IBM Developer
SKILLS NETWORK

Winning Space Race with Data Science

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Outline

- Executive Summary
- Introduction
- Methodology
- Results
- Conclusion
- Appendix

Executive Summary

- Summary of methodologies

- Data Collection and Data Wrangling
- Exploratory Data Analysis (EDA) and Interactive Visual Analytics
- Exploratory Data Analysis with Structured Query language (SQL)
- Predictive Analysis (Classification)
- Building an interactive map with Folium
- Building Plotly Dash Dashboard

- Summary of all results

- EDA with visualization results
- EDA with SQL results
- Interactive map with Folium results
- Plotly Dash dashboard results
- Predictive analysis (classification) results

Introduction

- Project background and context

  In this capstone project, we predicted if the Falcon 9 first stage will land successfully. SpaceX advertises Falcon 9 rocket launches on its website with a cost of 62 million dollars; other providers cost upward of 165 million dollars each, much of the savings is because SpaceX can reuse the first stage. Therefore if we can determine if the first stage will land, we can determine the cost of a launch. This information can be used if an alternate company wants to bid against SpaceX for a rocket launch.

- Problems you want to find answers

- What influences the rocket to land successfully?
- Impact of correlations between certain rocket variables in determining successful landing success rate
- Factors that SpaceX needs to consider in achieving best results to ensure high success landing rate

Section 1

Methodology

Methodology

Executive Summary

- Data collection methodology:

- SpaceX API
- Web Scraping from Wikipedia page: [List of Falcon 9 and Falcon Heavy Launches]

- Perform data wrangling

- Performed Exploratory Data Analysis to find some patterns in the data and determined label for training supervised models

- Perform exploratory data analysis (EDA) using visualization and SQL
- Perform interactive visual analytics using Folium and Plotly Dash

- Plotting maps, scatter graphs, bar graphs and pie charts to show interactive relationships between variables and data patterns.

- Perform predictive analysis using classification models
  - How to build, tune, evaluate classification models

Data Collection

- Describe how data sets were collected.

- In this lab, we used *GET Request* function to SpaceX API to collect data and performed some basic data wrangling and formatting.
- *API Source url*: https://api.spacexdata.com/v4/launches/past
- The other way, we performed web scraping to collect Falcon 9 historical launch records from a Wikipedia page using *BeautifulSoup* titled "List of Falcon 9 and Falcon Heavy launches. *Source url*: https://en.wikipedia.org/wiki/List_of_Falcon_9_and_Falcon_Heavy_launches

- You need to present your data collection process use key phrases and flowcharts

- **SpaceX REST API (Flow Chart)**

Request and parse SpaceX REST API using requests.get() → API response in JSON code → Decode response using .json() → Normalize data into Pandas dataframe using .json_normalize() → Filter data using BoosterVersion → Save filtered data into new dataframe

- **Web Scarping (Flow Chart)**

Getting Response from HTML using requests.get() → Create BeautifulSoup object using .BeautifulSoup() → Extract all variables from HTML using .find_all () → Normalize data into dataframe by parsing HTML tables → Save parsed data into new dataframe

Data Collection SpaceX API

1. Request and parse SpaceX REST API using *request.get()*

```
spacex_url="https://api.spacexdata.com/v4/launches/past"
```

```
response = requests.get(spacex_url)
```

2. API response in JSON code

```
print(response.content)
```

3. Normalize data into dataframe using *.json_normalize()*

```
response = requests.get(static_json_url).json()
data = pd.json_normalize(response)
```

4. Filter the dataframe using *BoosterVersion()*

```
getLaunchSite(data)
getPayloadData(data)
getCoreData(data)
```

```
getBoosterVersion(data)
```

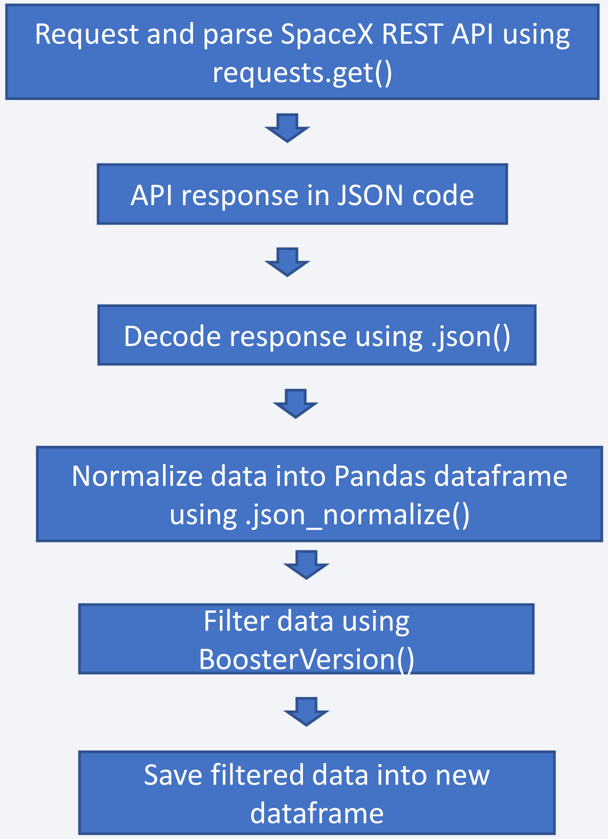
```
data_falcon9 = df[df['BoosterVersion']!='Falcon 1']
```

5. Save the filtered data into new dataframe for data wrangling

```
data_falcon9.to_csv('dataset_part\_1.csv', index=False)
```

[GitHub Url Notebook - Data Collection SpaceX API]

SpaceX API Data Collection Flow Chart



Data Collection - Scraping

1. **Getting Response from HTML using requests.get()**

```
Wikipage = requests.get(static_url)
Wikipage.status_code
```

2. **Create BeautifulSoup object using .BeautifulSoup()**

```
soup = BeautifulSoup(Wikipage.text, 'html.parser')
```

3. **Extract all variables from HTML using .find_all()**

```
html_tables = soup.find_all('table')
```

```
column_names = []
temp = soup.find_all('th')
for x in range(len(temp)):
    try:
        name = extract_column_from_header(temp[x])
        if (name is not None and len(name) > 0):
            column_names.append(name)
    except:
        pass
```

