



IBM Developer  
SKILLS NETWORK

# Winning Space Race with Data Science

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# Outline

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- Executive Summary
- Introduction
- Methodology
- Insights drawn from EDA
- Launch Sites Proximities Analysis
- Build a Dashboard with Plotly Dash
- Predictive Analysis
- Conclusion
- Appendix





# Executive Summary

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## Summary of Methodologies

### 1. Data Collection:

- Utilized the *SpaceX* REST API to fetch launch data.
- Complemented the dataset with web scraping from Wikipedia.

### 2. Data Wrangling:

- Filtered out Falcon 1 launches to focus solely on Falcon 9.
- Addressed missing values.

### 3. Exploratory Data Analysis (EDA):

- Conducted visual analysis using charts to uncover trends and relationships.
- Executed SQL queries to derive insights.

### 4. Interactive Visual Analytics:

- Created interactive maps using Folium to visualize launch sites and outcomes.
- Built dynamic dashboards with Plotly Dash.

### 5. Predictive Modeling:

- Developed classification models (Logistic Regression, Decision Trees, etc.) to predict landing outcomes.

## Summary of Results

### 1. Insights from Data Analysis:

- Launch sites such as KSC LC-39A and CCAFS LC-40 emerged as pivotal in *SpaceX*'s operations, showing high success rates.
- Payload mass and orbit types demonstrated significant influence on landing outcomes.

### 2. Interactive Visualizations:

- Folium maps effectively highlighted geographical patterns in launch site success.
- Plotly Dash dashboards enabled detailed exploration of payload vs. success trends.

### 3. Predictive Modeling Results:

- Logistic Regression emerged as the best-performing model, achieving an accuracy of 83.33%.
- Confusion matrix analysis confirmed its reliability in distinguishing successful from failed landings.

### 4. Actionable Insights:

- The findings underscore the importance of payload selection and site optimization in achieving successful launches.

# Introduction

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*SpaceX* has been revolutionizing the space industry by reducing the cost of space exploration and improving the success rate of rocket launches. Their reusable rocket technology has set a new benchmark for innovation. This project aims to analyse *SpaceX's* historical launch data to uncover patterns and insights that contribute to their success.

## **Problems You Want to Find Answers For:**

1. What are the key factors influencing the success or failure of *SpaceX* launches?
2. How do payload mass and orbit type impact the likelihood of successful landings?
3. Which launch sites contribute the most to *SpaceX's* success?
4. Can we predict the success of a launch based on historical data and specific mission parameters?

Section 1

# Methodology

# Methodology

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## 1. Data Collection:

- REST API: Data from *SpaceX* endpoint `api.spacexdata.com/v4/launches/past` with additional data from `/rockets`, `/payloads`, and `/launchpads`.
- Web Scraping: HTML tables from Falcon 9 Wiki pages cleaned and integrated into pandas dataframes.

## 2. Data Wrangling:

- Filtered out Falcon 1 launches to focus on Falcon 9.
- Replaced missing PayloadMass values with the mean.

## 3. Exploratory Data Analysis (EDA):

- Visualized data with bar charts, pie charts, scatter plots, and SQL queries for trends and relationships.

## 4. Interactive Visual Analytics:

- Folium: Interactive maps with launch site markers, radii, and trajectories.
- Plotly Dash: Dashboard for filtering by launch sites, payload mass, and visualizing success rates.

## 5. Predictive Analysis:

- Built classification models to predict landing outcomes.
- Tuned models using GridSearchCV and evaluated with accuracy and F1-score.

## 6. Model Selection:

- Compared models via cross-validation.
- Visualized accuracy and selected the best-performing model using confusion matrix analysis.

# Data Collection

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## ***SpaceX* REST API:**

- Endpoint: [api.spacexdata.com](https://api.spacexdata.com)
- This endpoint provided structured data about past *SpaceX* launches, including details about rockets, payloads, launchpads, and more. The data was retrieved in JSON format.
- Supplementary data was gathered by querying additional API endpoints (e.g., /rockets, /launchpads, /payloads) to enrich and clarify key fields.

## **Web Scraping:**

- HTML tables containing Falcon 9 launch data were extracted from relevant Wiki pages using Python's BeautifulSoup library.
- These tables were parsed, cleaned, and converted into pandas dataframes for integration with the API data.

# Data Collection – SpaceX API



## 1. Initiate API Calls:

- Used the requests library to perform GET requests on the *SpaceX* REST API endpoint: <https://api.spacexdata.com/v4/launches/past>.
- Fetched launch data, including rocket details, payload, and launch outcomes.

## 2. Parsing API Responses:

- Parsed JSON responses from the API using the `json()` method.
- Extracted nested data for detailed analysis (e.g., rocket IDs, payload information).

## 3. Data Normalization:

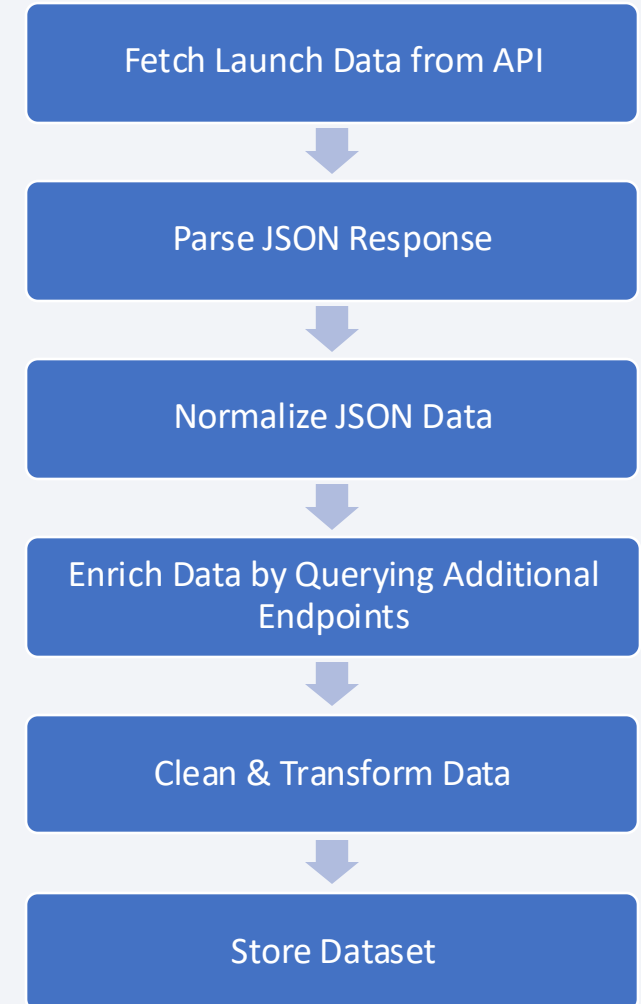
- Utilized `pandas.json_normalize` to flatten nested JSON structures into tabular format.
- Mapped IDs (e.g., rockets, payloads) to descriptive details by querying supplementary API endpoints.

## 4. Data Cleaning:

- Filtered data to exclude Falcon 1 launches, focusing exclusively on Falcon 9.
- Handled missing values in key columns like `PayloadMass` by replacing them with the column's mean.

## 5. Storing Data:

- Prepared a clean and structured dataset for analysis and visualization.





# Data Collection - Scraping

## 1. Target Data Source:

- The target webpage is [https://en.wikipedia.org/wiki/List\\_of\\_Falcon\\_9\\_and\\_Falcon\\_Heavy\\_launches](https://en.wikipedia.org/wiki/List_of_Falcon_9_and_Falcon_Heavy_launches).
- HTML tables containing launch records were identified as the main source of data.

## 2. Scraping with BeautifulSoup:

- The requests library was used to fetch the HTML content of the webpage.
- BeautifulSoup parsed the HTML content to locate relevant <table> elements.

## 3. Extracting Table Data:

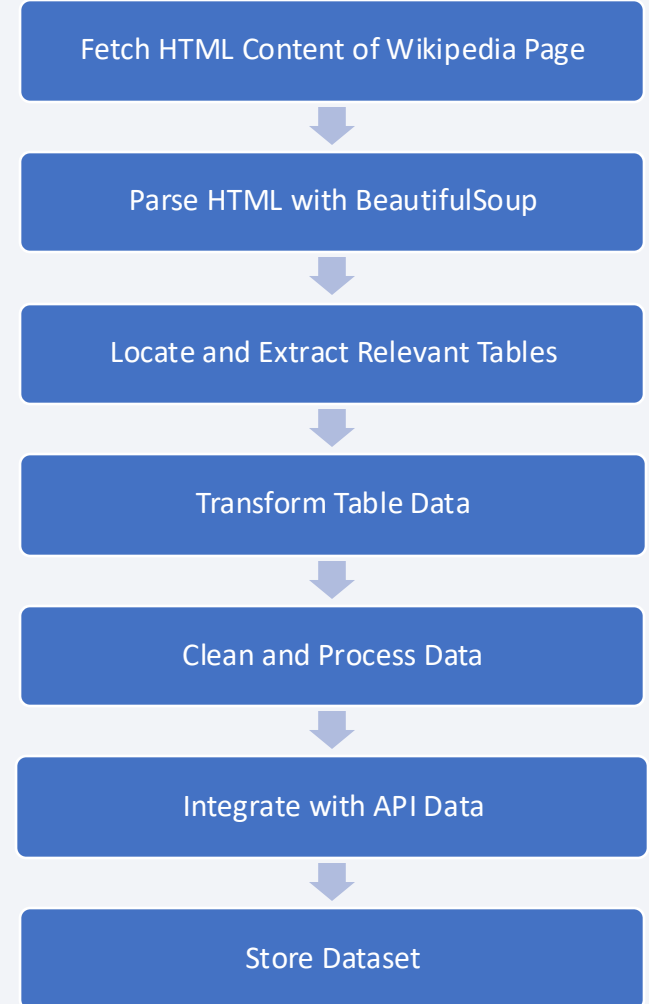
- Iterated over the rows of the identified table to extract data into lists or dictionaries.
- Specific columns, such as launch date, payload, and outcome, were extracted for analysis.

