IBM Developer
SKILLS NETWORK

Winning Space Race with Data Science

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•Outline

•**Executive Summary** – Project objectives and key findings

•**Introduction** – SpaceX reusability challenge and motivation

•**Methodology** – Data collection, wrangling, SQL, EDA, visualization, ML pipeline

•**Results** – EDA insights, interactive dashboards, predictive model performance

•**Conclusion** – Main takeaways and recommendations

•**Appendix** – Extra figures, confusion matrices, SQL queries

Executive Summary

- Collected and wrangled SpaceX launch data from multiple sources (CSV, SQL queries, APIs).
- Performed exploratory data analysis (EDA) with Pandas, Matplotlib, and Seaborn to uncover launch success patterns.
- Built interactive geospatial visualizations with **Folium** and dashboards with **Plotly Dash**.
- Applied machine learning (Logistic Regression, SVM, Decision Trees, KNN) to predict Falcon 9 first stage landing success.
- Achieved ~83% accuracy across models, with **Logistic Regression** as the best-performing classifier.

Introduction

- SpaceX’s Falcon 9 rocket reusability has drastically reduced the cost of space travel.
- The ability to predict the success of first-stage landings is key to improving efficiency and planning.
- This project analyzes SpaceX launch data to answer:
- Which factors influence launch success the most?
- Can we build predictive models to estimate landing outcomes?
- What insights can be gained through data visualization and interactive dashboards?

Section 1

Methodology

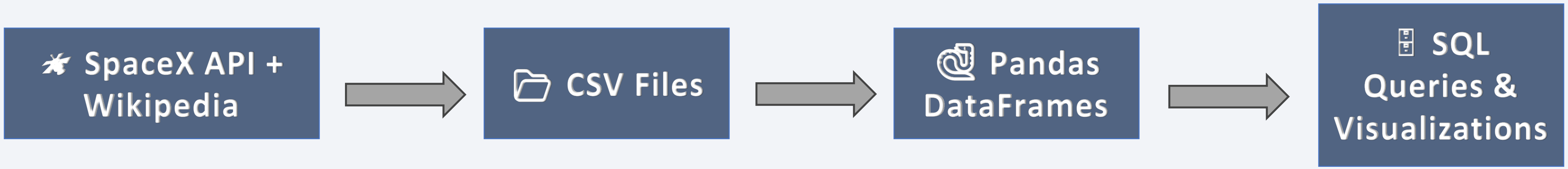
Methodology

Executive Summary

•**Data Acquisition:**
Launch data from SpaceX was retrieved via the company's API and supplemented with external datasets, including Wikipedia entries and publicly available records.
•**Data Preparation:**
Raw data underwent cleaning to address missing values, encoding of categorical variables, creation of new features, and normalization of payload mass.
•**Exploratory Data Analysis (EDA):**
Utilized visualization libraries such as Matplotlib and Seaborn, alongside SQL queries, to identify launch trends, relationships, and success metrics.
•**Interactive Visual Analytics:**
Developed interactive maps using **Folium** to assess the proximity of launch sites to highways, coastlines, and urban areas, and constructed dashboards with **Plotly Dash** allowing dynamic filtering by site, payload, and launch outcome.
•**Predictive Modeling (Classification):**
Implemented classification algorithms including **Logistic Regression, SVM, Decision Tree, and KNN**, optimizing hyperparameters with **GridSearchCV**. Model performance was assessed via accuracy, confusion matrices, and validation metrics.

Data Collection

- **Data Collection**
- **Primary Source:** SpaceX REST API with launch records.
- **Supplementary Data:** Wikipedia datasets for booster versions, launch outcomes, and additional attributes.
- **Storage & Processing:** Data was stored in CSV format and imported into Pandas DataFrames for wrangling and analysis.
- **Tools Used:** Python (Pandas, Requests), SQL (SQLite) for structured queries.

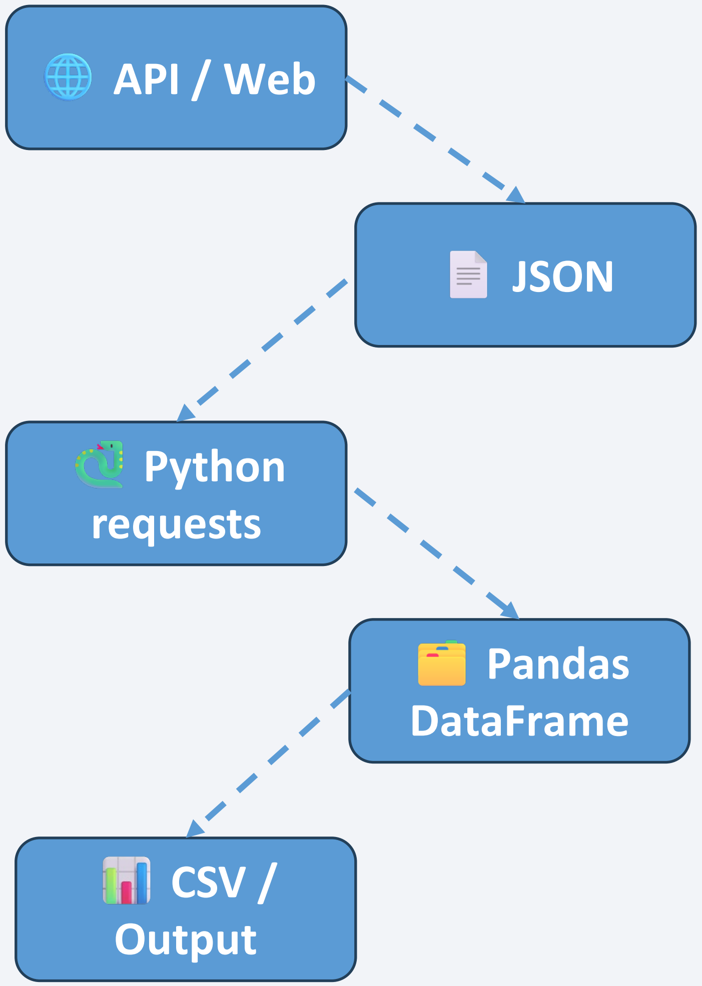


Data Collection – SpaceX API

•Employed Python requests to retrieve data from the SpaceX REST API, extracting information such as launch site, payload mass, booster version, and mission outcomes.

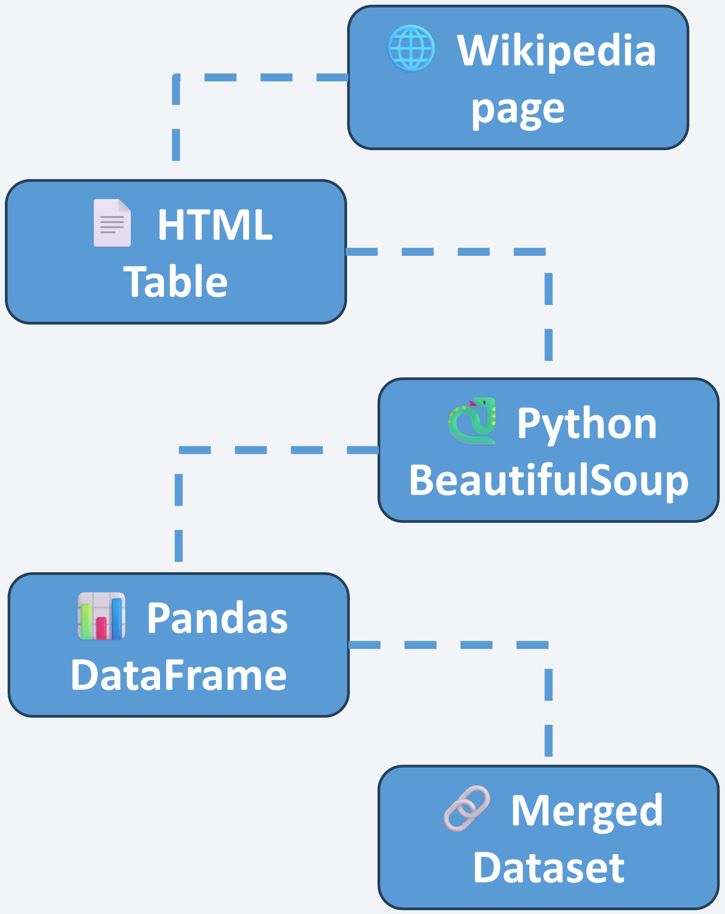
•Converted the JSON response into a Pandas DataFrame, verified data type consistency, and exported the dataset to CSV format for subsequent analysis.

•The related GitHub notebook can be found in the API folder:



Data Collection - Scraping

- ✓ Utilized Python libraries (BeautifulSoup/Requests) to query Wikipedia pages.
- ✓ Extracted tables with booster version, mission outcome, and other relevant details.
- ✓ Cleaned and processed the scraped data into a Pandas DataFrame.
- ✓ Integrated the data with the SpaceX API dataset for comprehensive analysis.
- ✓GitHub notebook documenting the web scraping workflow → Link



Data Wrangling

Data Wrangling Steps

- Removed missing values, handled duplicates, and standardized column names.
- Converted payload mass and other numeric fields to consistent units.
- Encoded categorical variables (e.g., Launch Site, Booster Version) for ML readiness.
- Created new engineered features (e.g., Success/Failure indicator).
- Validated schema and ensured data consistency across API and scraped datasets.+

GitHub Link

Notebook documenting wrangling workflow → GitHub - Data Wrangling

EDA with Data Visualization

Charts Created and Their Objectives

•**Bar Charts**: To compare the number of successful versus failed launches at various launch sites.

•**Pie Charts**: To illustrate the share of successful launches for each site.