4. **Normalize data into dataframe by parsing HTML tables**

```
launch_dict= dict.fromkeys(column_names)
```

```
extracted_row = 0
#Extract each table
for table_number,table in enumerate(soup.find_all('table',"wikitable plainrowheaders collapsibl
e")):
```

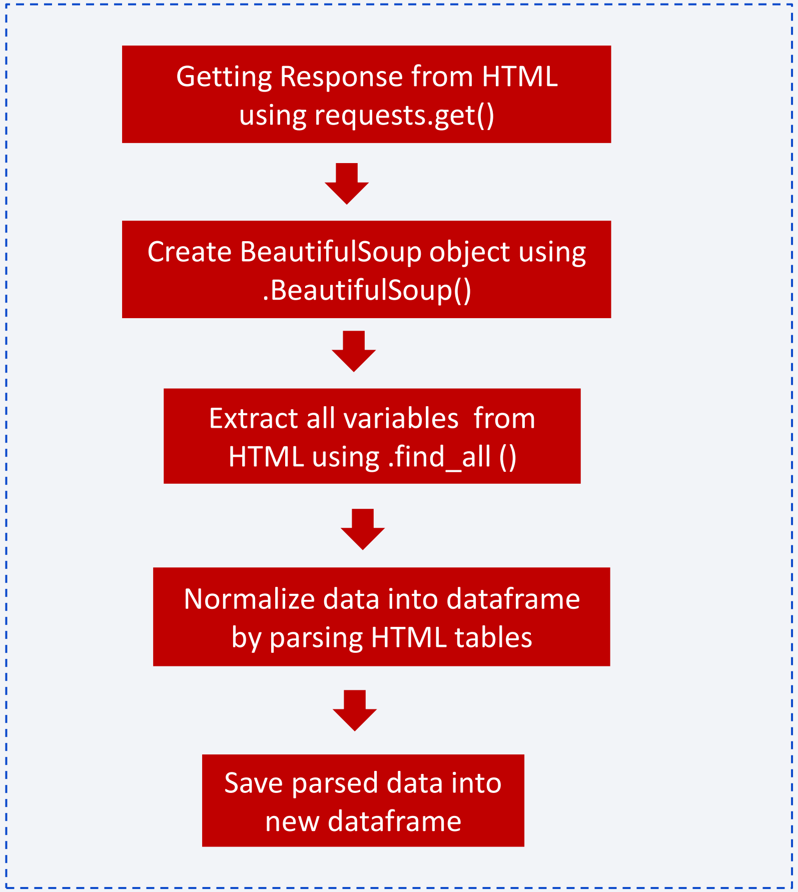
```
df=pd.DataFrame(launch_dict)
```

5. **Save parsed data into new dataframe**

```
df.to_csv('spacex_web_scraped.csv', index=False)
```

[GitHub Url Notebook - Web Scraping SpaceX]()

Web Scraping Flow chart



Data Wrangling

Introduction

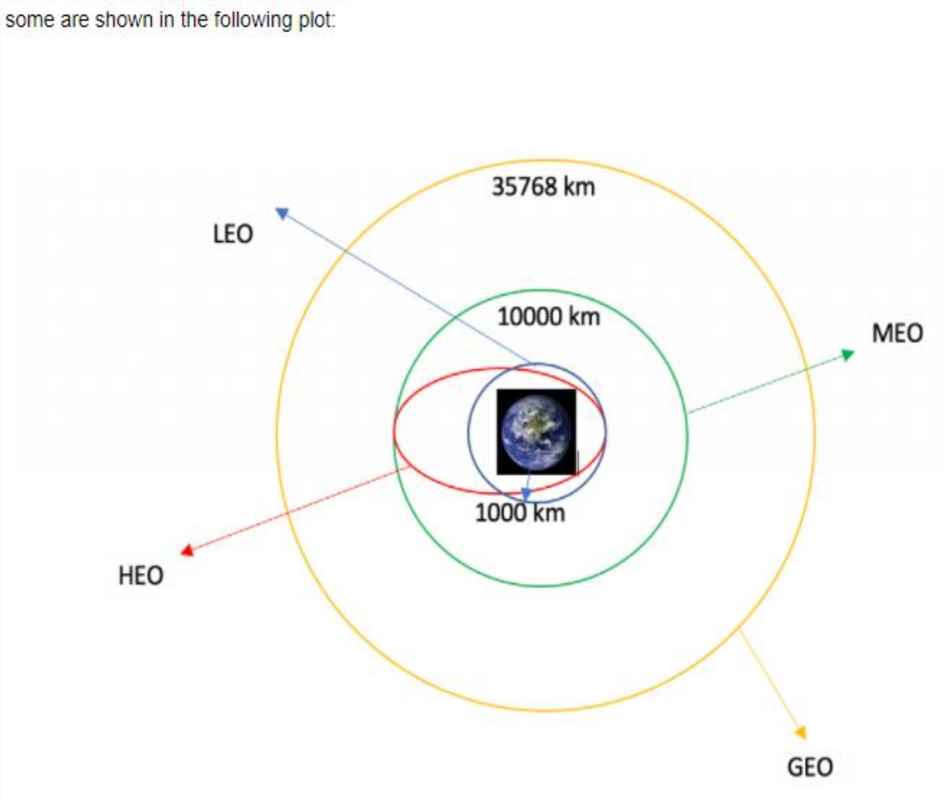
In this section, we performed some Exploratory Data Analysis (EDA) to find some patterns in the data and determine what would be the label for training supervised models. In the data set, there are several different cases where the booster did not land successfully. Sometimes a landing was attempted but failed due to an accident; for example, True Ocean means the mission outcome was successfully landed to a specific region of the ocean while False Ocean means the mission outcome was unsuccessfully landed to a specific region of the ocean. True RTLS means the mission outcome was successfully landed to a ground pad False RTLS means the mission outcome was unsuccessfully landed to a ground pad. True ASDS means the mission outcome was successfully landed on a drone ship False ASDS means the mission outcome was unsuccessfully landed on a drone ship. In this section, we will mainly convert those outcomes into Training Labels with 1 means the booster successfully landed 0 means it was unsuccessful.