## 4. Data Cleaning and Transformation:

- Converted raw table data into a pandas dataframe for further processing.
- Cleaned up missing or irrelevant values, ensuring consistency in the dataset.

## 5. Data Integration:

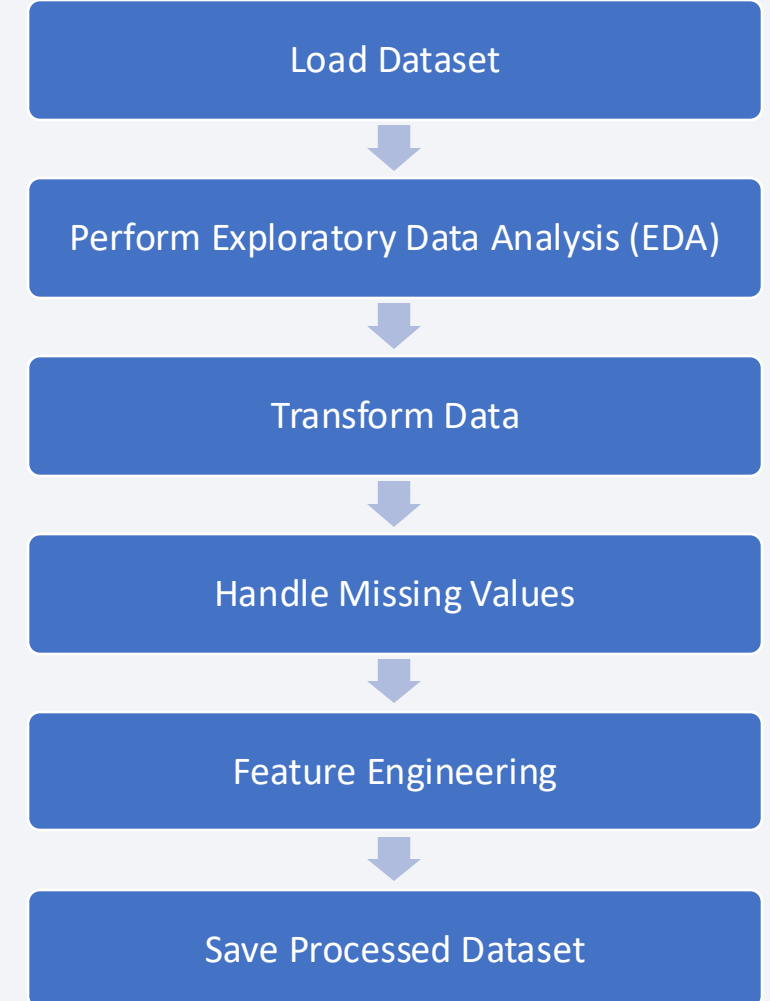
- The scraped data was integrated with data from the *SpaceX* API to create a comprehensive dataset.



# Data Wrangling



1. Data Exploration:
  - Explored data to identify patterns and inconsistencies.
  - Examined outcomes such as True Ocean, False Ocean, True RTLS, False RTLS, True ASDS, and False ASDS to understand success and failure cases.
2. Data Transformation:
  - Converted landing outcomes into binary labels: 1 for successful landings and 0 for unsuccessful ones.
  - Extracted meaningful columns for machine learning, focusing on landing success and other significant features.
3. Handling Missing Data:
  - Identified and addressed null values in critical columns, replacing them with appropriate substitutes like the mean or mode.
4. Feature Engineering:
  - Created new features from existing data to enhance predictive modeling, such as categorizing outcomes or normalizing numeric columns.
5. Integration and Storage:
  - Integrated cleaned and transformed data into a final dataset, ready for analysis or training supervised models.



## 1. Bar Charts:

- *Why:* To visualize categorical distributions, such as the number of successful vs. unsuccessful landings or the frequency of launch sites.
- *Example:* A bar chart showing the count of launches by launch site to identify the most frequently used sites.

## 2. Pie Charts:

- *Why:* To display proportions, such as the percentage of launches that succeeded or failed.
- *Example:* A pie chart illustrating the success rate of Falcon 9 landings.

## 3. Scatter Plots:

- *Why:* To analyze relationships between numerical variables, such as payload mass and landing outcome.
- *Example:* A scatter plot showing payload mass versus success rate to identify trends.

## 4. Histograms:

- *Why:* To display distributions of continuous variables, such as payload mass.
- *Example:* A histogram of payload mass to identify common payload sizes.

## 5. Box Plots:

- *Why:* To analyze data variability and detect outliers.
- *Example:* A box plot of payload mass grouped by success or failure to understand variability in payload sizes.

## 6. Line Charts:

- *Why:* To observe trends over time, such as the number of successful launches per year.
- *Example:* A line chart showing the trend of successful landings over time.

## 1. Data Ingestion:

- Loaded the *SpaceX* dataset into a database table using CSV import methods.
- Verified successful data ingestion with `SELECT COUNT(*)` and table structure inspection.

## 2. Basic Exploration:

- Queried the first few rows of the table using `SELECT * FROM table_name LIMIT n`.
- Checked unique values for key fields like LaunchSite using `SELECT DISTINCT column_name`.

## 3. Aggregations:

- Calculated the total number of launches per launch site using `GROUP BY` and `COUNT()`.
- Summarized the success rate of landings with `COUNT` and `CASE` statements.

## 4. Filtering and Conditions:

- Filtered records for specific rockets (e.g., Falcon 9) using `WHERE` conditions.
- Queried payload data for launches exceeding a specified mass using `WHERE payload_mass > value`.

## 5. Joins:

- Joined tables to enrich launch data with additional details, such as rocket or payload information.
- Used `INNER JOIN` for integrating related datasets based on unique identifiers.

## 6. Sorting:

- Ranked launches by payload mass using `ORDER BY payload_mass DESC` to identify the heaviest payloads.



# Build and Interactive Map with Folium



Element	Purpose	Why
<b>Markers</b>	Highlight specific launch site locations on the map. Provide information about each launch site (e.g., name and location) through popups.	Helps visualize where each launch site is geographically located.
<b>Circles</b>	Represent the radius around each launch site to analyze proximity-related factors (e.g., population density or water bodies).	Useful for understanding spatial relationships and their potential impact on launch outcomes.
<b>Lines</b>	Draw trajectories from launch sites to target locations in orbit or highlight distances between locations.	Provides a visual representation of launch trajectories and geographic context.
<b>Layers</b>	Use additional map layers (e.g., satellite view or terrain view) to analyze geographic features.	Offers diverse perspectives for understanding environmental and geographic impacts.

# Build a Dashboard with Plotly Dash



## **Pie Chart:**

- *Purpose:* Displays the success rate of launches for selected launch sites.
- *Interactions:* Dropdown to select a specific launch site or view aggregated data for all sites.
- *Why:* Offers a clear and intuitive representation of success rates, making it easy to compare performance.

## **Scatter Plot:**

- *Purpose:* Visualizes the relationship between payload mass and launch success for different launch sites.
- *Interactions:* Dropdown to filter data by specific launch sites or show all sites, Dynamic updates based on user selection.
- *Why:* Helps identify patterns or correlations between payload and launch success across sites.

## **Range Slider for Payload Mass:**

- *Purpose:* Allows users to filter data by payload mass range.
- *Interactions:* Adjusting the slider dynamically updates the scatter plot to reflect the selected payload range.
- *Why:* Enables detailed exploration of the impact of payload mass on launch success.

## **Dynamic Layout:**

- *Purpose:* Organizes the dashboard with interactive components and visualizations for a seamless user experience.
- *Why:* Ensures that all interactions and plots are accessible and visually appealing.

## **Why These Plots and Interactions Were Added**

- To facilitate interactive exploration of *SpaceX* launch data.
- To provide insights into key performance metrics, such as payload effects and success rates.
- To make the analysis user-friendly and visually compelling through dynamic updates and customizable filters.

# Predictive Analysis (Classification)



## Model Development Process

### 1. Data Preparation:

- Selected key features (payload mass, orbit, launch site, booster version).
- Encoded categorical variables (e.g., one-hot encoding).
- Normalized numerical values for uniform scaling.

### 2. Model Building:

- Tested models: Logistic Regression, Decision Trees, SVM, KNN, and Random Forests.

### 3. Model Evaluation:

- Metrics: Accuracy, Precision, Recall, F1-Score.
- Applied cross-validation for robustness.

### 4. Hyperparameter Tuning:

- Used GridSearchCV to optimize key parameters (e.g., C for Logistic Regression, max\_depth for Decision Trees).

### 5. Best Model Selection:

- Chose the model with the highest F1-Score and cross-validation performance.

### 6. Final Testing:

- Validated on unseen test data and analyzed the confusion matrix.

# Results

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## Insights from EDA:

- Launch sites such as CCAFS LC-40 were identified as key contributors to SpaceX's success.
- A positive correlation was observed between payload mass and launch outcomes in certain orbits.

## Interactive Maps:

- Maps demonstrated the geographical distribution of launch sites and their success rates.
- Proximity analyses to infrastructure like highways and coastlines were visualized.

## Predictive Models:

- Models such as Logistic Regression and Decision Trees achieved similar accuracy (~83.33%).
- The Logistic Regression model was selected as the best performer based on F1-score and confusion matrix analysis.