•**Scatter Plots**: To examine the relationship between payload mass and launch success.

•**Line Plots**: To investigate trends in launch outcomes over time.

•**Boxplots**: To identify variability and detect outliers within the payload data.

These visual tools enabled us to pinpoint critical factors influencing launch success, including payload ranges and site-specific performance metrics.

GitHub Link

Notebook detailing EDA & Visualization → GitHub - EDA Visualization

EDA with SQL

SQL Queries Permored

- Queried launch records to count successful vs. failed launches.
- Grouped results by **Launch Site** to identify top-performing locations.
- Calculated average **Payload Mass** per site.
- Filtered missions by **Booster Version** to analyze success trends.
- Joined tables (launch outcomes + booster data) to enrich analysis.

```sql
-- 1. Count total launches by outcome
SELECT class, COUNT(*) AS total
FROM spacex
GROUP BY class;

-- 2. Success rate per Launch Site
SELECT Launch_Site, AVG(class) AS success_rate
FROM spacex
GROUP BY Launch_Site;

-- 3. Average payload mass per site
SELECT Launch_Site, AVG(Payload_Mass_kg) AS avg_payload
FROM spacex
GROUP BY Launch_Site;

-- 4. Booster version performance
SELECT Booster_Version, COUNT(*) AS launches, AVG(class) AS success_rate
FROM spacex
GROUP BY Booster_Version;
```

GitHub Link

Notebook documenting SQL EDA → [GitHub - SQL EDA]

Build an Interactive Map with Folium

Interactive Map

✓ Added **launch site markers** to visualize the geographic location of SpaceX launch facilities.
✓ Used **circle markers** to highlight payload ranges and mission outcomes (success vs. failure).
✓ Added **popups** with detailed mission info (site name, payload mass, outcome).
✓ Connected launch sites with **polylines** to display proximity to nearby landing zones.
✓ Purpose: provide an **intuitive geographic overview** of launch patterns, enabling exploration of spatial trends.

🔗 GitHub notebook documenting the interactive Folium map → *GitHub - Folium Map*

Build a Dashboard with Plotly Dash

Dashboard Overview (Plotly Dash)

Implemented Plots & Interactions

•**Launch Site dropdown** (dcc.Dropdown) allows selection of *All Sites* or a specific launch site.
•**Success pie chart** updates through callbacks to display:
  •*All Sites:* total successful launches by each site.
  •*Selected Site:* success versus failure breakdown for the chosen site.
•**Payload range slider** (dcc.RangeSlider) filters missions based on *Payload Mass (kg)*.
•**Scatter plot** illustrating *Payload Mass (kg)* against *Success (class)*, colour-coded by **Booster Version**, dynamically filtered according to site and payload range.
•**Callbacks** (@app.callback) connect the dropdown and slider inputs to update pie and scatter plots, ensuring seamless interactivity.

Rationale for Component Choices

•The **dropdown** enables users to concentrate on a particular launch site or examine aggregated data.
•The **pie chart** provides an instant overview of *success distribution*, serving as a quick performance indicator.
•The **payload slider** facilitates exploratory analysis of various payload mass ranges.
•The **scatter plot** uncovers the *correlation between payload and success*, highlighting variations across **Booster Versions**.

GitHub Notebook/App

•Complete Dash application (including layout, callbacks, and figures):
🔗 **Dashboard folder** → Dashboard

Predictive Analysis (Classification)

Model Development Process

- Split data into **train/test sets**.
- Applied **GridSearchCV (cv=10)** for hyperparameter tuning.
- Evaluated four classifiers:
  - **Logistic Regression**
  - **Support Vector Machine (SVM)**
  - **Decision Tree**
  - **K-Nearest Neighbors (KNN)**
- Tuned hyperparameters (e.g., C, penalty, kernel, max_depth, n_neighbors) for best performance.
- Used **confusion matrix** to analyze classification errors.
- Compared models by **accuracy on test set**.
- **Best model:** Logistic Regression (Accuracy ≈ 83.3%).

Predictive Models notebook → LINK

Results

Results

Exploratory Data Analysis (EDA)

•Launch success rate varied significantly across launch sites.

•Payload mass had little correlation with mission outcome.

•Certain booster versions showed higher success rates.

Interactive Analytics (Folium & Plotly Dash)

•Folium map: visualized launch sites, success rates, and payload distributions.

•Plotly Dash dashboard: enabled interactive exploration by year, site, and payload mass.

Predictive Analysis

•Tested four classifiers: Logistic Regression, SVM, Decision Tree, and KNN.

•All models achieved ~83% accuracy on test data.

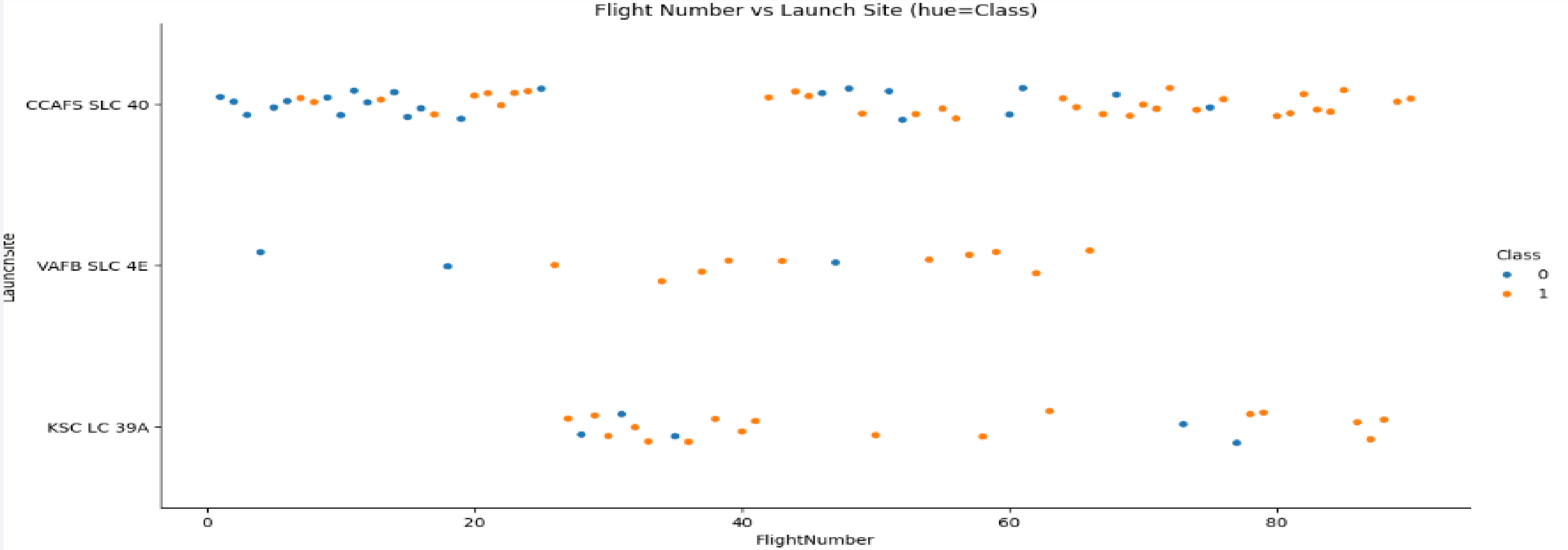
•**Best performing model:** Logistic Regression.

Section 2

Insights drawn from EDA

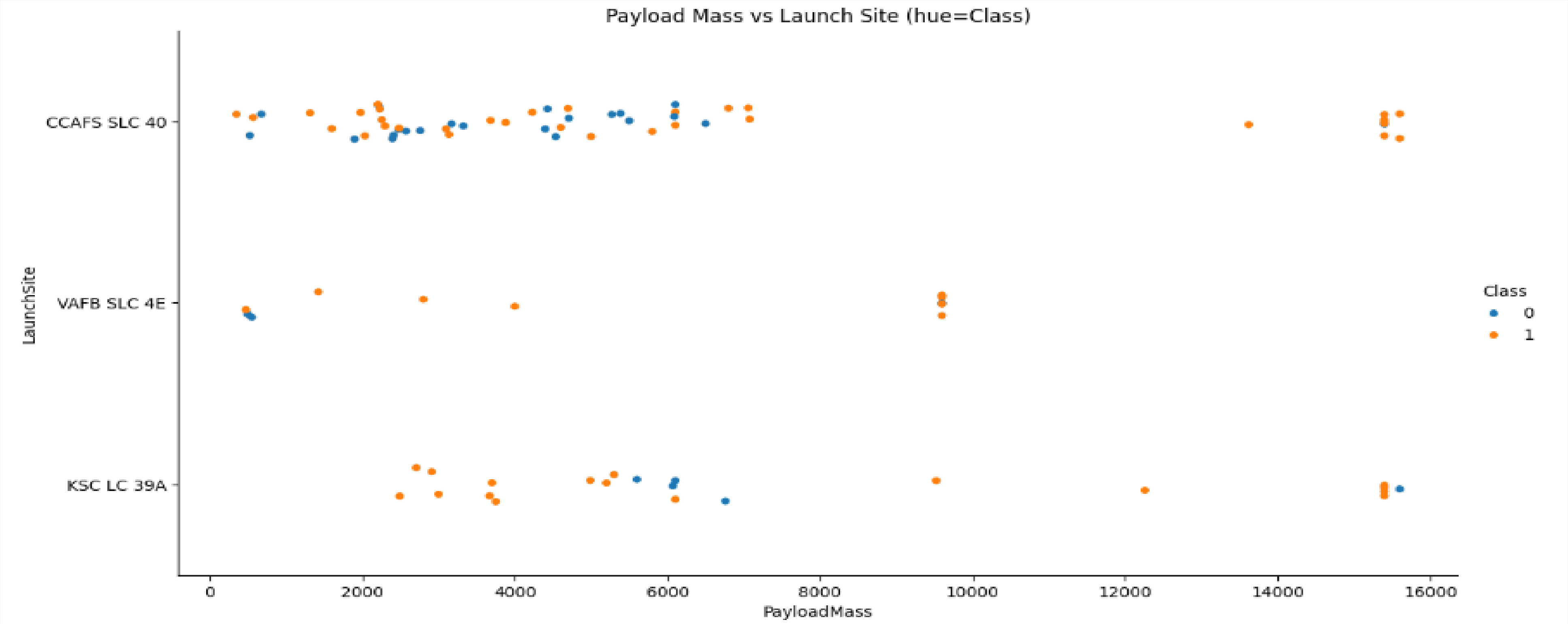
Flight Number vs. Launch Site

- Scatter plot shows **Flight Number** against **Launch Site**, color-coded by mission outcome (Class 0 = Failure, Class 1 = Success).
- Early flights (low flight numbers) show more failures, especially at **CCAFS SLC 40** and **VAFB SLC 4E**.
- As flight numbers increase, the success rate improves, reflecting learning curve and technology improvements.
- At **KSC LC 39A**, launches appear more successful even at lower flight numbers.