Process and Flow Chart

Perform EDA on dataset → Calculate the number of launches on each site → Calculate the number of occurrence of each orbit → Calculate the number and occurrence of mission outcome per orbit type → Create landing outcome label from outcome column → Determine success rate → Export dataset to .CSV

[GitHub Url Notebook - Data Wrangling]

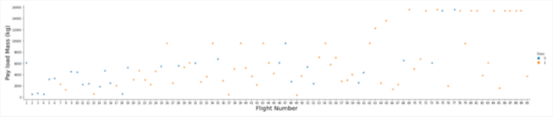
Each launch aims to an dedicated orbit, and here are some common orbit types:



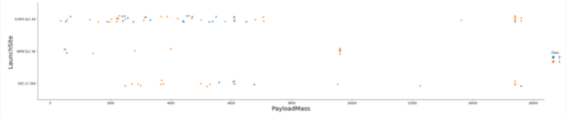
EDA with Data Visualization

Scatter charts :- Scatter charts are used to analyze the correlation between two variables and to observe which variables has high dependency and strong relationships. Such as:

- Flight Number Vs Pay Load Mass (kg)

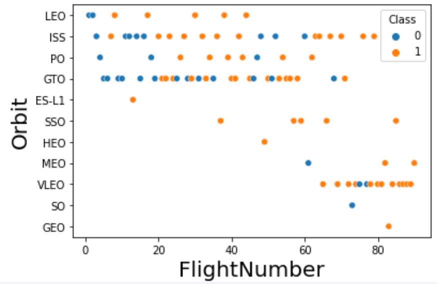


- Payload Vs. launch Site

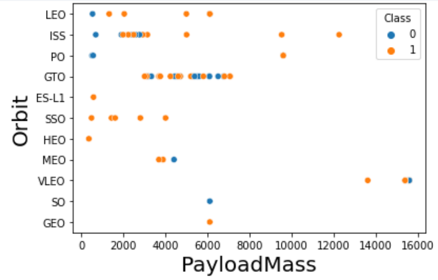


- Flight Number Vs Launch Site

- Flight Number Vs. Orbit type

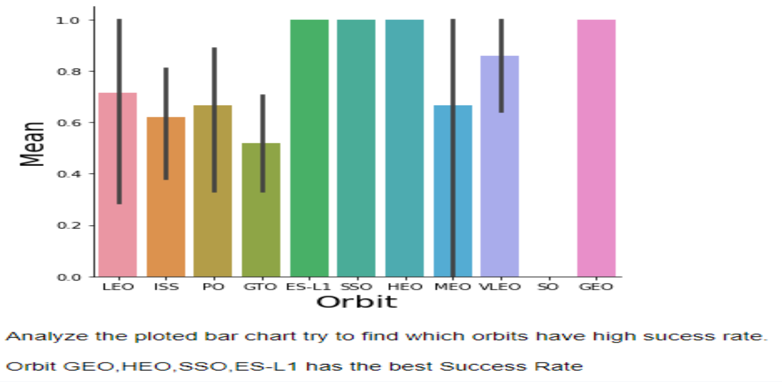


- Payload Vs Orbit type



- [GitHub url Notebook - EDA with Data Visualization]

Bar chart :- Bar chart is used to visually analyze the relationship between success rate of each orbit to find which orbits have high success rate by calculating the mean value.



Line Graph :- Line graph is used to visualize the launch success rate yearly trend over a period of time.

EDA with SQL

- SQL queries performed to carry out EDA with SpaceX Data set

- Display the names of the unique launch site in the space mission
- Display 5 records where launch sites begin with the strong 'CCA'
- Display the total payload mass carried by boosters launched by NASA (CRS)
- Display average payload mass carried by booster version F9 V1. 1
- List the date when the first successful landing outcome in ground pad was achieved
- List the names of the boosters which have success in drone ship and have payload mass greater than 4000 but leas than 6000
- List the total number of successful and failure mission outcomes
- List the names of the booster_versions which have carried the maximum payload mass. Use a subquery
- List the failed landing_outcomes in drone ship, their booster versions, and launch site names for in year 2015
- Rank the count of landing outcomes between the date 2010-06-04 and 2017-03-20, in descending order

[GitHub url Notebook - EDA with SQL]

Build an Interactive Map with Folium

We discovered that the launch success rate depends on many factors such as payload mass, orbit type, and so on. However, it may also depend on the location and proximities of a launch site, i.e., the initial position of rocket trajectories. Finding an optimal location for building a launch site certainly involves many factors and we could discover some of the factors by analyzing the existing launch site locations using more interactive visual map analytics with Folium.

- We marked all launch sites on a map using site's latitude and longitude coordinates by pinning them with Circle Marker and text label on a specific coordinate.

- We also marked the success/failed launches for each site on the map using launch successful as *class=1* with **Green** marker color and launch failed as *class=0* with **Red** marker color by creating *MarkerCluster()* object to identify which launch sites have relatively high success rate.

- Moreover, we calculated the distances between a launch site to its proximities with lines on the map to measure distance to the launch sites to identify the impact of proximity in finding an optimal location for building a launch site.

- Some findings after plotting distance lines between a launch site to its proximities :-

  - **Are launch sites in close proximity to railways?**

    My Findings:- Closest distance to railway being 1.28 km, comparatively its bit further from launch site. That is to avoid accidents and danger to human lives.
  - **Are launch sites in close proximity to highways?**

    My Findings:- Closest distance to hihgway being 0.58 km, comparatively its the most closest from launch site. May be for the ease of transport of goods and services and reduce logistical cost.
  - **Are launch sites in close proximity to coastline?**

    My Findings:- Closest distance to coastline being 0.90 km, comparatively its quiet close from launch site too. Is because to ensure that no components are shed over populated areas which will not endanger human lives or adjacent lauch pads.
  - **Do launch sites keep certain distance away from cities?**

    My Findings:- yes, launch sites has maintained enough distance away from cities to avoid high risk to population and livelihoods in case of catastrophic failure.

[GitHub url Notebook - Interactive Map with Folium]()

Build a Dashboard with Plotly Dash

- In this section, we build a Plotly Dash application for users to perform interactive visual analytics on SpaceX launch data in real-time. This dashboard application contains input components such as a **dropdown list** and **range slider** to interact with a **pie chart** and a **scatter point chart**.

- **Pie chart** displays relative proportions of total success launches by site which helps us to determine the largest successful launches and **dropdown menu** lets us select different launch sites to check its detailed success rate.