The background of the slide is an abstract composition. It features a dark blue base color. Overlaid on this are numerous diagonal streaks in shades of blue and red, creating a sense of motion or data flow. A faint, light blue grid pattern is also visible, particularly in the lower-left quadrant. The overall effect is high-tech and digital.

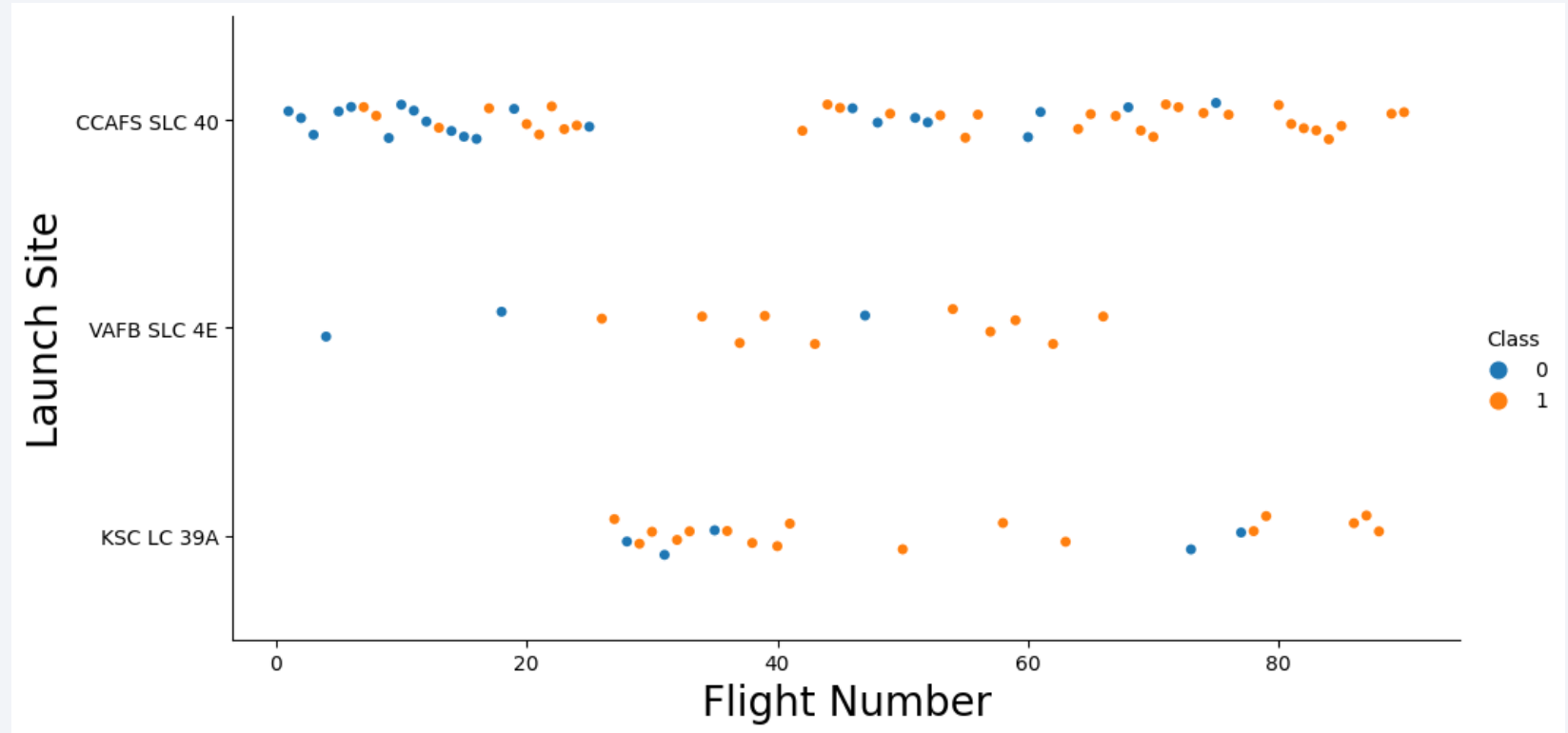
Section 2

# Insights drawn from EDA



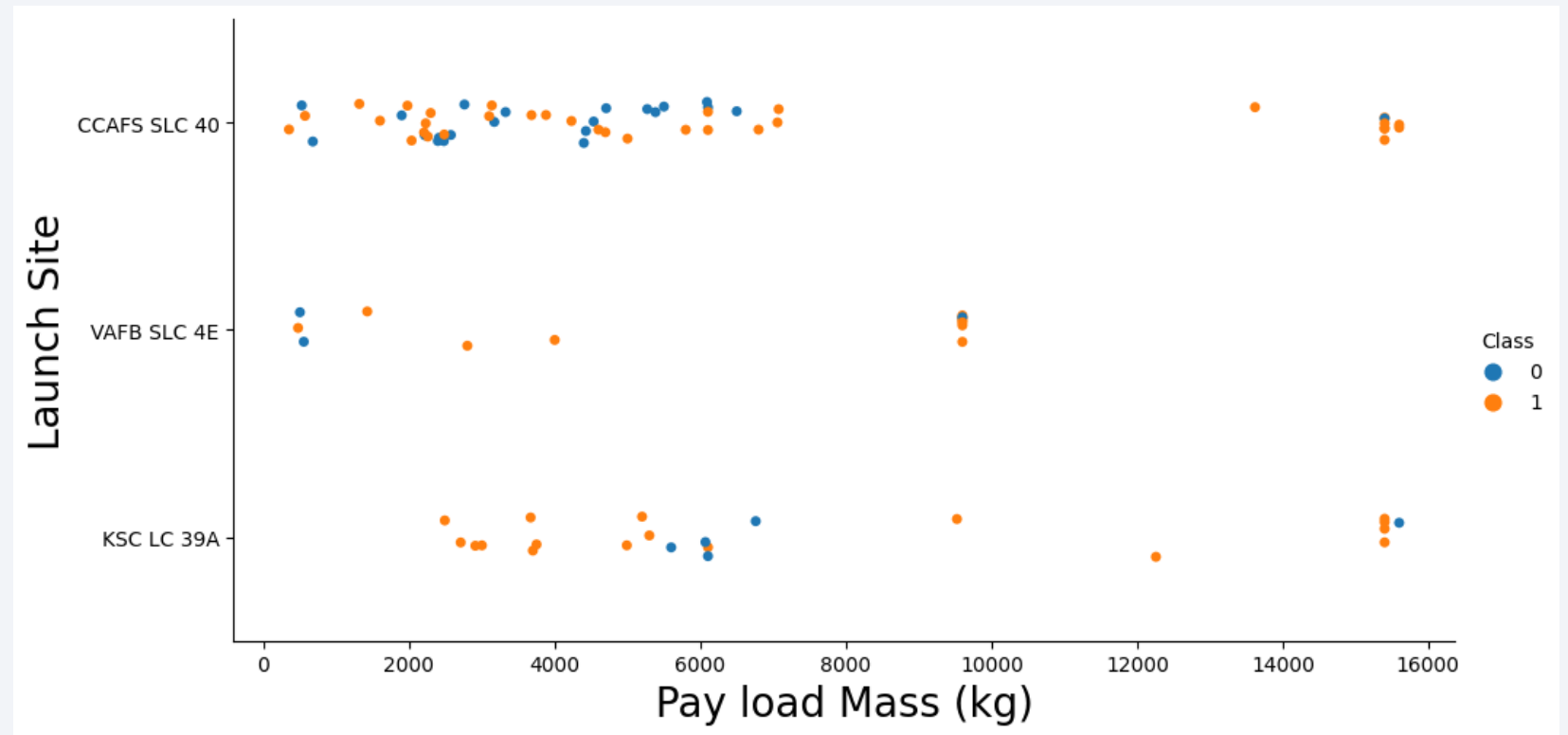
# Flight Number vs. Launch Site

This scatter plot demonstrates the relationship between the flight number and the launch site. It highlights the frequency of launches from each site, revealing that CCAFS LC-40 and KSC LC-39A hosted the majority of SpaceX's missions. This insight emphasizes the operational importance of these sites in *SpaceX's* strategy.