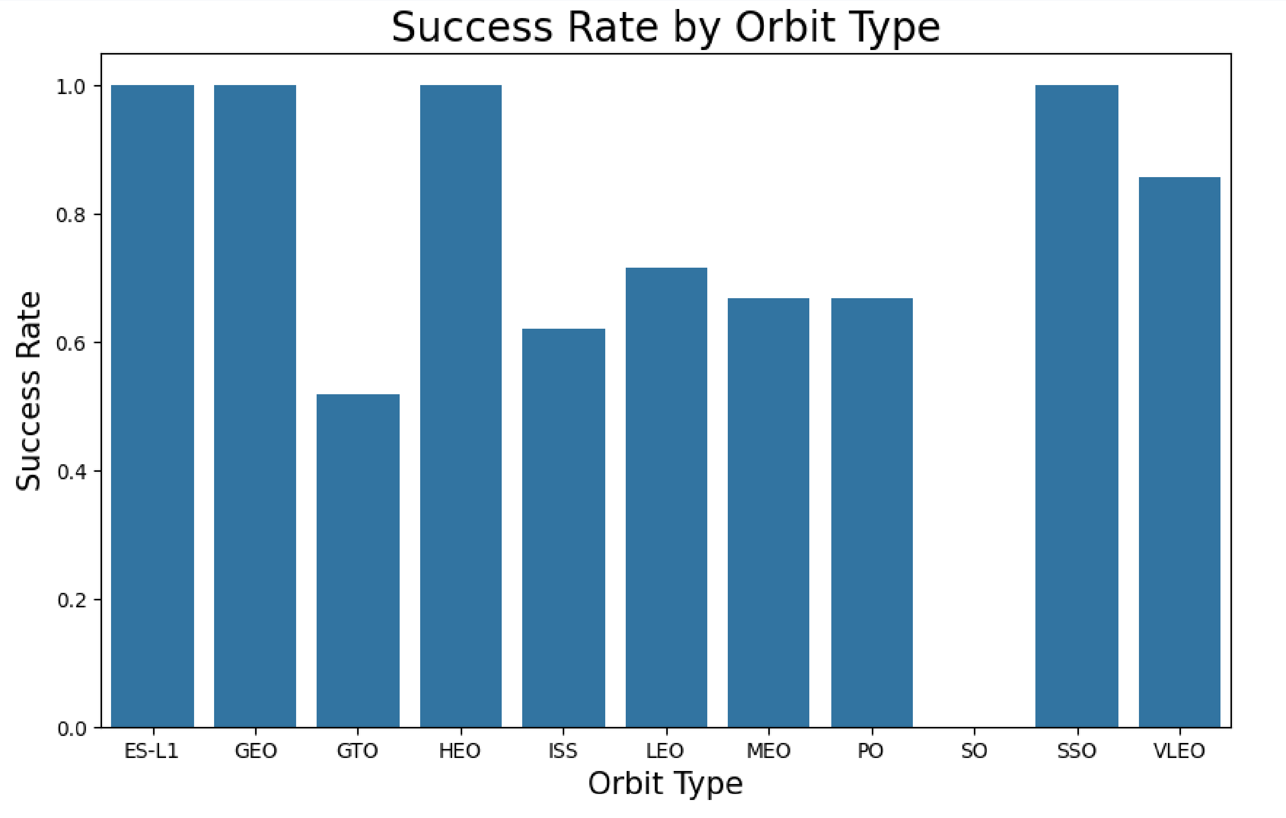
Payload vs. Launch Site

- Scatter plot shows **Payload Mass (kg)** across different **Launch Sites**, color-coded by success (Class).
- Successful missions (Class = 1) tend to cluster around medium payload ranges (2000–8000 kg).
- Extremely high payloads (> 9000 kg) show mixed outcomes, highlighting technical challenges.
- KSC LC-39A handled heavier payloads compared to other sites, indicating higher mission capacity.



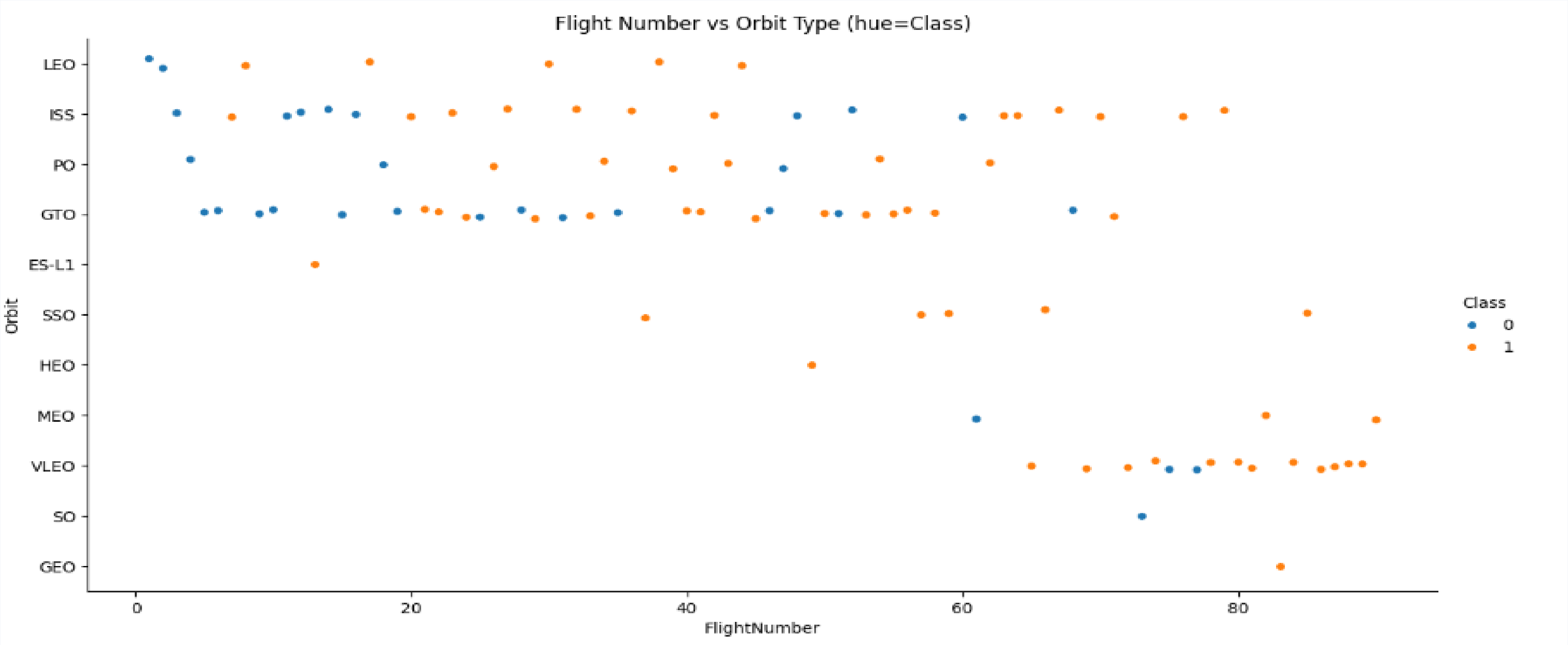
Success Rate vs. Orbit Type

- Helps identify which orbit types are most reliable for future missions.
- **Bar chart** compares the **success rate** of launches across different orbit types.
- **GTO (Geostationary Transfer Orbit)** and **LEO (Low Earth Orbit)** show the highest success rates.
- Some orbits (e.g., Polar, HEO) have lower success rates, reflecting **technical challenges** or fewer missions.