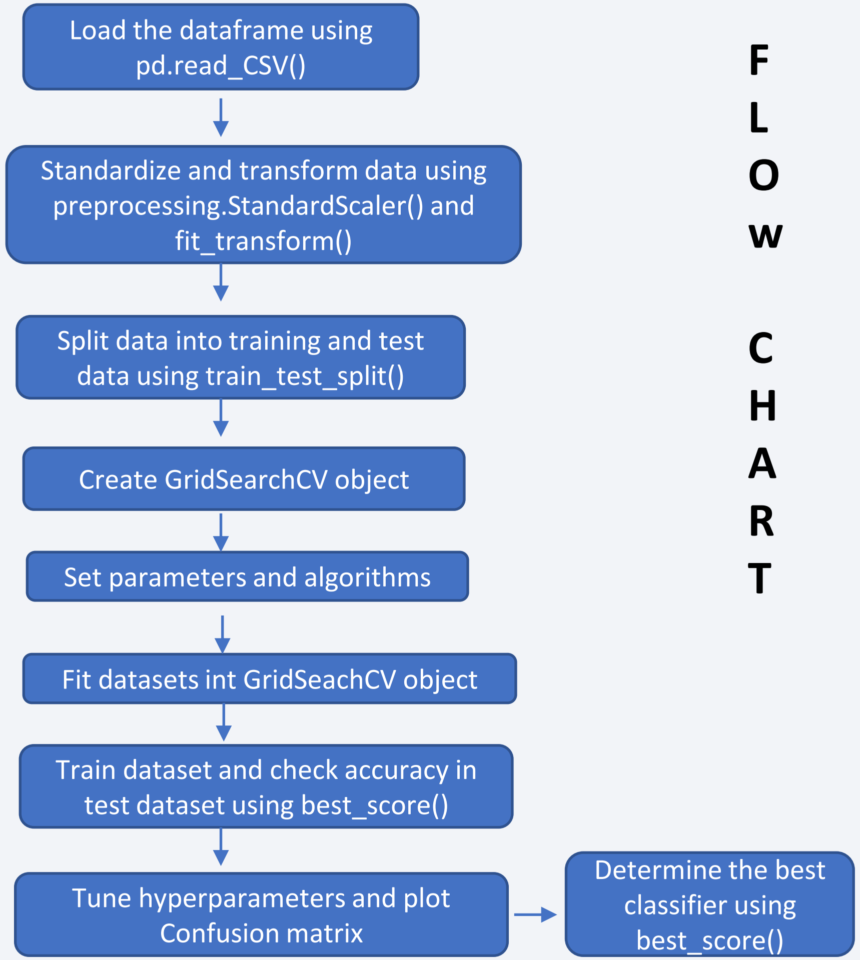
- **Scatter plot chart** displays the correlation between payload mass and success for all sites for different Booster versions which helps us to determine highest and lowest launch success rate. In addition, **range slider** enable us to easily select different payload range to identify some visual patterns and correlation. It is also a best method to show non-linear patterns.

- GitHub url to source code

Predictive Analysis (Classification)

- **Building Model**
- Import Python libraries and define auxiliary functions
- Load the data into dataframe
- Transform the data
- Split that data into training and testing data
- Check how many test samples
- List types of machine learning algorithms for analysis
- Create GridSearchCV object to set parameters and algorithms
- Fit datasets into GridSearchCV object and train our dataset
- [GitHub url Notebook - Predictive Analysis]()

- **Evaluating Model**
- Check accuracy on the validation data for each model
- Tune hyperparameters for each model
- Plot Confusion matrix
- **Improving Model**
- Feature Engineering
- Algorithm tuning
- **Finding the best performing classification model**
- Model with the best score determines the best performing model



Results

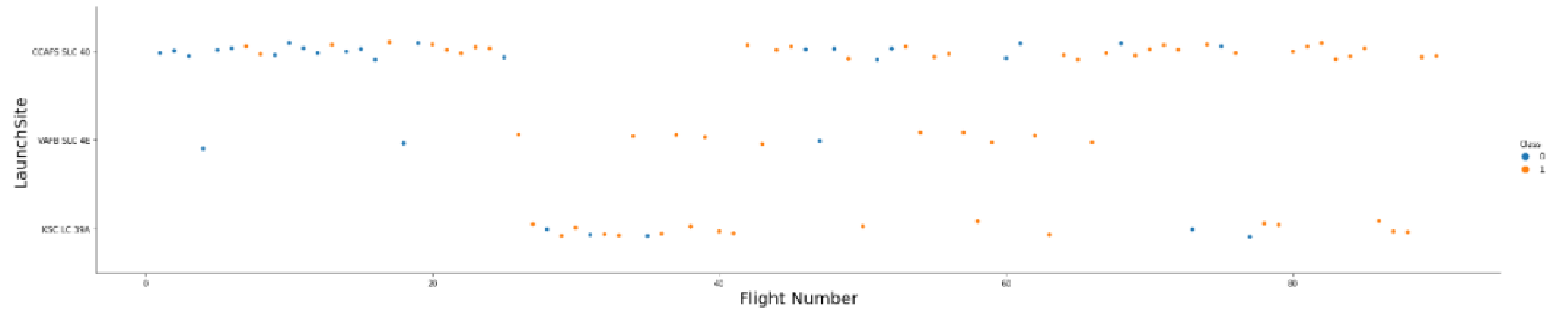
- Exploratory data analysis results
- Interactive analytics demo in screenshots
- Predictive analysis results