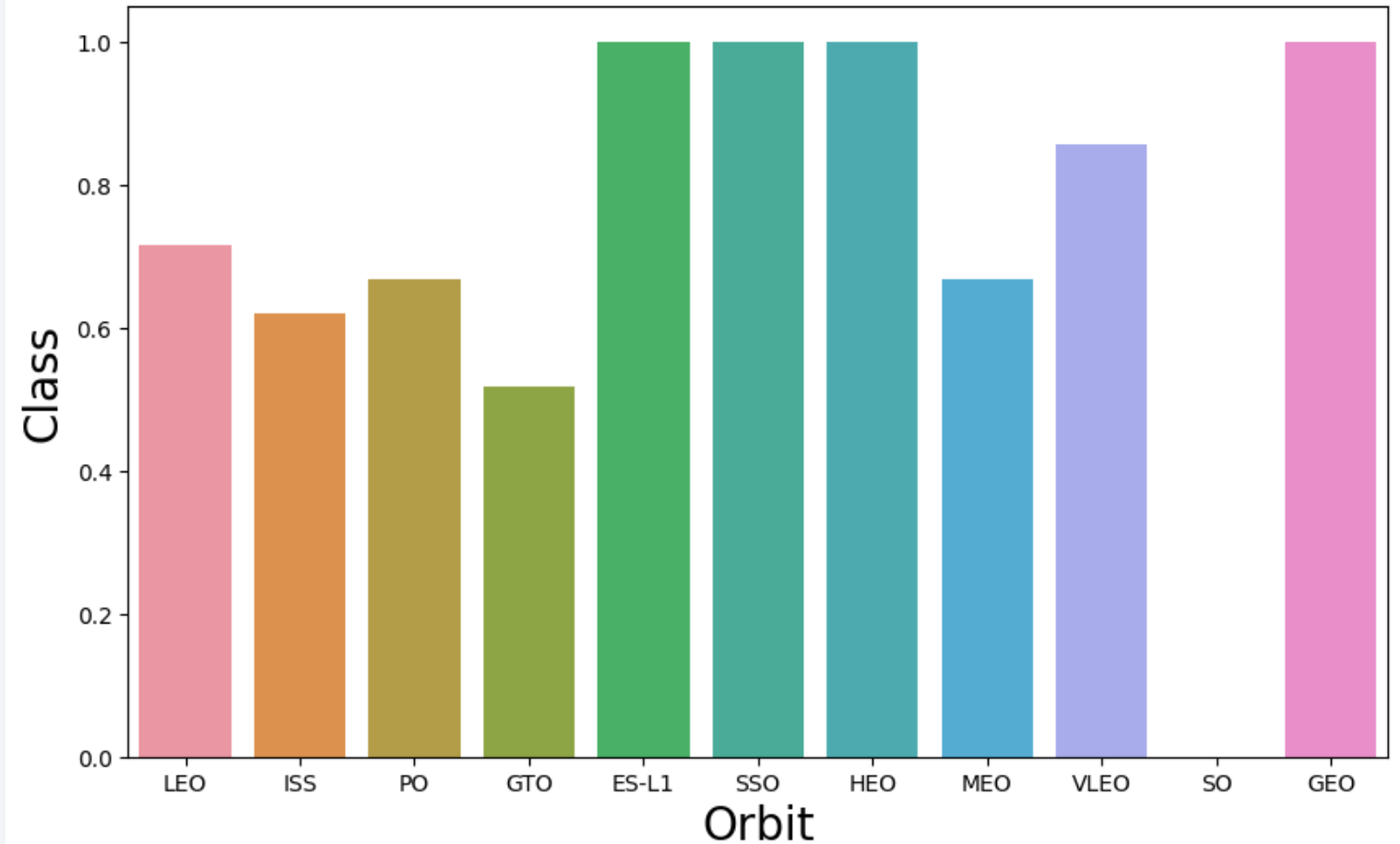
# Payload vs. Launch Site

The plot illustrates the payload mass for different launches across *SpaceX's* sites. It shows that heavier payloads were often launched from KSC LC-39A, suggesting that this site is better equipped for missions involving higher payload masses.



# Success Rate vs. Orbit Type

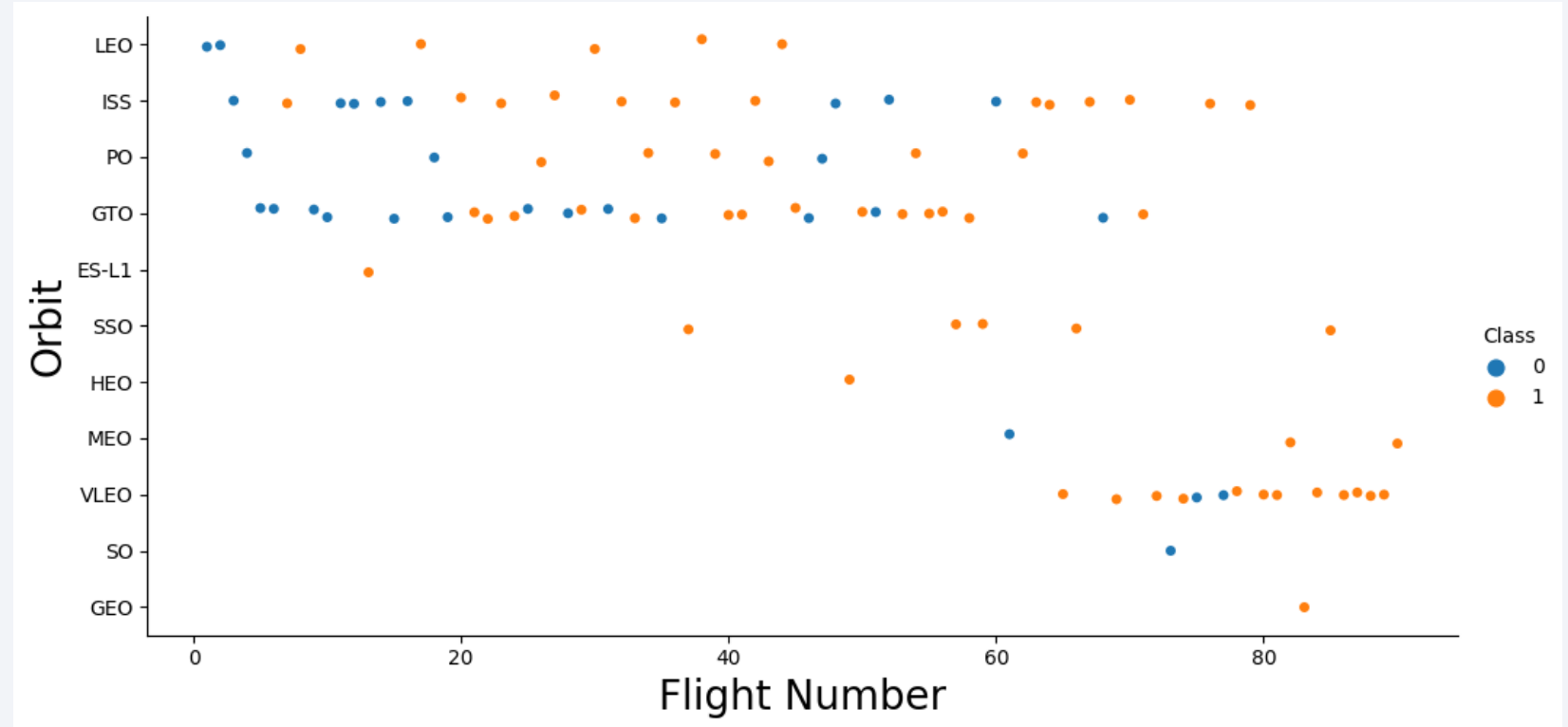
This bar chart showcases the success rate for different orbit types. Geostationary Transfer Orbit (GTO) has a slightly lower success rate compared to Low Earth Orbit (LEO), indicating that GTO missions are more challenging due to higher technical demands.





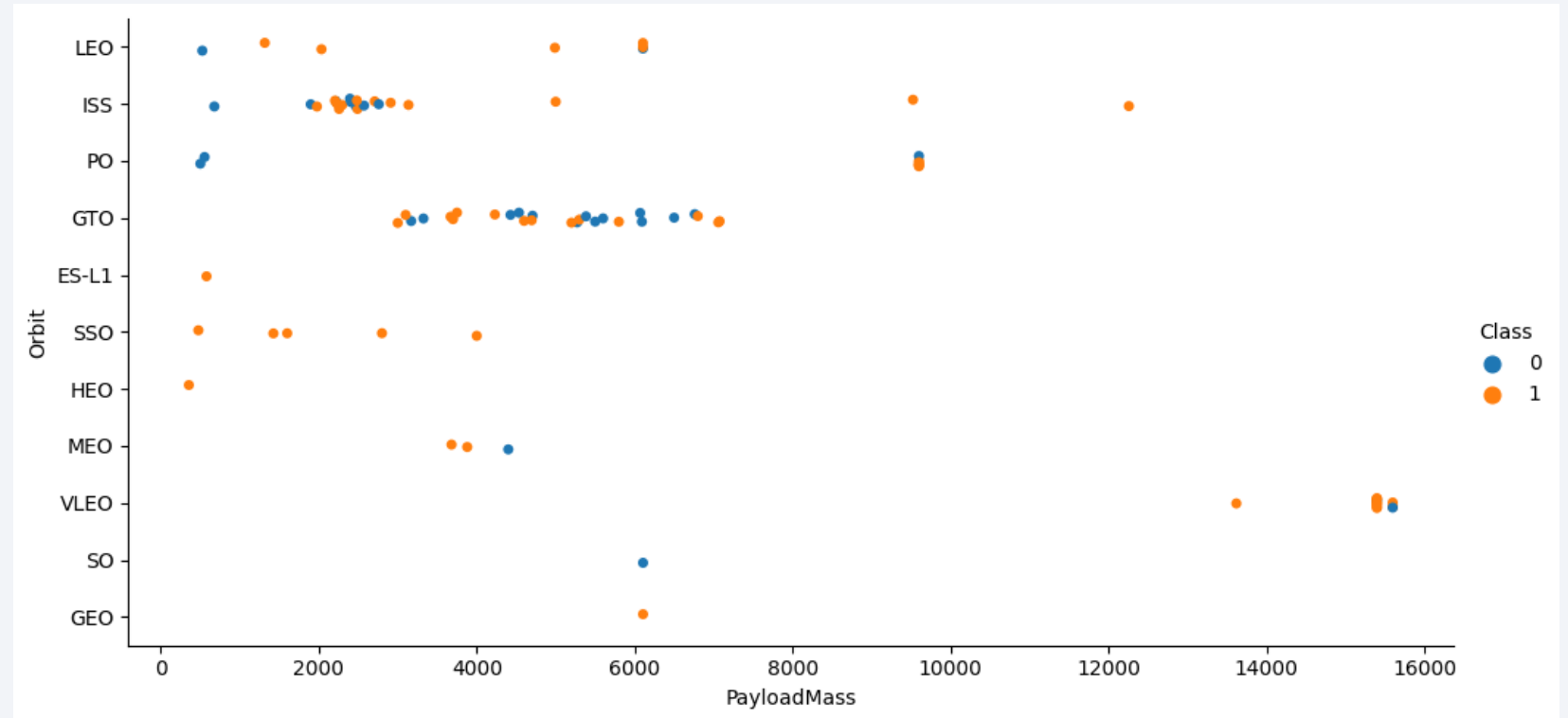
# Flight Number vs. Orbit Type

This scatter plot shows how orbit type distribution evolved as *SpaceX* launched more flights. Early missions targeted simpler orbits (LEO), while later flights included more complex missions to GTO and beyond.