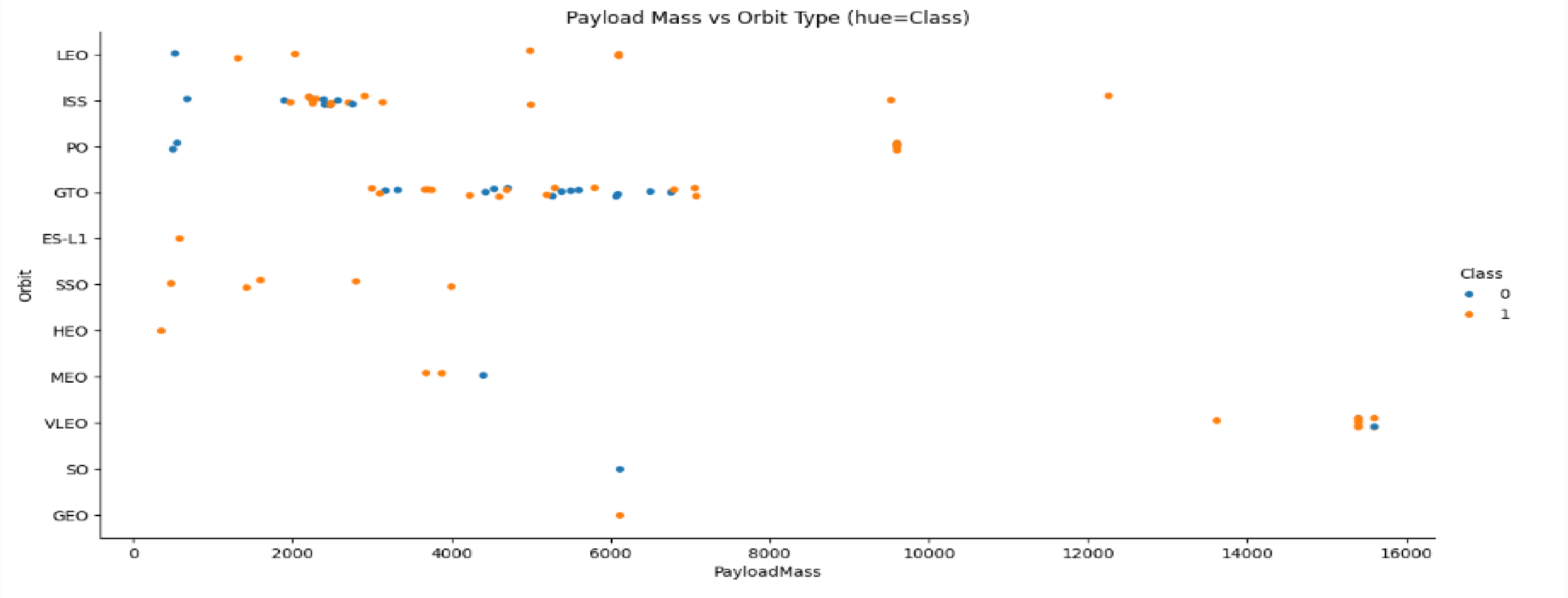
Flight Number vs. Orbit Type

•**Scatter plot** shows the relationship between **flight experience (flight number)** and **success across orbit types**.
•Higher flight numbers → Higher success probability.
•Some orbit types (e.g., GTO, LEO) required more flights to reach stable success rates



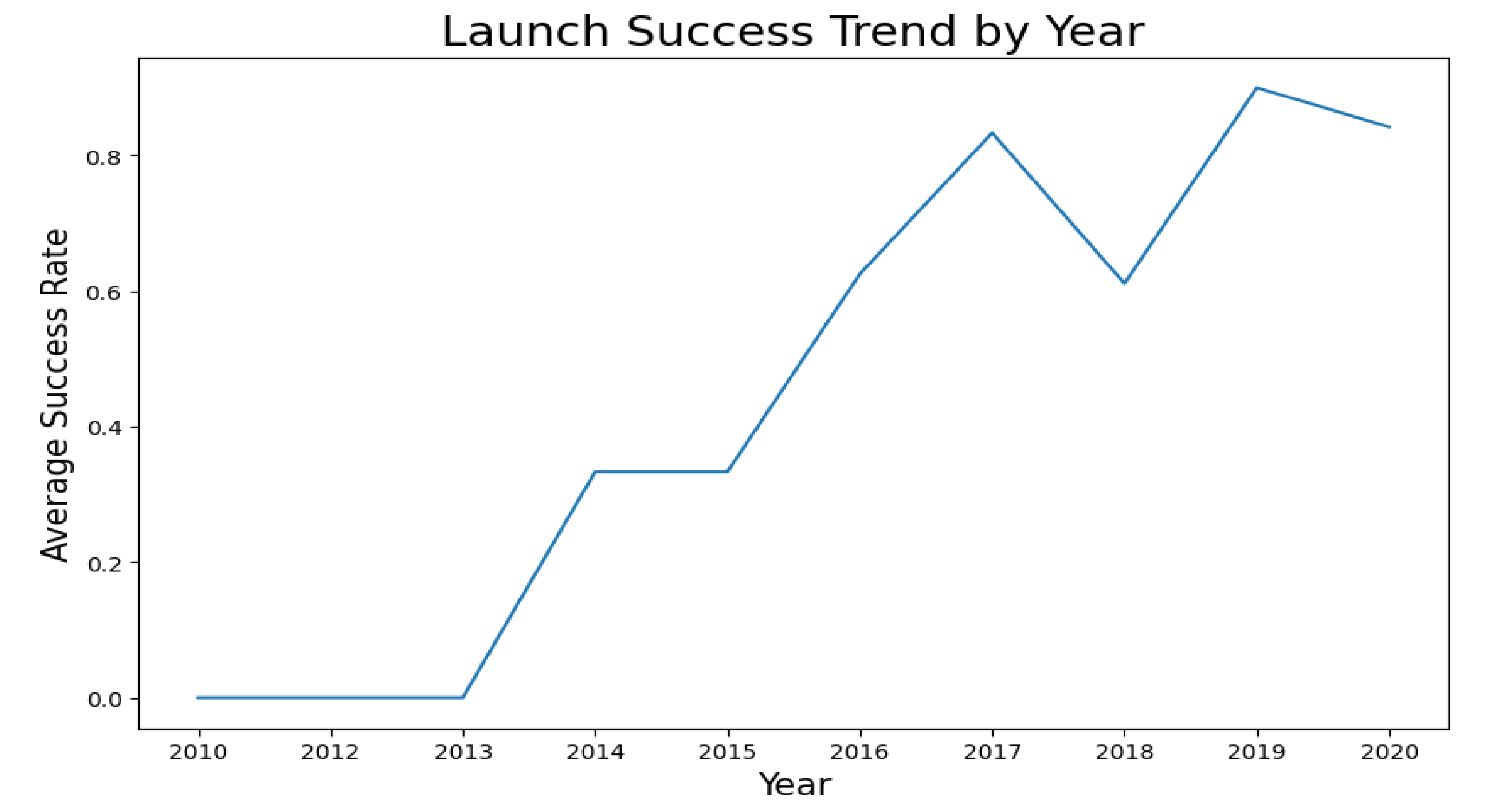
Payload vs. Orbit Type

- **Scatter plot** shows relationship between payload mass and orbit type.
- Heavier payloads are typically associated with GTO and GEO orbits.
- Success probability varies with payload: some heavier launches required more optimization for reliability.



Launch Success Yearly Trend

•The **line chart** illustrates the annual average success rate of SpaceX launches.
•It reveals a consistent upward trajectory, emphasizing advancements in technology, procedures, and operational expertise.
•In recent times, success rates have reached **almost 100% reliability**, demonstrating SpaceX's growth and refinement.



All Launch Site Names

- **Distinct launch locations listed in the dataset:**
  - CCAFS SLC-40 (Cape Canaveral)
  - KSC LC-39A (Kennedy Space Center)
  - VAFB SLC-4E (Vandenberg Air Force Base)
  - CCAFS LC-40 (utilized for earlier missions)
- **Overview:**
  SpaceX conducts launches mainly from **Florida (Cape Canaveral and Kennedy Space Center)** and **California (Vandenberg Air Force Base)**. Each facility caters to particular mission requirements, including **polar orbit deployments from Vandenberg** and **geostationary launches from Florida**.

```
%sql
SELECT DISTINCT Launch_Site
FROM SPACEXTABLE;
```

```
 * sqlite:///my_data1.db
Done.
```

Launch_Site
CCAFS LC-40
VAFB SLC-4E
KSC LC-39A
CCAFS SLC-40

Launch Site Names Begin with 'CCA'

This confirms that several launches were conducted from **Cape Canaveral Air Force Station (CCAFS)**, one of SpaceX's main launch facilities in Florida. This site has been crucial for both **early demonstration flights** and **later operational missions**, highlighting its central role in SpaceX's launch history.

```
SELECT *
FROM SPACEXTABLE
WHERE Launch_Site LIKE 'CCA%'
LIMIT 5;
```

```
 * sqlite:///my_data1.db
Done.
```

Date	Time (UTC)	Booster_Version	Launch_Site	Payload	PAYLOAD_MASS__KG_	Orbit	Customer	Mission_Outcome	Landing_Outcome
2010-06-04	18:45:00	F9 v1.0 B0003	CCAFS LC-40	Dragon Spacecraft Qualification Unit	0	LEO	SpaceX	Success	Failure (parachute)
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	Success	Failure (parachute)
2012-05-22	7:44:00	F9 v1.0 B0005	CCAFS LC-40	Dragon demo flight C2	525	LEO (ISS)	NASA (COTS)	Success	No attempt
2012-10-08	0:35:00	F9 v1.0 B0006	CCAFS LC-40	SpaceX CRS-1	500	LEO (ISS)	NASA (CRS)	Success	No attempt
2013-03-01	15:10:00	F9 v1.0 B0007	CCAFS LC-40	SpaceX CRS-2	677	LEO (ISS)	NASA (CRS)	Success	No attempt

Total Payload Mass

- The query calculates the **total payload mass carried by NASA (CRS) missions**.
- The result shows a total payload mass of **45,596 kg** transported by SpaceX boosters.
- This highlights SpaceX's role in supporting **NASA cargo resupply missions** to the ISS.