Section 2

Insights drawn from EDA

Flight Number vs. Launch Site

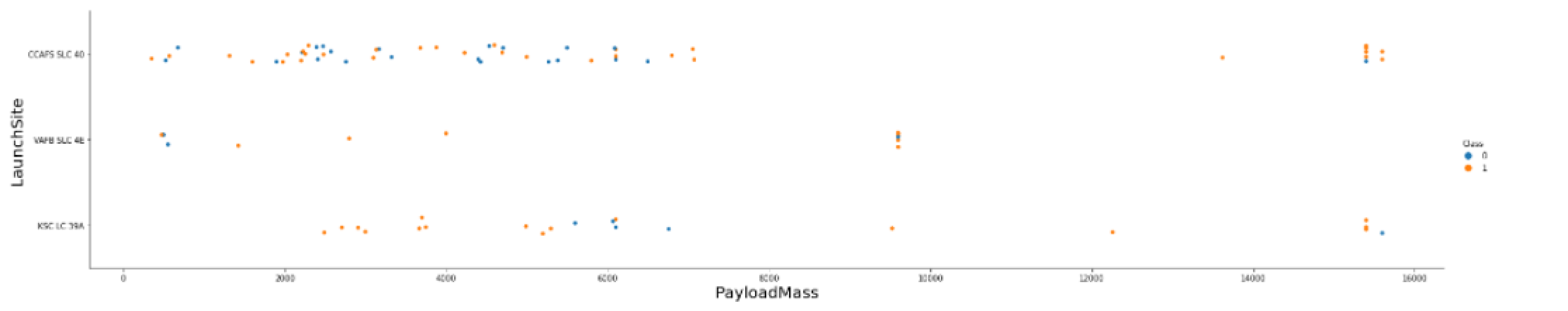
- Scatter plot of Flight Number vs. Launch Site



The more amount of flights at a launch site the greater the success rate at a launch site.

Payload vs. Launch Site

- Scatter plot of Payload vs. Launch Site

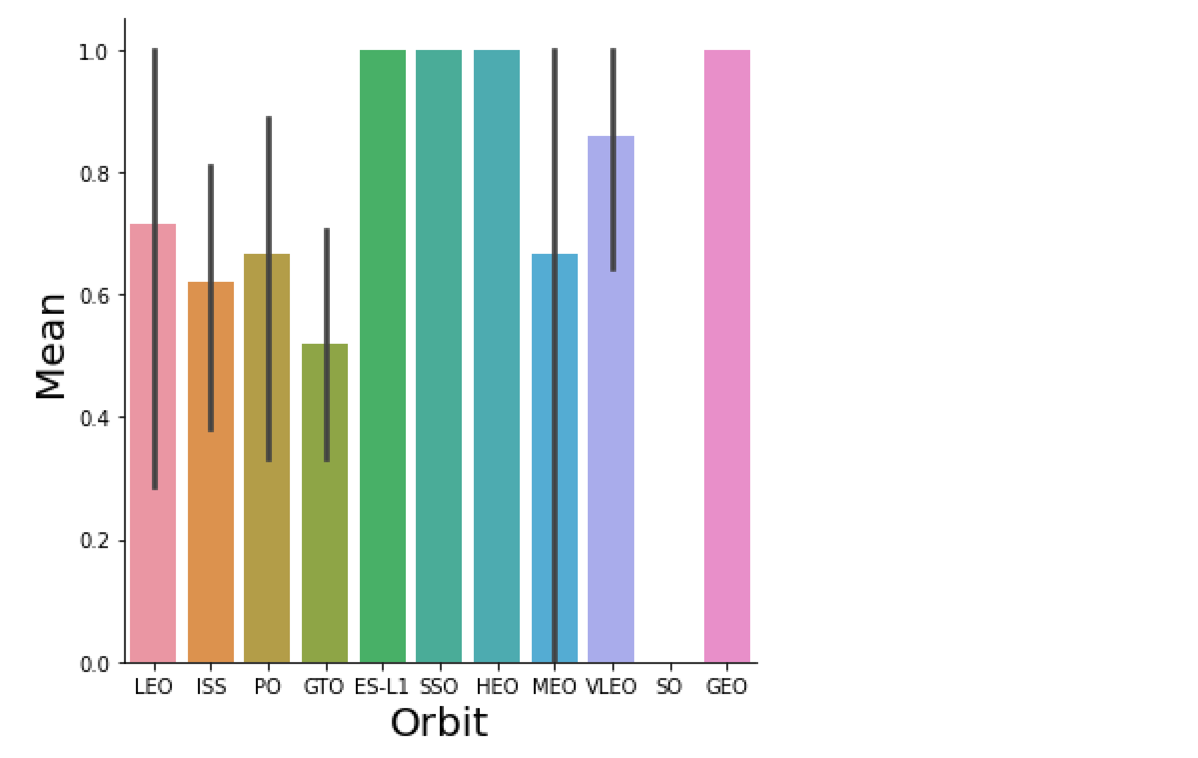


The greater the payload mass for Launch Site CCAFS SLC 40 the higher the success rate for the Rocket.

There is not quite clear pattern to be found using this visualization to make a decision if the Launch Site is dependent on Pay Load Mass for a success launch.

Success Rate vs. Orbit Type

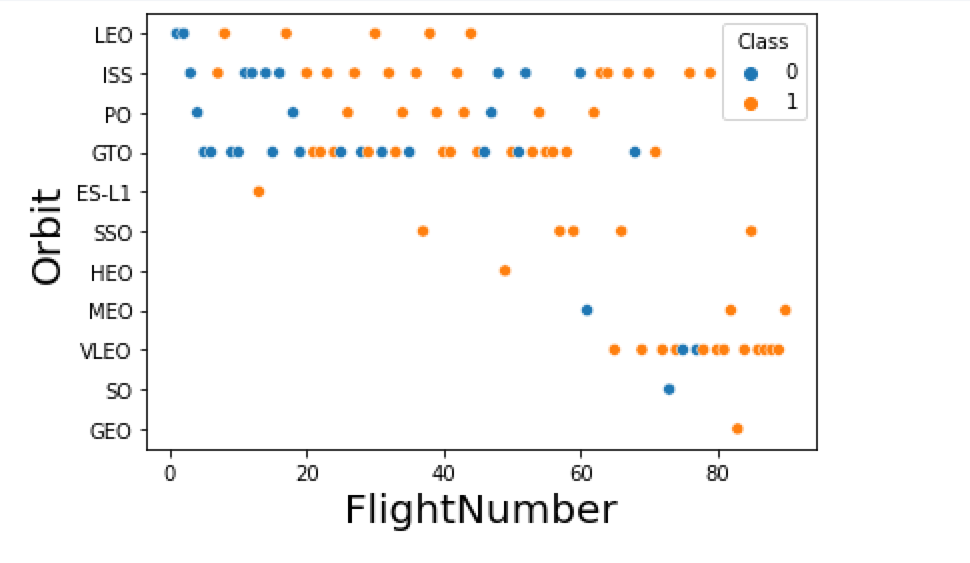
- Bar chart for the success rate of each orbit type