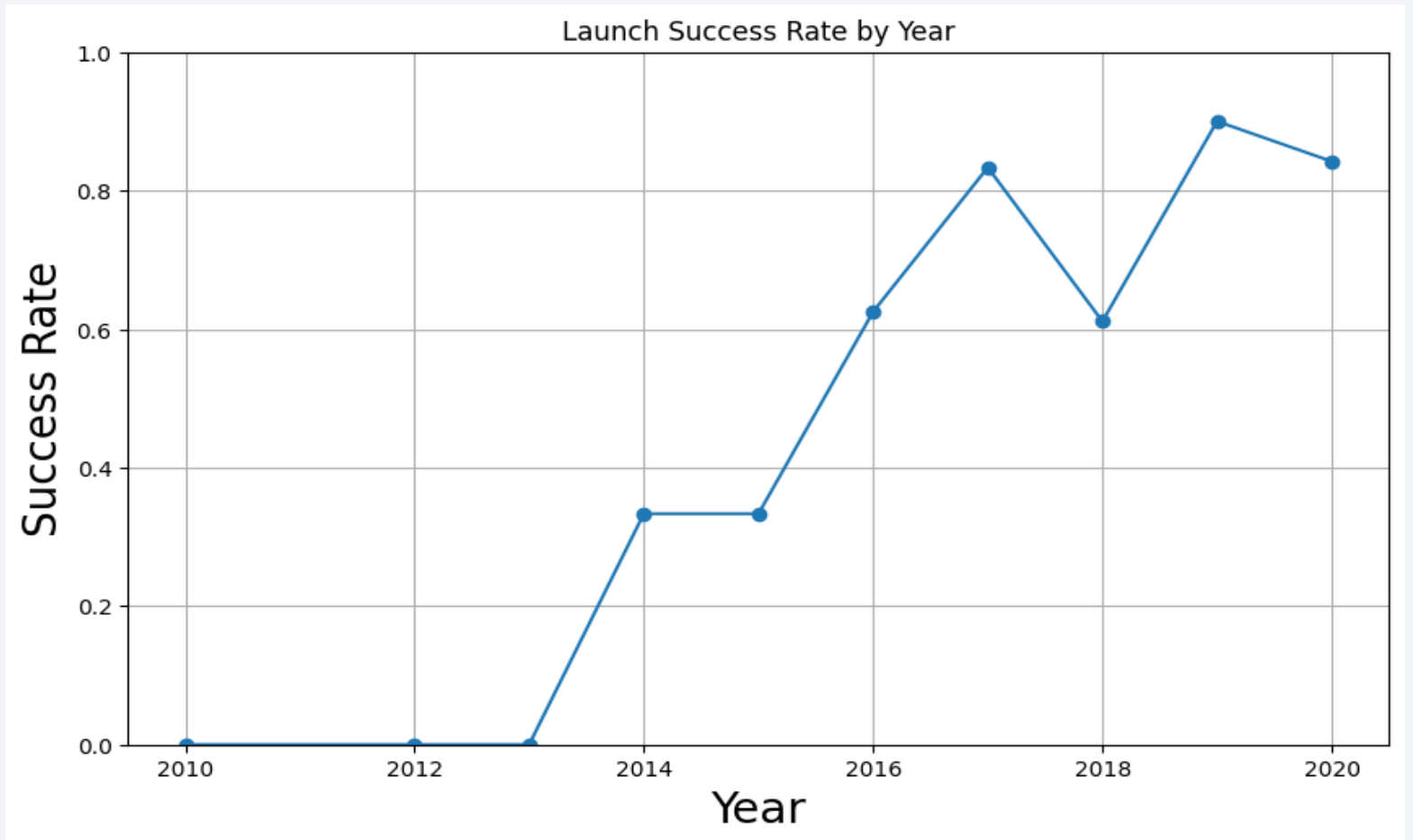
# Payload vs. Orbit Type

This scatter plot analyzes how payload mass varies across orbit types. LEO missions can accommodate heavier payloads compared to GTO, reflecting differences in mission requirements and technical constraints.



# Launch Success Yearly Trend

The line chart depicts the yearly trend in *SpaceX's* launch success rate. A consistent improvement over time is evident, showcasing the company's learning curve and technological advancements.



# All Launch Site Names

---

```
SELECT
    distinct(Launch_Site)
FROM
    SPACEXTABLE
```

Launch Site	Lat	Long
CCAFS LC-40	28.562302	-80.577356
CCAFS SLC-40	28.563197	-80.576820
KSC LC-39A	28.573255	-80.646895
VAFB SLC-4E	34.632834	-120.610745

## Explanations

This query retrieves the unique names of all launch sites where SpaceX missions have taken place. The result shows sites such as CCAFS LC-40 and KSC LC-39A, highlighting their significance in SpaceX's operations.



# Launch Site Names Begin with 'CCA'

```
SELECT
    *
FROM
    SPACEXTABLE
WHERE
    Launch_Site like 'CCA%' limit 5
```

Date	Time (UTC)	Booster_Version	Launch_Site	Payload	PAYLOAD_MASS_KG_	Orbit	Customer
2010-06-04	18:45:00	F9 v1.0 B0003	CCAFS LC-40	Dragon Spacecraft Qualification Unit	0	LEO	SpaceX
2010-12-08	15:43:00	F9 v1.0 B0004	CCAFS LC-40	Dragon demo flight C1, two CubeSats, barrel of Brouere cheese	0	LEO (ISS)	NASA (COTS) NRO
2012-05-22	7:44:00	F9 v1.0 B0005	CCAFS LC-40	Dragon demo flight C2	525	LEO (ISS)	NASA (COTS)
2012-10-08	0:35:00	F9 v1.0 B0006	CCAFS LC-40	SpaceX CRS-1	500	LEO (ISS)	NASA (CRS)
2013-03-01	15:10:00	F9 v1.0 B0007	CCAFS LC-40	SpaceX CRS-2	677	LEO (ISS)	NASA (CRS)

## Explanations

This query filters launch sites whose names start with 'CCA', limiting the result to the first five records. It focuses on sites such as CCAFS LC-40 and CCAFS SLC-40 to analyze their operational patterns.

# Total Payload Mass

---

```
SELECT
    SUM(PAYLOAD_MASS__KG_) as TOTAL_PAYLOAD_MASS_KG_
FROM
    SPACEXTABLE
WHERE
    Customer = 'NASA (CRS)'
```

TOTAL\_PAYLOAD\_MASS\_KG\_

**45596**

## Explanations

The query calculates the total payload mass carried by boosters for NASA (CRS) missions. This provides insights into NASA's dependency on SpaceX for delivering heavy payloads.

# Average Payload Mass by F9 v1.1

---

```
SELECT
    AVG(PAYLOAD_MASS__KG_) as AVG_PAYLOAD_MASS_KG_
FROM
    SPACEXTABLE
WHERE
    Booster_Version LIKE 'F9 v1.1%'
```

AVG\_PAYLOAD\_MASS\_KG\_

2534.6666666666665

## Explanations

This query computes the average payload mass for the Falcon 9 v1.1 booster version, offering insights into its operational capacity and performance.

# First Successful Ground Landing Date

---

```
SELECT
    Date
FROM
    SPACEXTABLE
WHERE
    Landing_Outcome LIKE 'Success%' order by Date asc limit 1
```

## Explanations

This query identifies the date of SpaceX's first successful ground landing. It showcases a milestone in SpaceX's reusability goals and technological achievements.

Date
2015-12-22

## Successful Drone Ship Landing with Payload between 4000 and 6000

```
SELECT
    Booster_Version
FROM
    SPACEXTABLE
WHERE
    Landing_Outcome == 'Success (drone ship)'
    AND
    PAYLOAD_MASS__KG_ > 4000
    AND
    PAYLOAD_MASS__KG_ < 6000
```

Booster_Version
F9 FT B1022
F9 FT B1026
F9 FT B1021.2
F9 FT B1031.2

### Explanations

This query lists the boosters that successfully landed on a drone ship while carrying payloads between 4000 and 6000 kg. It demonstrates SpaceX's precision in handling medium payloads.



# Total Number of Successful and Failure Mission Outcomes

```
SELECT
    Mission_Outcome,
    COUNT(*) as Count
FROM
    SPACEXTABLE
GROUP BY
    Mission_Outcome
```

Mission_Outcome	Count
Failure (in flight)	1
Success	98
Success	1
Success (payload status unclear)	1

```
SELECT
    COUNT(CASE WHEN Landing_Outcome LIKE 'Success%' THEN 1 END) AS SuccessCount,
    COUNT(CASE WHEN Landing_Outcome LIKE 'Failure%' THEN 1 END) AS FailureCount
FROM
    SPACEXTABLE;
```

Success	Failures
61	10

# Boosters Carried Maximum Payload

```
SELECT
    DISTINCT Booster_Version
FROM
    SPACEXTABLE
WHERE
    PAYLOAD_MASS__KG_ = (
        SELECT MAX(PAYLOAD_MASS__KG_)
        FROM SPACEXTABLE)
```

## Explanations

This query identifies the boosters that carried the heaviest payloads, showcasing their maximum capacity and reliability.