Display the total payload mass carried by boosters launched by NASA (CRS)

```
%%sql
SELECT SUM(PAYLOAD_MASS__KG_) AS TotalPayloadMass
FROM SPACEXTABLE
WHERE Customer = 'NASA (CRS)';
```

```
 * sqlite:///my_data1.db
Done.
```

TotalPayloadMass
45596

Average Payload Mass by F9 v1.1

- The query calculates the **average payload mass** for booster version **F9 v1.1**.
- The result shows an **average of 2,928.4 kg** per launch.
- This indicates the typical payload capacity handled by this specific booster configuration.

Display average payload mass carried by booster version F9 v1.1

```sql
%%sql
SELECT AVG("PAYLOAD_MASS__KG_") AS avg_payload_kg
FROM SPACEXTABLE
WHERE Booster_Version = 'F9 v1.1';
```

```
 * sqlite:///my_data1.db
Done.
```

avg_payload_kg
2928.4

First Successful Ground Landing Date

- The query identifies the **earliest successful landing on a ground pad** using the MIN() function.
- Result: **December 22, 2015**, marking the **first time SpaceX achieved a ground landing** with Falcon 9.
- This milestone demonstrated reusability and revolutionized the economics of spaceflight.

List the date when the first succesful landing outcome in ground pad was acheived.

Hint:Use min function

```
%%sql
SELECT MIN(Date) AS first_success_ground_pad
FROM SPACEXTABLE
WHERE "Landing_Outcome" = 'Success (ground pad)';
```

```
 * sqlite:///my_data1.db
Done.
```

first_success_ground_pad
2015-12-22

Successful Drone Ship Landing with Payload between 4000 and 6000

•Query filters boosters that had a **successful landing on a drone ship** and carried payloads **between 4000 kg and 6000 kg**.
•Result: Boosters like **F9 FT B1022, B1026, B1021.2, and B1031.2** demonstrated both **medium payload capacity** and **reliable drone ship landings**.

List the names of the boosters which have success in drone ship and have payload mass greater than 4000 but less than 6000

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

```
 * sqlite:///my_data1.db
Done.
```

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

Total Number of Successful and Failure Mission Outcomes

✓ The query groups missions by **Mission_Outcome** and counts occurrences.
✓ Results show a large majority of missions were **successful (98)**, while only a few ended in **failure (1 in-flight failure)** or had special cases (e.g., payload status unclear).
✓ This highlights **SpaceX's high success rate** and reliability over time.

List the total number of successful and failure mission outcomes

```
%%sql
SELECT Mission_Outcome, COUNT(*) AS Total
FROM SPACEXTABLE
GROUP BY Mission_Outcome
ORDER BY Total DESC;
```

```
* sqlite:///my_data1.db
Done.
```

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

Boosters Carried Maximum Payload

✓ The query highlights boosters that delivered the **highest payload mass** documented in the dataset.
✓ Multiple Falcon 9 Block 5 boosters (such as **B1048.4, B1049.4, B1051.3**) reached this milestone.
✓ These boosters exemplify **SpaceX's strongest and most dependable models**, designed specifically for heavy payload missions.

List all the booster_versions that have carried the maximum payload mass, using a subquery with a suitable aggregate function.

```
%%sql
SELECT Booster_Version
FROM SPACEXTABLE
WHERE "PAYLOAD_MASS__KG_" = (SELECT MAX("PAYLOAD_MASS__KG_") FROM SPACEXTABLE);
```

```
 * sqlite:///my_data1.db
Done.
```

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

✓ In 2015, there were **two failed drone ship landings**, both occurring at **CCAFS LC-40**.
✓ The boosters involved were **F9 v1.1 B1012** (January) and **F9 v1.1 B1015** (April).
✓ These failures illustrate the **experimental stage** of early Falcon 9 landings before achieving consistent drone ship recovery success.

```
%%sql
SELECT
    substr(Date, 6, 2) AS Month,
    "Landing_Outcome",
    Booster_Version,
    Launch_Site
FROM SPACEXTABLE
WHERE "Landing_Outcome" = 'Failure (drone ship)' AND substr(Date, 0, 5) = '2015'
ORDER BY Month;
```

```
 * sqlite:///my_data1.db
Done.
```

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

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

✓ Between **2010-06-04 and 2017-03-20**, the majority of launches had **“No attempt”** at landing (10 cases).
✓ There were **5 successful** and **5 failed drone ship landings**, showing the experimental phase of recovery during this period.
✓ Additionally, there were **3 controlled ocean landings**, where boosters were intentionally discarded.
✓ Ground pad successes (3 cases) mark the beginning of reliable land recoveries for Falcon 9.

Rank the count of landing outcomes (such as Failure (drone ship) or Success (ground pad)) between the date 2010-06-04 and 2017-03-20, in descending order.

```
%%sql
SELECT "Landing_Outcome", COUNT(*) AS OutcomeCount
FROM SPACEXTABLE
WHERE Date BETWEEN '2010-06-04' AND '2017-03-20'
GROUP BY "Landing_Outcome"
ORDER BY OutcomeCount DESC;
```

```
 * sqlite:///my_data1.db
Done.
```

Landing_Outcome	OutcomeCount
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

Section 3

Launch Sites Proximities Analysis

Global Distribution of SpaceX Launch Sites

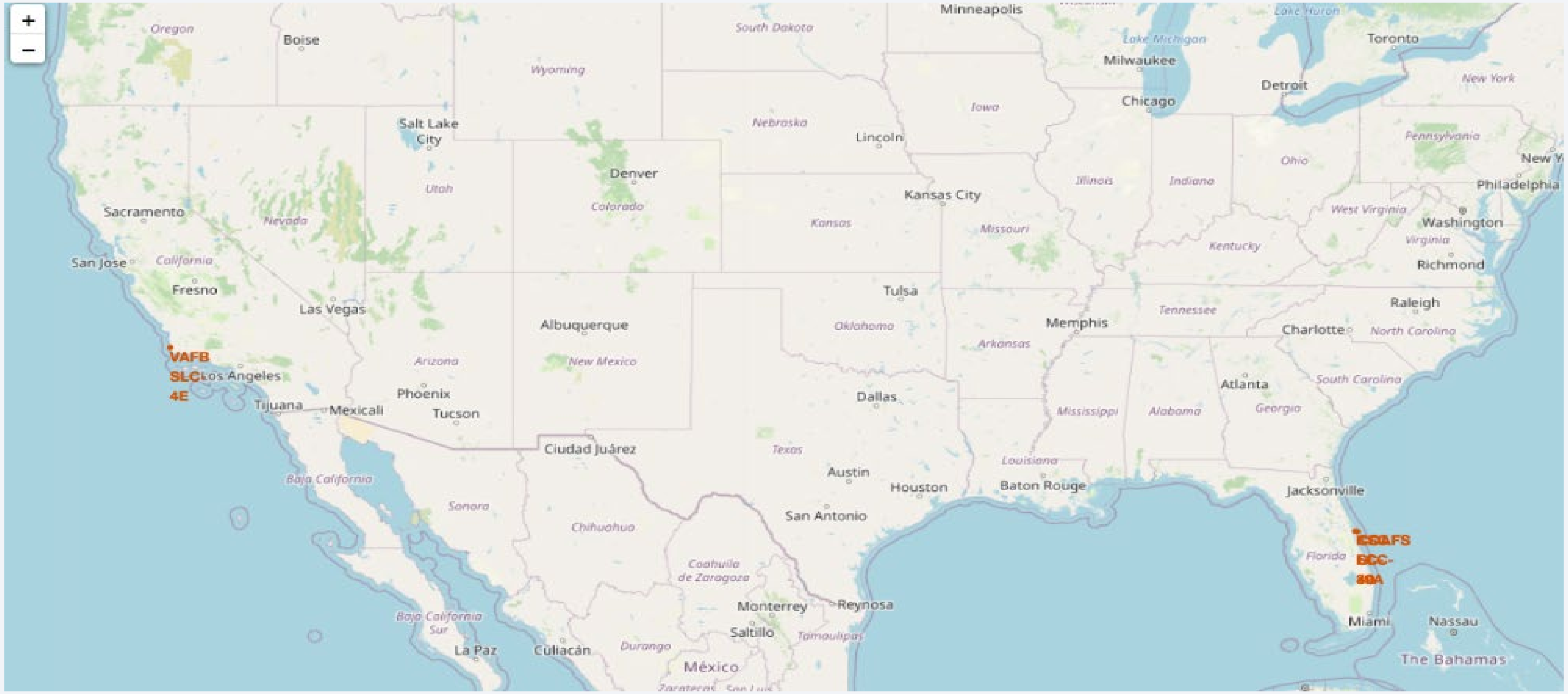
Explanation:

✓ The folium map shows the **geographic distribution of all SpaceX launch sites**, marked with location pins.

✓ Most sites are concentrated in **Florida (Cape Canaveral & Kennedy Space Center)** and **California (Vandenberg AFB)**.

