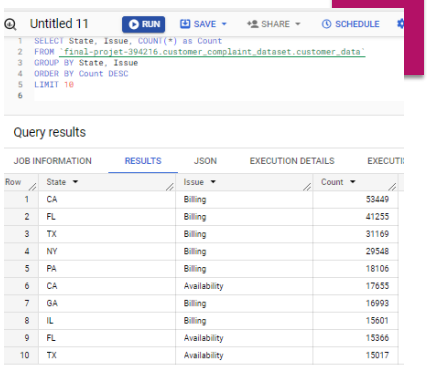


Druvana Sree Sreepada

Top 10 Issues in Complaints by State

- Query: Top 10 issues in complaints by state
- Description: This grouped bar chart shows the top 10 issues in complaints by state, providing insights into geographical variations in the issues.

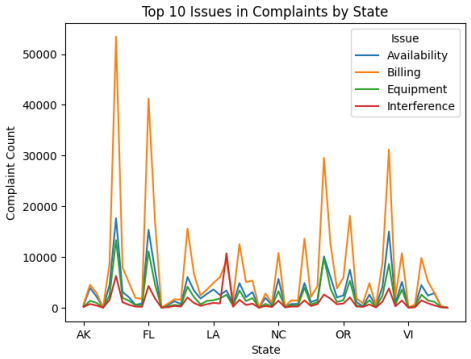
Druvana Sree Sreepada



Query results

JOB INFORMATION | RESULTS | JSON | EXECUTION DETAILS | EXECUTI

Row	State	Issue	Count
1	CA	Billing	53449
2	FL	Billing	41255
3	TX	Billing	31169
4	NY	Billing	29548
5	PA	Billing	18106
6	CA	Availability	17655
7	GA	Billing	16993
8	IL	Billing	15601
9	FL	Availability	15366
10	TX	Availability	15017



Conclusion

- We successfully cleaned and preprocessed a large, messy dataset using OpenRefine, enhancing its usability for analysis.
- Our exploration of the dataset using BigQuery and Python revealed interesting insights about consumer complaints, such as the most common issues and their geographical distribution
- The use of various visualization techniques helped us to understand the data better and to communicate our findings effectively.
- The project demonstrated the power of cloud-based tools like Google Cloud Storage, Hadoop, and BigQuery in handling and analyzing large datasets.
- The insights gained from this project can help businesses to improve their services, address common issues, and enhance customer satisfaction.

BONUS - Sentiment Analysis Dashboard

Description: The Sentiment Analysis Dashboard provides real-time insights into customer sentiments based on their complaints. The interactive dashboard offers a user-friendly interface, allowing businesses to monitor and respond to customer sentiments promptly.

- Real-time Sentiment Monitoring: Live feed of incoming customer complaints with automatic sentiment analysis (positive, negative, neutral).
- Sentiment Trends Over Time: Visualizations (line charts, area plots) showing how customer sentiments change over time, identifying emerging trends.
- Word Cloud of Emotions: Word cloud displaying frequently used words in positive and negative complaints, capturing prevalent emotions.
- Sentiment by Product/Service: Complaint filtering based on specific products or services to understand impact on customer sentiments.
- Responding to Negative Sentiments: Flagging high-impact negative sentiments for prioritized response and mitigation of potential escalations.

Druvana Sree Sreepada

BONUS - Root Cause Analysis for Major Complaints

Description: Root Cause Analysis is to identify underlying reasons behind major complaints and recurring issues, enabling targeted solutions and reducing overall complaint volume.

Key Points:

- **Utilize Data Mining Techniques:** Employ association rule mining or decision trees to uncover significant associations or patterns between complaint attributes and their root causes.
- **Identify Key Contributors:** Discover primary factors contributing to major complaints, including specific services, geographical locations, or demographic segments.
- **Implement Actionable Recommendations:** Make data-driven decisions to improve processes, enhance customer support, or refine product offerings to mitigate future complaints.
- **Foster Continuous Improvement:** Regularly perform root cause analysis to instill a culture of continuous improvement, keeping customer satisfaction a top priority.
- **Close the Feedback Loop:** Integrate insights from root cause analysis into the complaint resolution process, ensuring effective changes are implemented.
- These data-driven techniques enhances the value of the "Analyzing Consumer Complaints: A Data-Driven Approach" project. By leveraging advanced approaches, businesses can gain deeper insights, optimize customer experiences, and drive continuous improvement across their operations.

Druvana Sree Sreepada

References:

https://opendata.fcc.gov/Consumer/CGB-Consumer-Complaints-Data/3xyp-aqkj/data

Classroom material / Examples.

Thank you