Booster_Version		
F9	B5	B1048.4
F9	B5	B1049.4
F9	B5	B1051.3
F9	B5	B1056.4
F9	B5	B1048.5
F9	B5	B1051.4
F9	B5	B1049.5
F9	B5	B1060.2
F9	B5	B1058.3
F9	B5	B1051.6
F9	B5	B1060.3
F9	B5	B1049.7

# 2015 Launch Records

```
SELECT
    substr(Date, 6,2) as month,
    Landing_Outcome,
    Booster_Version,
    Launch_Site
FROM
    SPACEXTABLE
WHERE
    substr(Date,0,5)='2015'
    AND
    Landing_Outcome like 'Failure (drone ship)'
ORDER
    BY month;
```

Month	Landing_Outcome	Booster_Version	Launch_Site
01	Failure (drone ship)	F9 v1.1 B1012	CCAFS LC-40
04	Failure (drone ship)	F9 v1.1 B1015	CCAFS LC-40

## Explanations

This query retrieves records of failed drone ship landings in 2015, providing insights into early challenges faced by SpaceX.

## Rank Landing Outcomes Between 2010-06-04 and 2017-03-20

```
SELECT
    Landing_Outcome,
    COUNT(Landing_Outcome) as Count
FROM
    SPACEXTABLE
WHERE
    Date BETWEEN '2010-06-04' AND '2017-03-20'
GROUP BY
    Landing_Outcome
ORDER BY
    Count DESC
```

Landing_Outcome	Count
No attempt	10
Success (drone ship)	5
Failure (drone ship)	5
Success (ground pad)	3
Controlled (ocean)	3
Uncontrolled (ocean)	2
Failure (parachute)	2
Precluded (drone ship)	1

### Explanations

This query ranks landing outcomes during a specific timeframe, showing SpaceX's progress and challenges over the years.

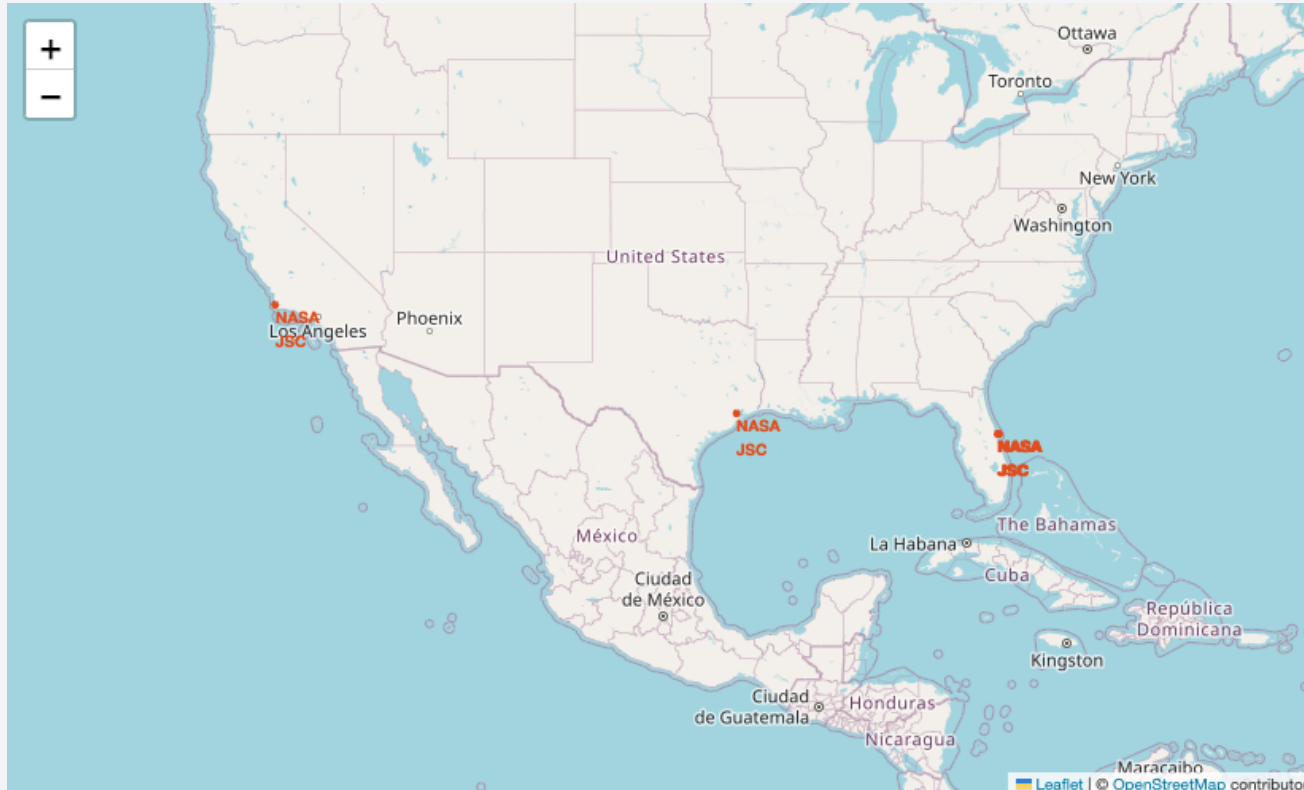
A satellite view of Earth from space, showing the curvature of the planet and city lights at night. The image is a composite of a solid blue background on the left and a satellite photograph of Earth on the right. The Earth's surface is dark blue, with numerous bright yellow and orange lights representing cities and urban areas. The horizon line of the Earth is visible, separating the dark surface from the blackness of space.

Section 3

# Launch Sites Proximities Analysis



# Folium Map - All Launch Sites

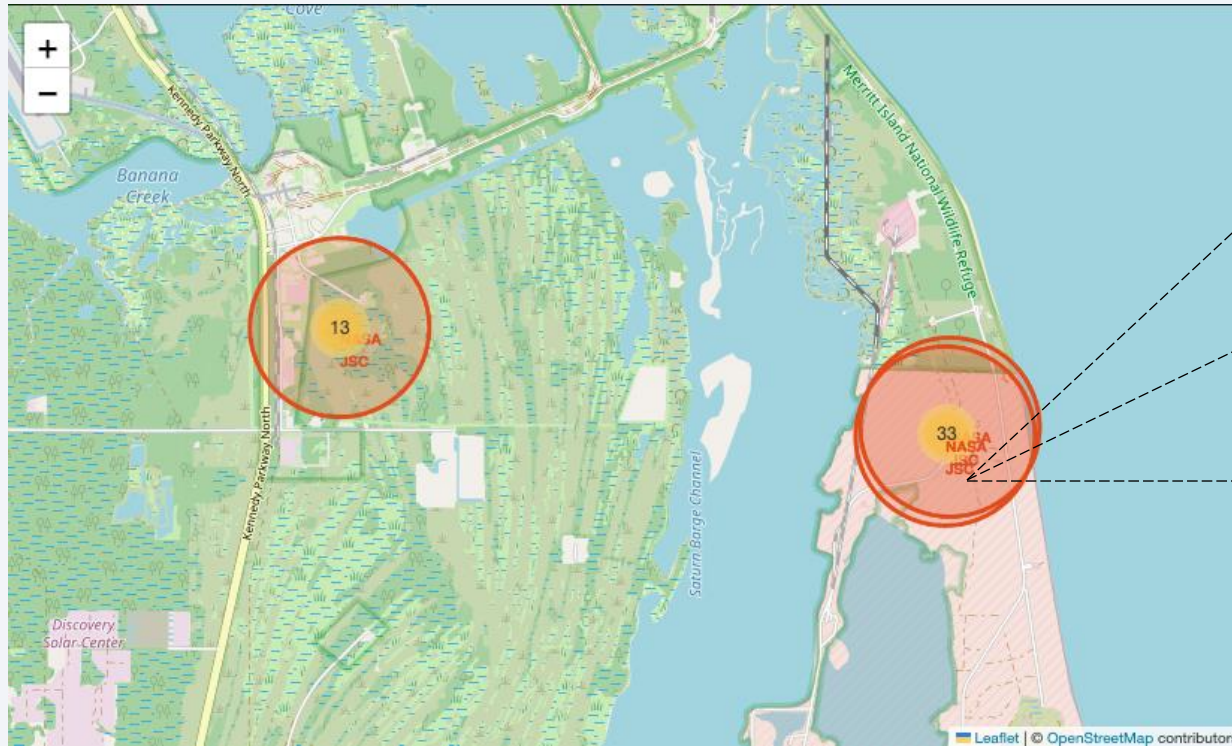


Launch Site	Lat	Long
CCAFS LC-40	28.562302	-80.577356
CCAFS SLC-40	28.563197	-80.576820
KSC LC-39A	28.573255	-80.646895
VAFB SLC-4E	34.632834	-120.610745

## Explanations

This interactive map marks all *SpaceX* launch sites. Key locations such as CCAFS LC-40 and KSC LC-39A are highlighted, providing a geographical overview of their strategic positions near the coastline.