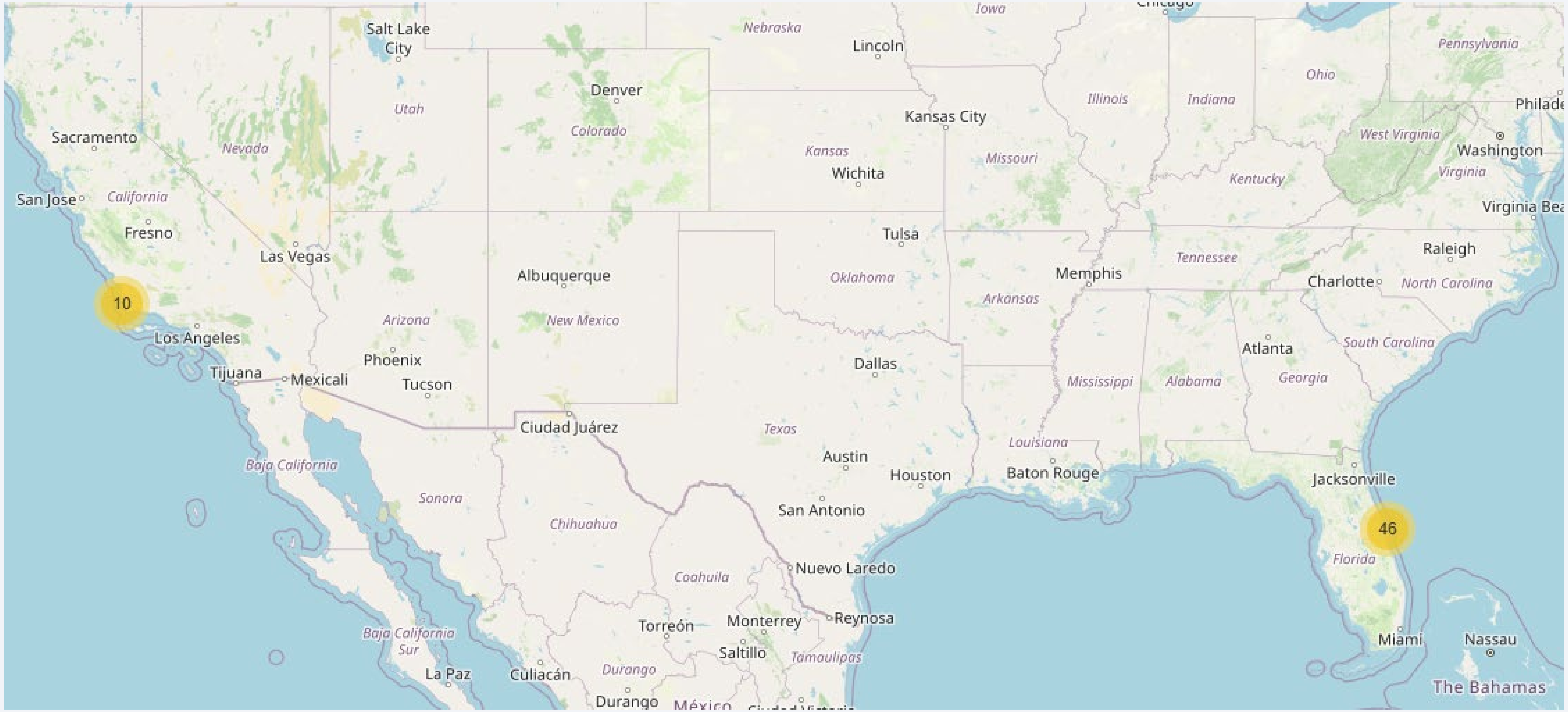
✓ Each marker helps visualize how SpaceX leverages **strategic coastal locations** for safe rocket launches and recovery.

✓ The map highlights the **global accessibility of orbital trajectories** depending on the site (e.g., polar orbits from Vandenberg, geostationary from Florida).



Launch Outcomes Visualization on Folium Map

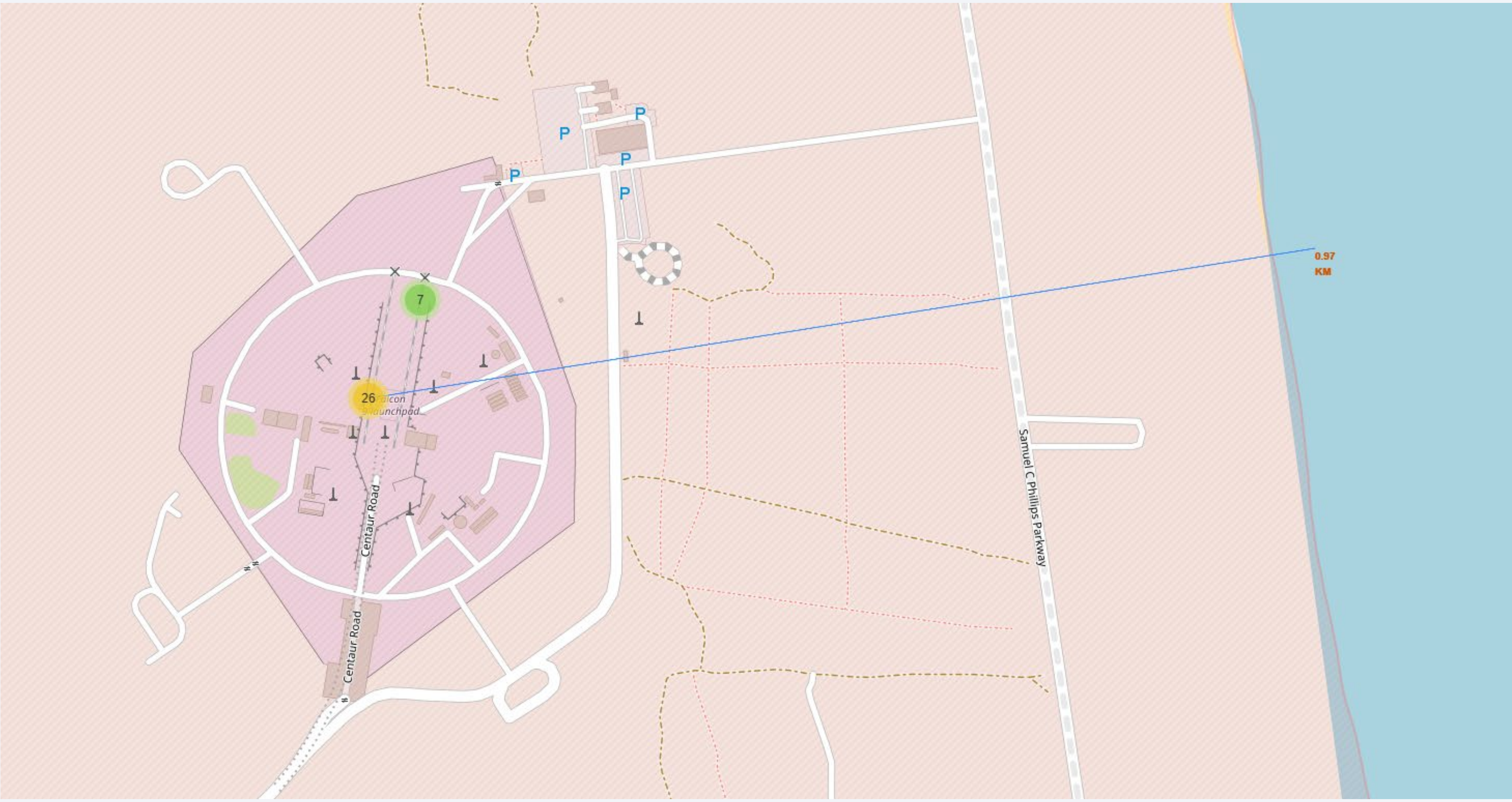
✓ The folium map shows the **distribution of launch outcomes** across SpaceX sites.
✓ Florida (Cape Canaveral & Kennedy Space Center) accounts for the majority of launches (**46 missions**).
✓ California (Vandenberg AFB) handled fewer launches (**10 missions**), mainly for polar orbits.
✓ This highlights the **geographic concentration and specialization** of SpaceX's operations.



Proximity Analysis of Launch Site with Folium

Explanation:

✓ The folium map highlights the **selected launch site** and its surroundings.
✓ Nearby infrastructure such as **roads, parking areas, and coastline** are shown to contextualize site accessibility.
✓ Markers indicate the **number of launches** performed at this location.
✓ Proximity mapping helps assess **logistical advantages** (transport, recovery, and safety).