Orbit GEO,HEO,SSO,ES-L1 has the best Success Rate

Flight Number vs. Orbit Type

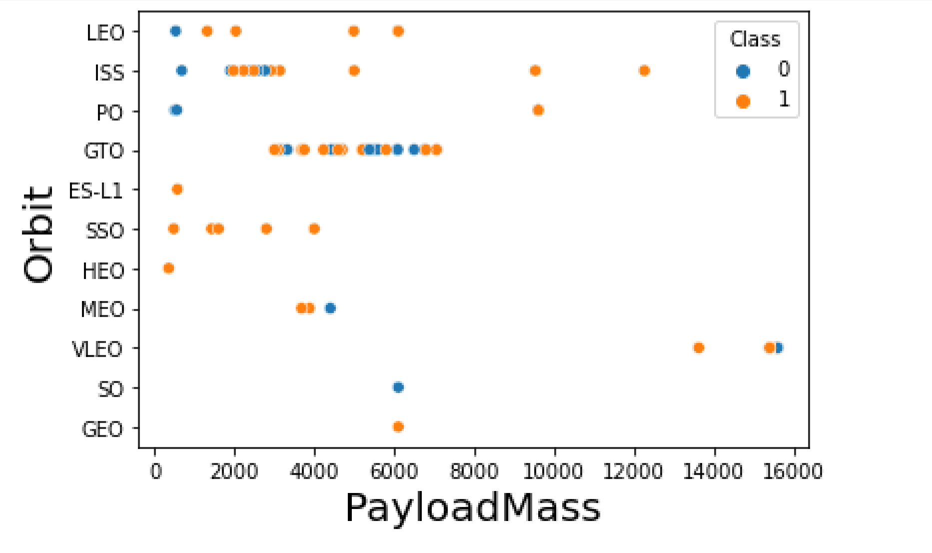
- Show a scatter point of Flight number vs. Orbit type



You should see that in the LEO orbit the Success appears related to the number of flights; on the other hand, there seems to be no relationship between flight number when in GTO orbit.

Payload vs. Orbit Type

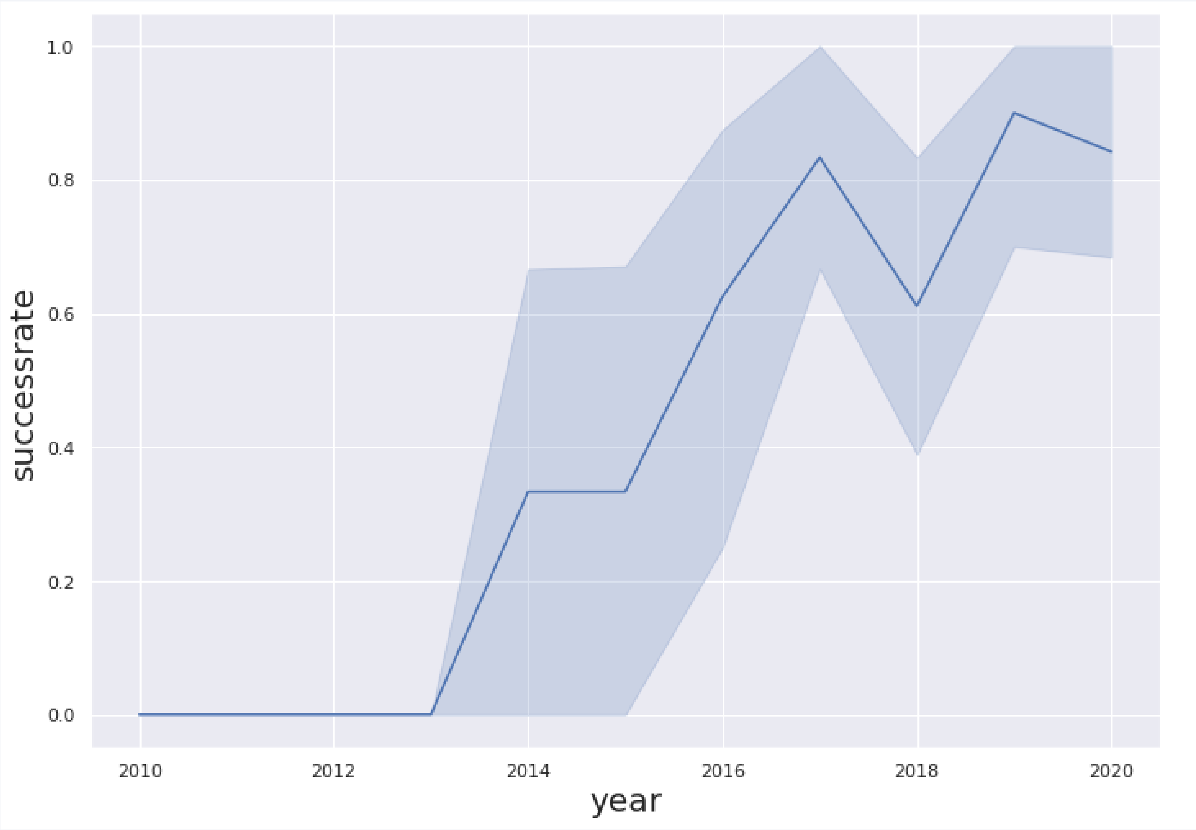
- Show a scatter point of payload vs. orbit type



You should observe that Heavy payloads have a negative influence on GTO orbits and positive on GTO and Polar LEO (ISS) orbits.

Launch Success Yearly Trend

- Line chart of yearly average success rate



You can observe that the success rate since 2013 kept increasing till 2020

All Launch Site Names (SQL Queries)

- Find the names of the unique launch sites

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

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

DISTINCT query selects unique values from ***Launch_site*** column from table ***SPACEDATASET***

Launch Site Names Begin with 'CCA'

- Find 5 records where launch sites begin with `CCA`

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

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	07:44:00	F9 v1.0 B0005	CCAFS LC-40	Dragon demo flight C2	525	LEO (ISS)	NASA (COTS)	Success	No attempt
2012-10-08	00:35:00	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

- ***SELECT **** means selects all from table ***SAPCEDATASET***, ***WHERE*** clause only focuses into column name ***Launch_Site*** and ***LIKE*** keyword consist of wild card **"CCA%"** with the percentage in the end means Launch_Site name must start with CCA, ***LIMIT*** keyword limiting only top 5 records to be displayed.