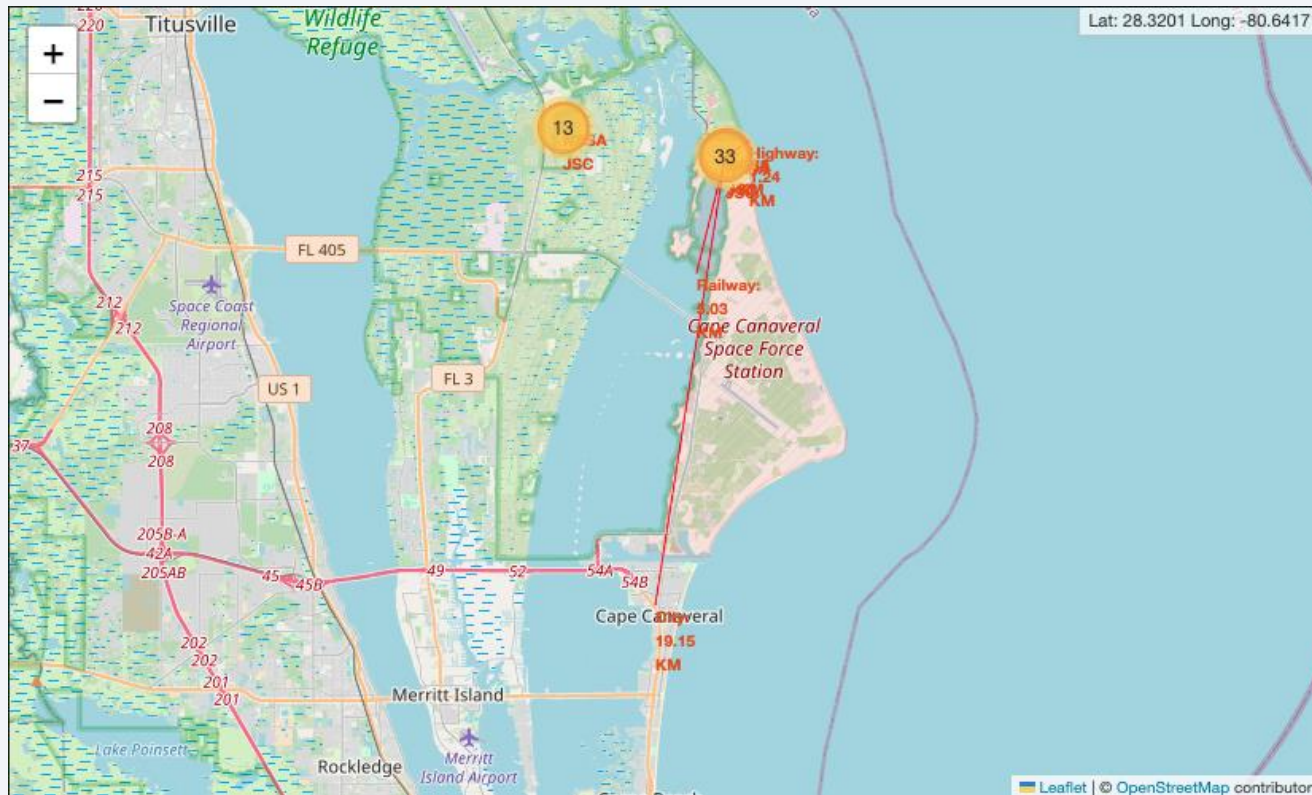
# Folium Map - Success/Failed launches for site



## Explanations

The color-coded markers indicate the success or failure of launches from each site. The clustering of successful launches around KSC LC-39A reflects its reliability and advanced infrastructure.

# Folium Map - Distance from launch site to proximities



## Explanations

This map visualizes the distances between launch sites and nearby infrastructure such as highways, railways, and coastlines. The proximity analysis aids in understanding logistical and safety considerations for site selection.

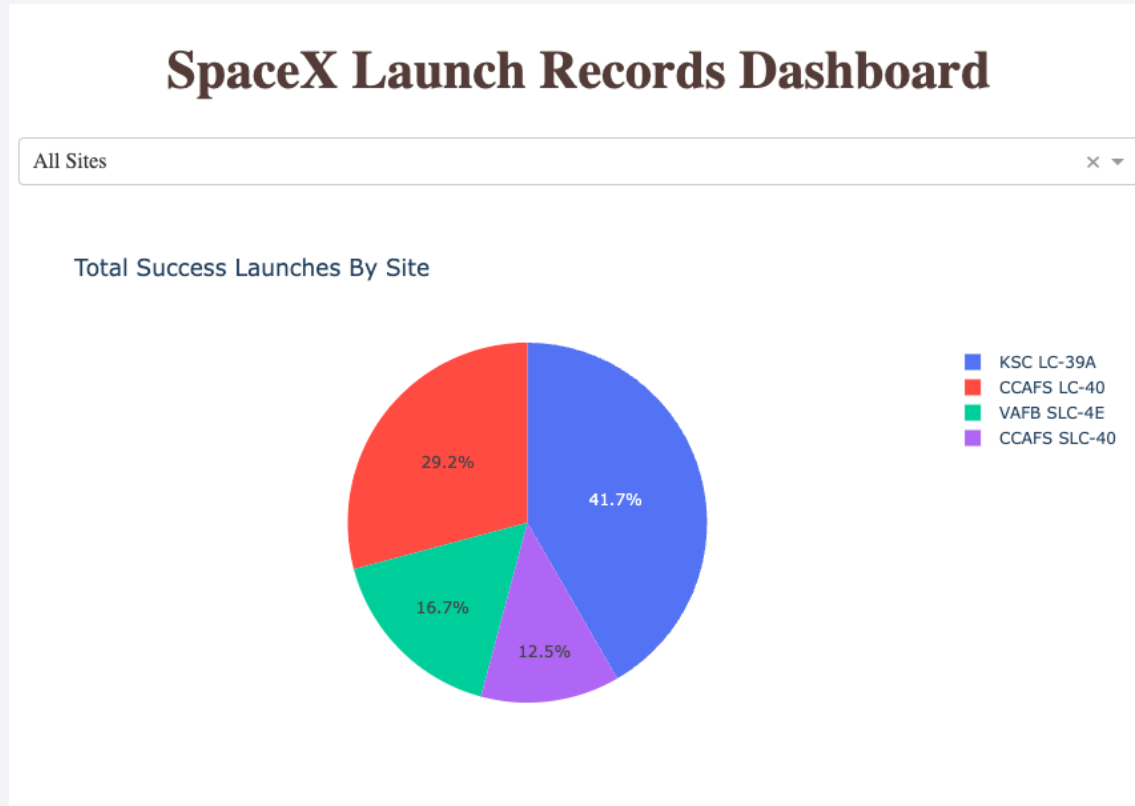




Section 4

# Build a Dashboard with Plotly Dash

# Dashboard Launch Success Rates Overview

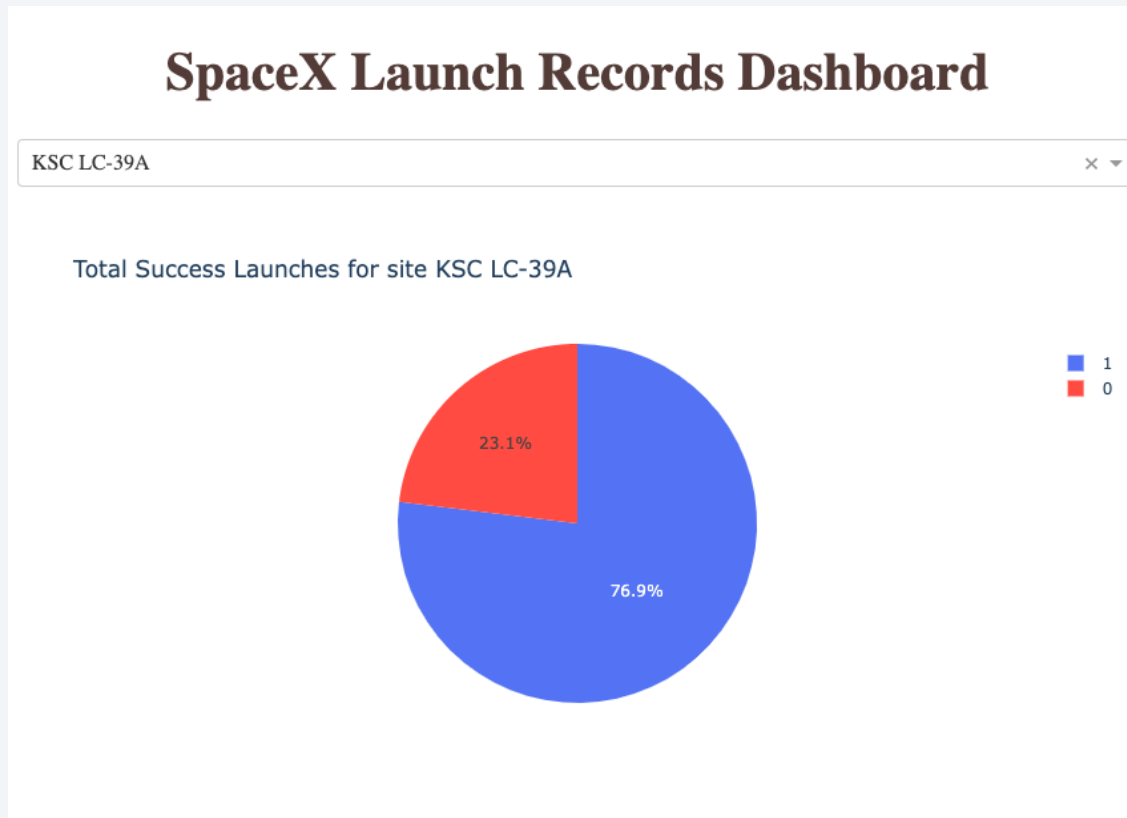


## Explanations

The pie chart displays the success rate of launches across all sites. KSC LC-39A leads in successful launches, emphasizing its pivotal role in *SpaceX's* operations.