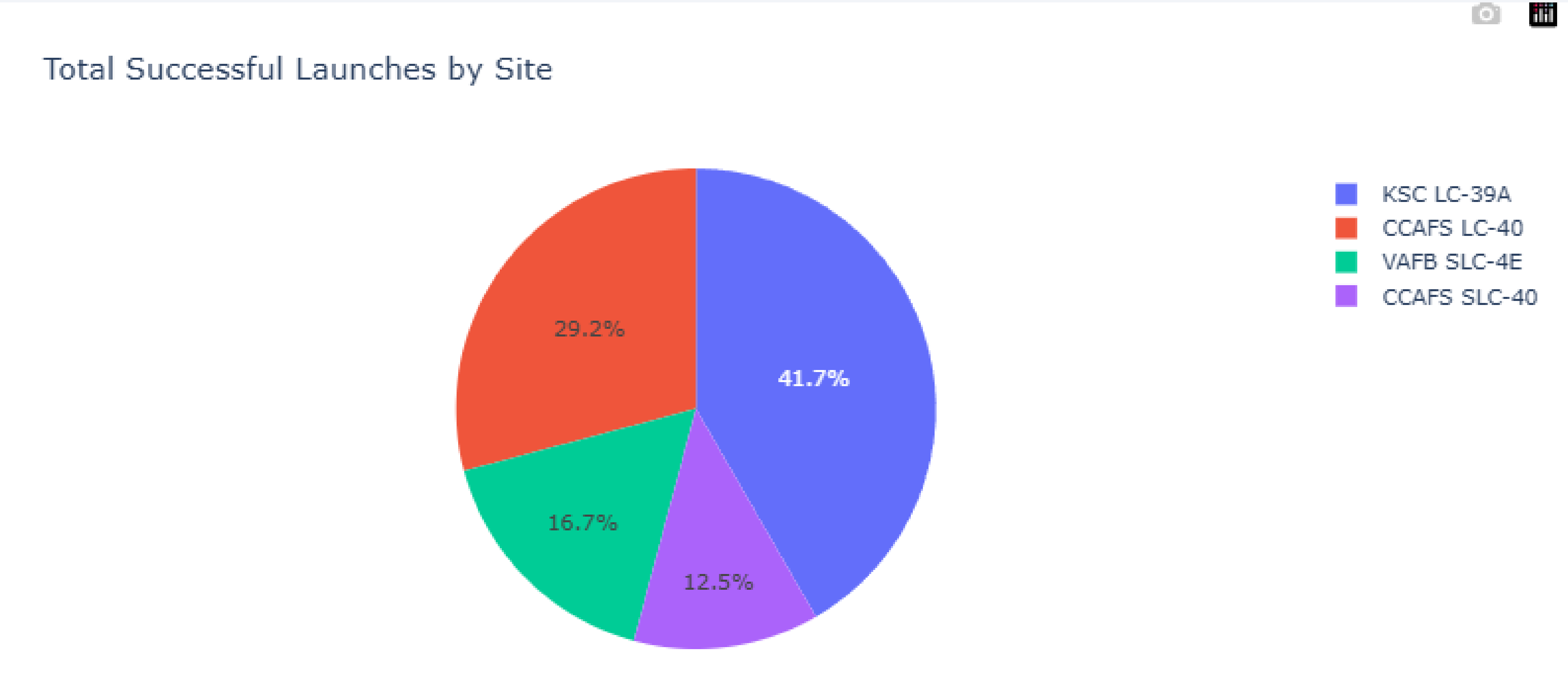


Section 4

Build a Dashboard with Plotly Dash

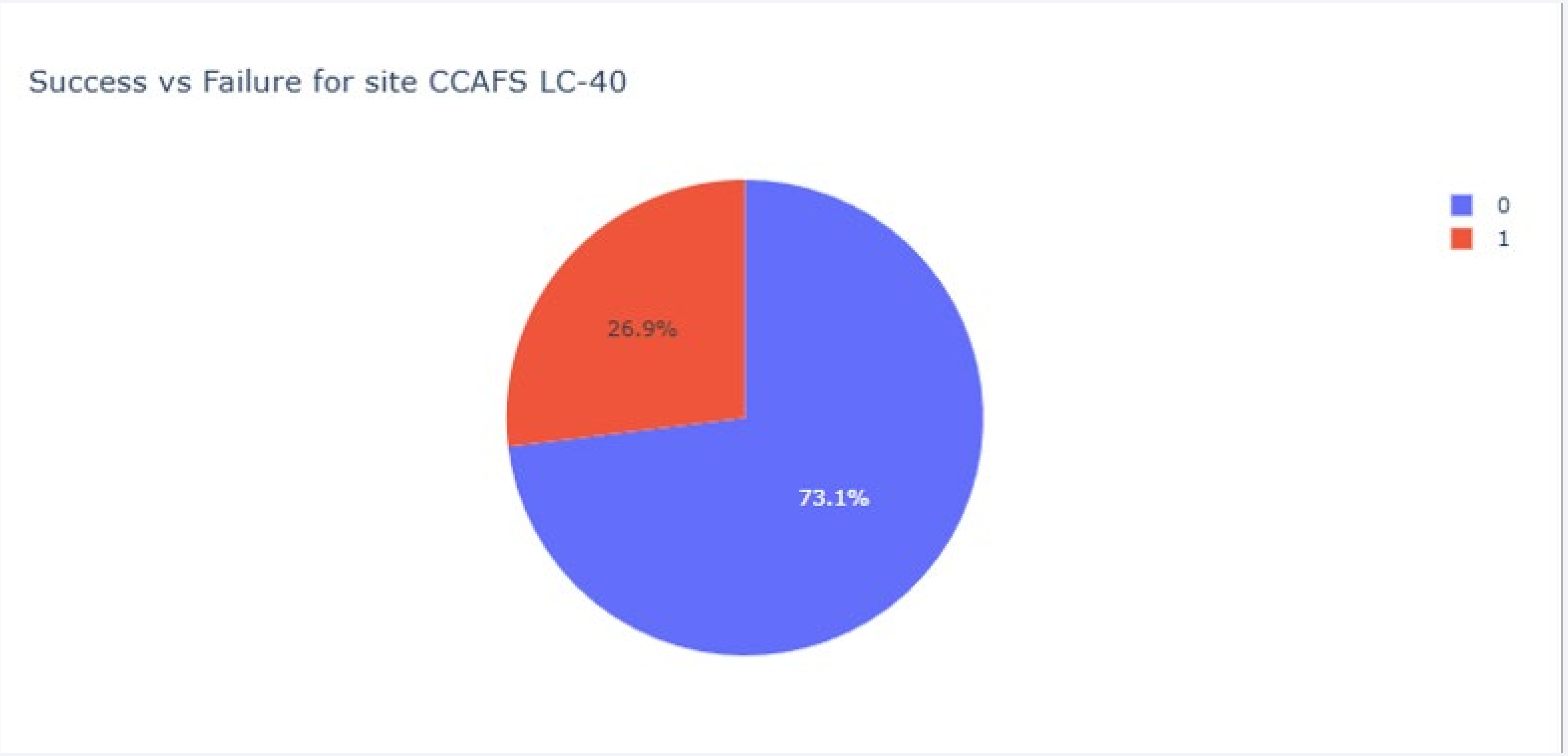
📊 Launch Success Distribution by Site (Dashboard)

- The pie chart shows the **distribution of successful launches** by site.
- **KSC LC-39A** accounts for the largest share (41.7%), followed by **CCAFS LC-40** with 29.2%.
- This highlights how Florida's launch sites play a dominant role in SpaceX missions.



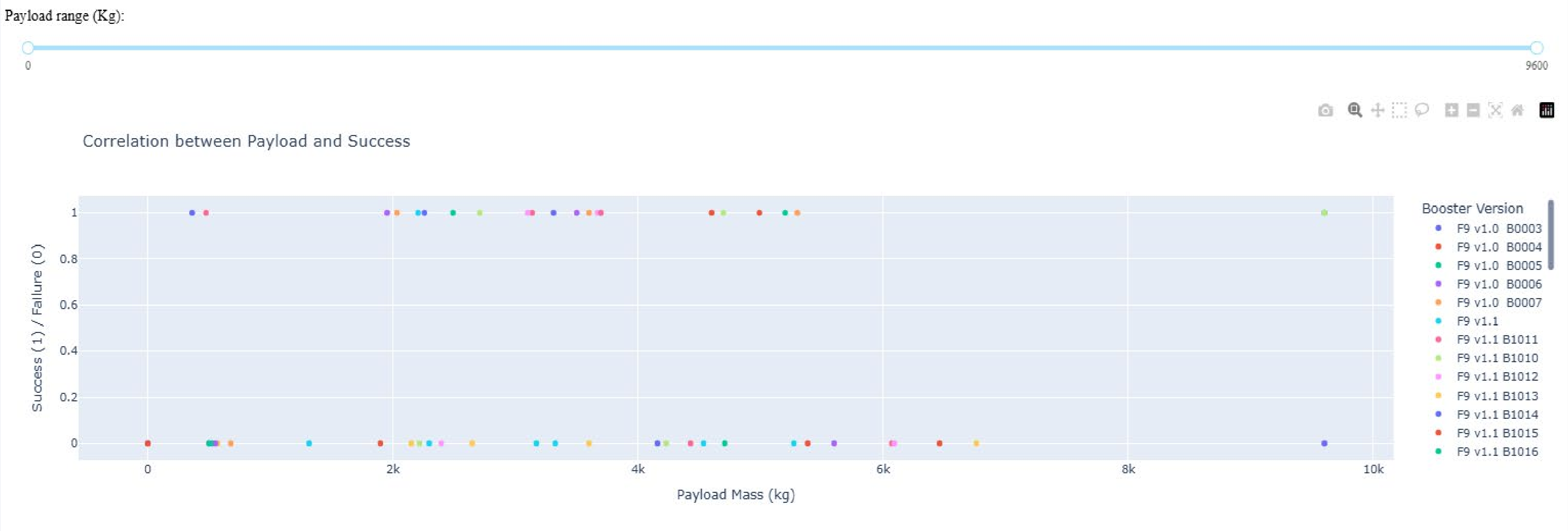
Launch Site with Highest Success Ratio (Dashboard)

•The pie chart highlights the success vs. failure ratio for the top-performing launch site.
•This site achieved the **highest success rate**, reflecting operational reliability.
•It provides a benchmark for comparing performance with other sites



Payload vs. Launch Outcome (Dashboard)

- The scatter plot shows the **relationship between payload mass and mission outcomes** across all launch sites.
- The **range slider** allows dynamic filtering of payload values, making it easier to analyze specific intervals.
- Most successful launches are concentrated in the **2000–6000 kg payload range**, which indicates an optimal performance window.
- Certain booster versions consistently appear in higher success clusters, reinforcing their reliability.