Total Payload Mass

- Calculate the total payload carried by boosters from NASA

```
%sql SELECT SUM(PAYLOAD_MASS__KG_) AS TotalPayLoadMass FROM SPACEXDATASET WHERE CUSTOMER = 'NA
SA (CRS)';
```

totalpayloadmass
45596

SUM function calculates the total value of column ***PAYLOAD_MASS_KG_***

WHERE clause filters the dataset to only perform calculations on ***CUSTOMER*** which is equal to ***NASA(CRS)***

Average Payload Mass by F9 v1.1

- Calculate the average payload mass carried by booster version F9 v1.1

```
%sql SELECT AVG(PAYLOAD_MASS__KG_) AS "Average Pay load Mass" FROM SPACEXDATASET WHERE BOOSTER
_VERSION = 'F9 v1.1';
```

Average Pay load Mass
2928

AVG function calculates the average value of the column *PAYLOAD_MASS_KG_*

WHERE clause filters the dataset to perform calculations only on column *BOOSTER_VERSION* which is equal to *'F9 v1.1'*

First Successful Ground Landing Date

- Find the dates of the first successful landing outcome on ground pad

```
%sql SELECT MIN(Date) AS "First Date Successful Landing Outcome in ground pad" FROM SPACEXDATASET WHERE LANDING__OUTCOME = 'Success (ground pad)';
```

First Date Successful Landing Outcome in ground pad
2015-12-22

- **MIN** function selects the minimum date from the column **Date** and **AS** defines the new column name from the table **SPACEDATASET**
- **WHERE** clause filters the dataset of column name **LANDING_OUTCOME** which equals to **'Success (ground pad)'**

Successful Drone Ship Landing with Payload between 4000 and 6000

- List the names of boosters which have successfully landed on drone ship and had payload mass greater than 4000 but less than 6000

```
%sql SELECT BOOSTER_VERSION FROM SPACEXDATASET WHERE LANDING__OUTCOME = 'Success (drone ship)'
AND 4000 < PAYLOAD_MASS__KG_ < 6000;
```

booster_version
F9 FT B1021.1
F9 FT B1023.1
F9 FT B1029.2
F9 FT B1038.1
F9 B4 B1042.1
F9 B4 B1045.1
F9 B5 B1046.1

- Selecting only Booster_Version names from table SPACEXDATASET
- WHERE clause filters the dataset to Landing_Outcome equals to ‘Success (drone ship)’
- AND clause states additional filter conditions Payload_mass_kg_ greater than 4000 but less than 6000

Total Number of Successful and Failure Mission Outcomes

- Calculate the total number of successful and failure mission outcomes

```
%%sql SELECT MISSION_OUTCOME, count(MISSION_OUTCOME) AS "Total Number"
FROM SPACEXDATASET
GROUP BY MISSION_OUTCOME;
```

mission_outcome	Total Number
Failure (in flight)	1
Success	99
Success (payload status unclear)	1

Selects column name **MISSION_OUTCOME** and counts total number of mission_outcome assigning column name as **“Total Number”** of successful and failure mission outcomes from table **SPACEXDATASET** group by **MISSION_OUTCOME**.

Boosters Carried Maximum Payload

- List the names of the booster which have carried the maximum payload mass

```
%%sql SELECT DISTINCT BOOSTER_VERSION
FROM SPACEXDATASET
WHERE PAYLOAD_MASS__KG_ = (SELECT MAX(PAYLOAD_MASS__KG_) FROM SPACEXDATASET);
```

DISTINCT query Selects unique values from column **Booster_Version** from table **SPACEXDATASET**

WHERE clause filters **Payload_mass_kg_** using subqueries to list the names of Booster versions which have carried the maximum **Payload mass**.

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

2015 Launch Records

- List the failed landing_outcomes in drone ship, their booster versions, and launch site names for in year 2015

```
%%sql SELECT LANDING__OUTCOME, BOOSTER_VERSION, LAUNCH_SITE
FROM SPACEXDATASET
WHERE LANDING__OUTCOME = 'Failure (drone ship)' AND YEAR(DATE) = 2015;
```

landing__outcome	booster_version	launch_site
Failure (drone ship)	F9 v1.1 B1012	CCAFS LC-40
Failure (drone ship)	F9 v1.1 B1015	CCAFS LC-40

- **SELECT** query selects value from columns names **LANDING_OUTCOME, BOOSTER_VERSION, LAUNCH_SITE** from table **SPACEXDATASET**
- **WHERE** clause filters the column value of **LANDING_OUTCOME** which equals to **'Failure (drone ship)'**
- **AND** clause aggregates filter value from column name **YEAR(DATE)** equal to year **'2015'**