# Dashboard Top Performing Launch Site



## Explanations

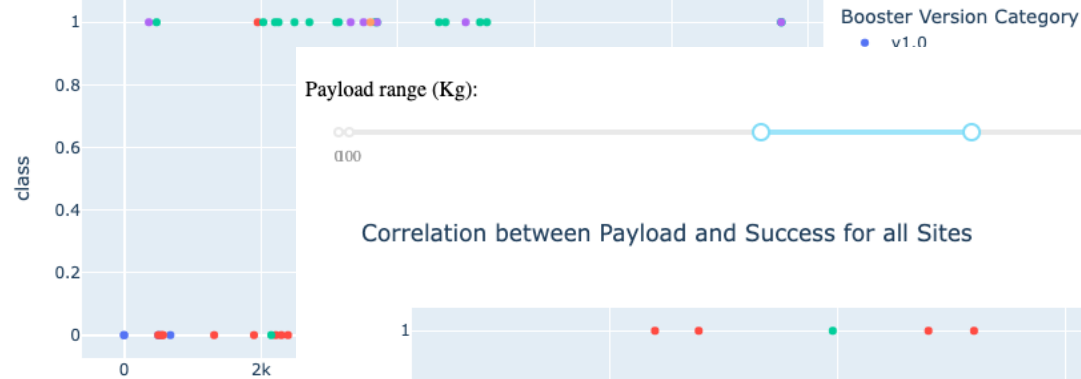
This pie chart focuses on the launch site with the highest success ratio. It confirms that KSC LC-39A has the most efficient setup, achieving consistent success over multiple launches.

# Dashboard Payload Impact on Launch Outcomes

Payload range (Kg):



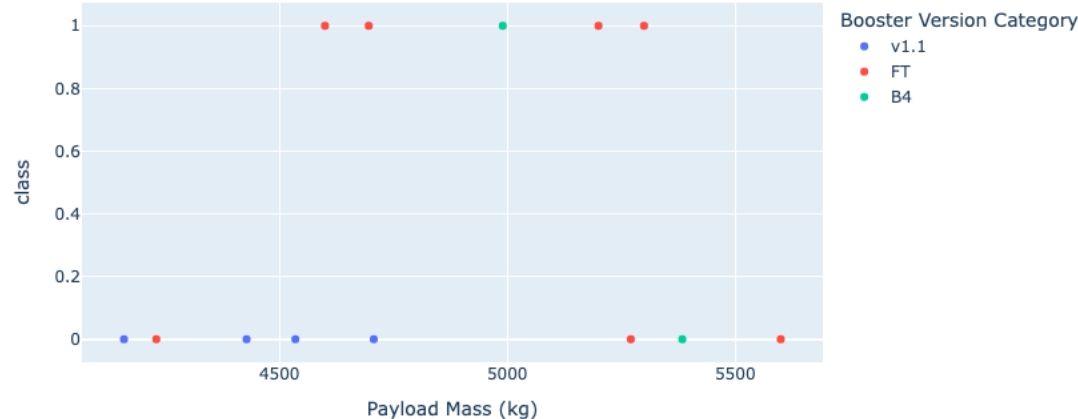
Correlation between Payload and Success for all Sites



Payload range (Kg):



Correlation between Payload and Success for all Sites



## Explanations

The scatter plot shows the relationship between payload mass and launch outcome for all sites. Higher payloads correlate with a slightly reduced success rate, particularly for complex missions to GTO.

Section 5

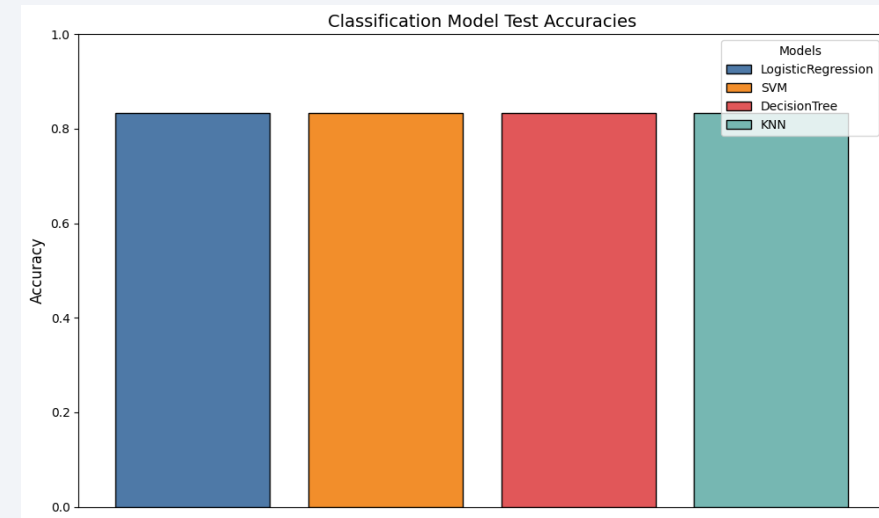
# Predictive Analysis (Classification)

# Classification Accuracy

## Best Model:

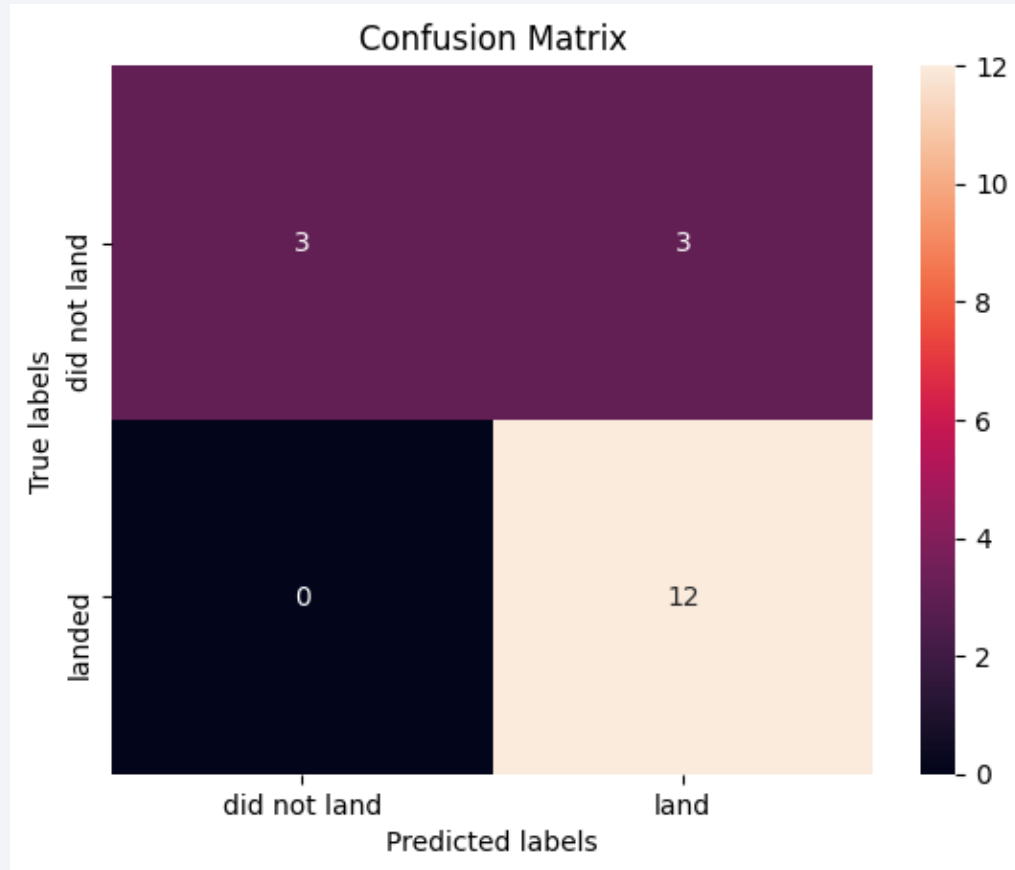
The ***Logistic Regression*** model was selected as the best-performing model for the following reasons:

1. **Consistency:** It maintained stable performance across all validation datasets.
2. **Simplicity:** Logistic Regression is computationally less expensive compared to other models like SVM or Random Forests, making it more efficient for real-time predictions.
3. **Interpretability:** The coefficients in Logistic Regression provide clear insights into feature importance, which aids in understanding the factors influencing landing outcomes.



Modelo	Exactitud de Prueba
LogisticRegression	0.8333
SVM	0.8333
DecisionTree	0.8333
KNN	0.8333

# Confusion Matrix



The confusion matrix above represents the performance of the best-performing classification model, likely Logistic Regression. :

- 1. True Positives (Bottom-Right, 12 instances):**  
This high count indicates the model's strength in identifying successful landings.
- 2. True Negatives (Top-Left, 3 instances):**  
These results confirm the model's ability to recognize failures.
- 3. False Positives (Top-Right, 3 instances):**  
Such misclassifications suggest that the model may overestimate the likelihood of success in borderline cases.
- 4. False Negatives (Bottom-Left, 0 instances):**  
Absence of false negatives indicates that the model successfully avoided misclassifying successful landings as failures.



# Conclusions

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## Key Takeaways:

- The integration of API and web-scraped data proved effective in creating a reliable dataset for analysis.
- Interactive visualizations and predictive models provided actionable insights into *SpaceX's* launch strategies.

## Recommendations:

- Further exploration of other machine learning models may improve predictive accuracy.
- Enhancing data quality with more granular payload and orbit details could refine analyses.

## Future Work:

- Expanding the analysis to include real-time data updates from the *SpaceX* API.
- Leveraging additional visualization techniques to better communicate findings to stakeholders.

# Appendix

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- Include any relevant assets like Python code snippets, SQL queries, charts, Notebook outputs, or data sets that you may have created during this project

Any Question?

Thank you!