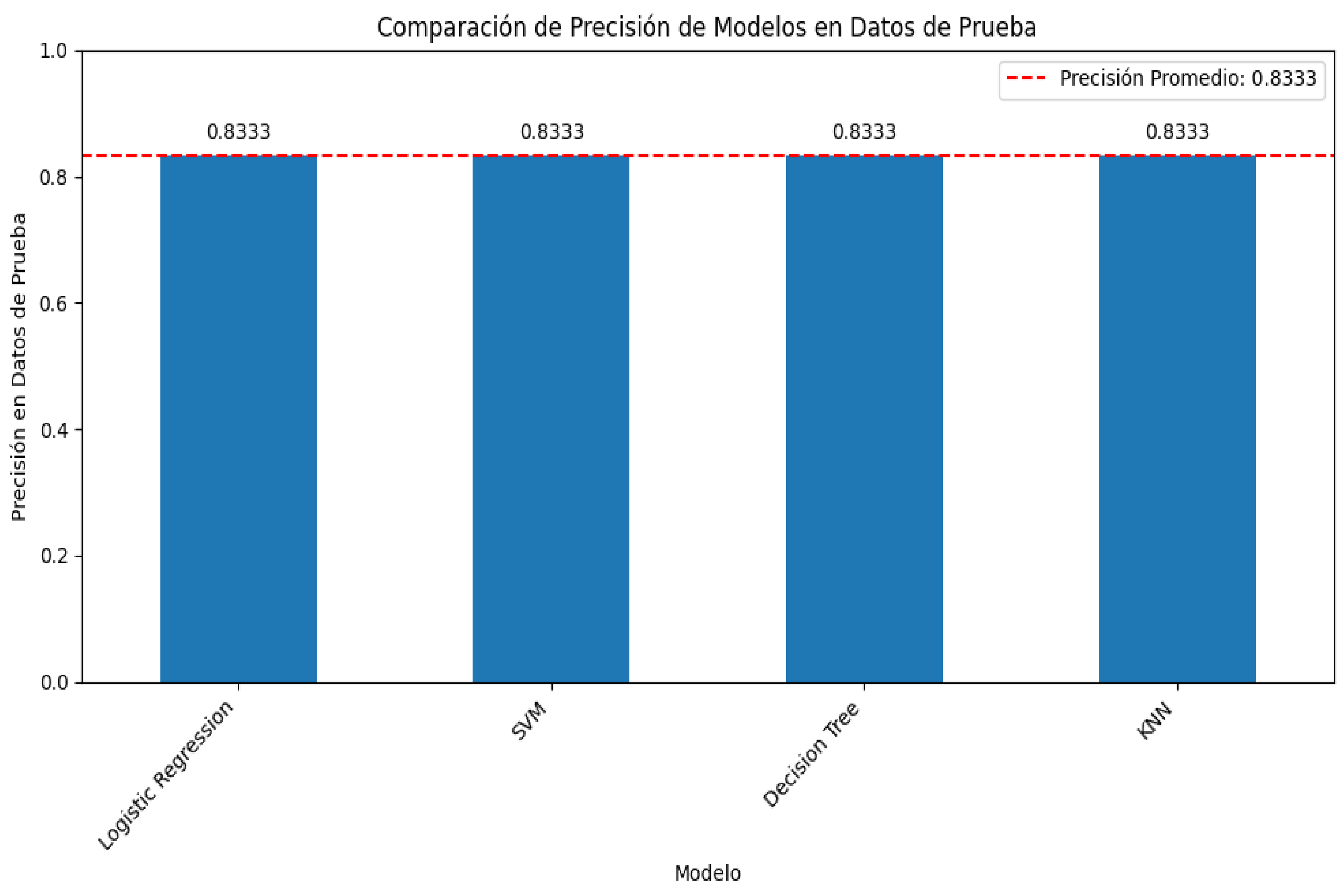
Section 5

Predictive Analysis (Classification)

Classification Accuracy

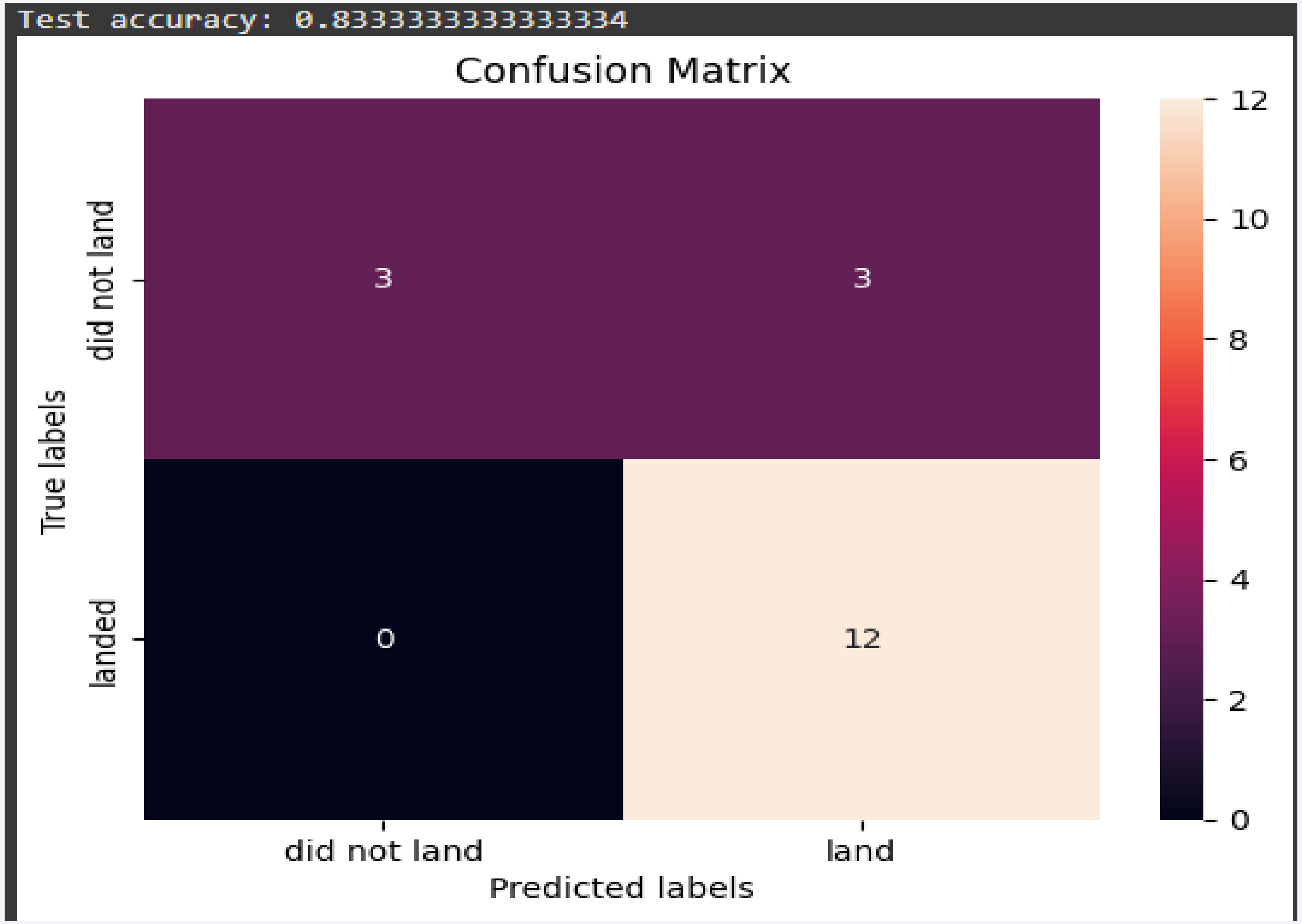
✔ The bar chart compares the accuracy of Logistic Regression, SVM, Decision Tree, and KNN models.
✔ All models achieved the same classification accuracy of **83.3%**.
✔ This indicates that no single model outperformed the others in terms of predictive accuracy for this dataset.

All models achieved the same accuracy (83.3%), so they performed equally well in terms of prediction. However, Logistic Regression may be preferred for its simplicity and interpretability, while Decision Trees offer flexibility for more complex patterns.



Confusion Matrix

- The confusion matrix displays the top classification model's results.
- From **18 samples**, it accurately identified **12 successful landings** and **3 non-landings**.
- There were **3 False Negatives** and no False Positives.
- The model achieved **83.3% accuracy**, showing reliable landing outcome predictions.



Conclusions

- **Flight experience enhances reliability**: An increased number of flights correlates with higher success rates, underscoring the significance of iterative learning and engineering advancements.
- **Impact of orbit type**: Certain orbits, such as GTO and LEO, demanded more launches before achieving consistent success, highlighting their inherent complexity.
- **Payload considerations**: While heavier payloads have been successfully delivered, the likelihood of success varies based on orbit type and booster version.
- **Launch site importance**: Florida launch sites (KSC LC-39A and CCAFS LC-40) lead in both the volume of launches and success rates, emphasizing their strategic importance.
- **Landing results**: Ground pad landings attained the first steady success in 2015, whereas drone ship landings required additional attempts but eventually demonstrated improvement.
- **Model performance**: Tested machine learning classifiers—including Logistic Regression, SVM, Decision Tree, and KNN—exhibited comparable accuracy (~83.3%), indicating dependable yet improvable predictive capabilities.
- **Confusion matrix findings**: The models accurately identify successful landings but show some misclassifications in failure predictions, suggesting that additional data could enhance performance.
- **Dashboard and visualization benefits**: Interactive dashboards built with Plotly Dash and Folium enable detailed exploration of launch success trends, payload metrics, and site distributions, serving as effective decision-support tools.

Appendix

Included Assets:

- **SQL Queries:** Used for extracting launch records, payload masses, and mission outcomes from the database.
- **Python Code Snippets:** Data wrangling, visualizations (Matplotlib, Seaborn, Plotly), and machine learning models (Logistic Regression, SVM, Decision Tree, KNN).
- **Charts & Visualizations:** Scatter plots, line charts, pie charts, Folium maps, and dashboards with Plotly Dash.
- **Machine Learning Outputs:** Model accuracy comparison bar chart and confusion matrix for performance evaluation.
- **Datasets:** SpaceX launch dataset used for SQL queries and ML training/testing.

Thank you!