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

- 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(LANDING__OUTCOME) AS TOTAL_NUMBER
FROM SPACEXDATASET
WHERE DATE BETWEEN '2010-06-04' AND '2017-03-20'
GROUP BY LANDING__OUTCOME
ORDER BY TOTAL_NUMBER DESC;
```

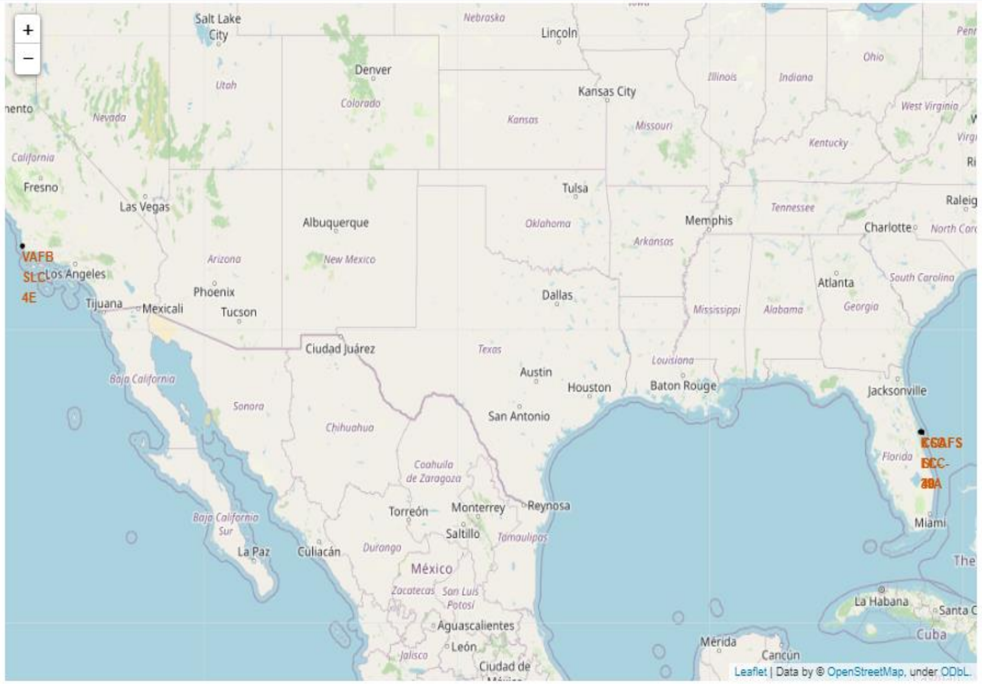
landing__outcome	total_number
No attempt	10
Failure (drone ship)	5
Success (drone ship)	5
Controlled (ocean)	3
Success (ground pad)	3
Failure (parachute)	2
Uncontrolled (ocean)	2
Precluded (drone ship)	1

- **SELECT** query selects value from column name **LANDING_OUTCOME** and **COUNT** function counts total records from table **SPACEXDATASET**
- **WHERE** clause filters datasets from column name **DATE** and **BETWEEN** clause limits the range for date
- **GROUP BY** clause groups values as unique entity and
- **ORDER BY** and **DESC** clauses arranges the values in descending order

Section 4

Launch Sites Proximities Analysis

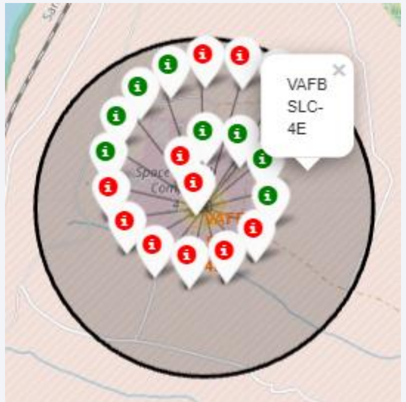
SpaceX – All Launch Sites Global Map Markers



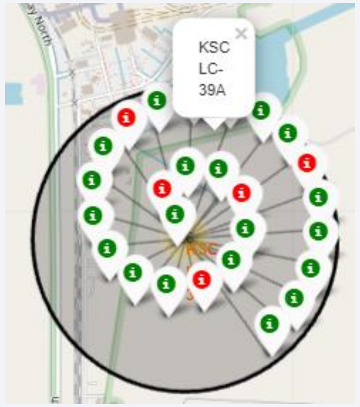
- According to the map, we can observe that SpaceX launch sites are located in the United States of America mainly close proximity to coast and Equator line which is Florida and California.

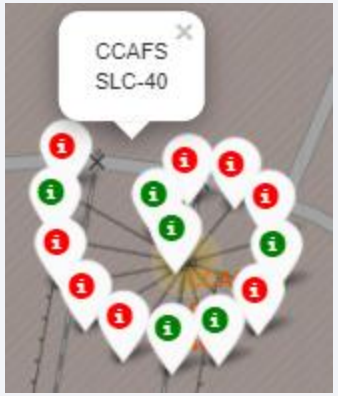
- Finding shows that all launch sites are proximity to the Equator line because geographically it is considered as shortest distance travel to space and fuel consumption is also less. On the other hand, all launch sites are located in close proximity to coast, may be because of various safety protocols.

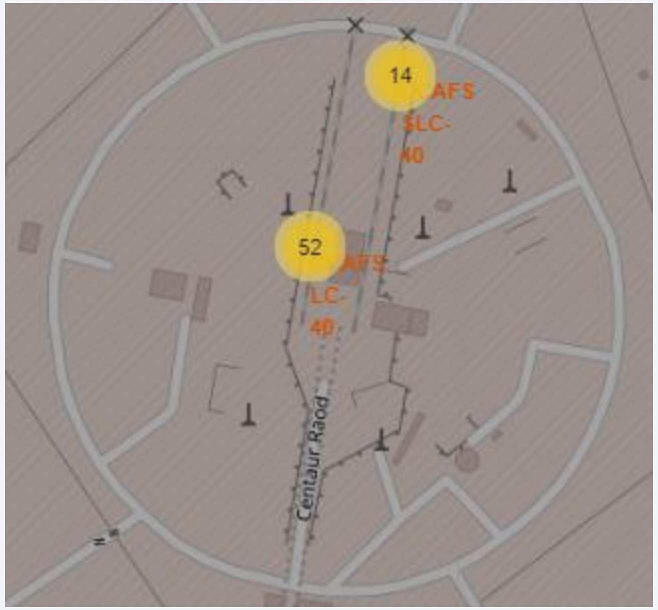
SpaceX – Color Labeled Markers

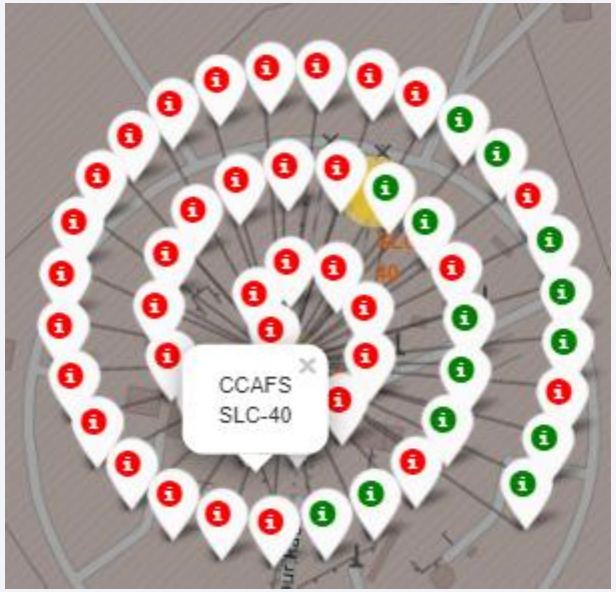


California Launch Site





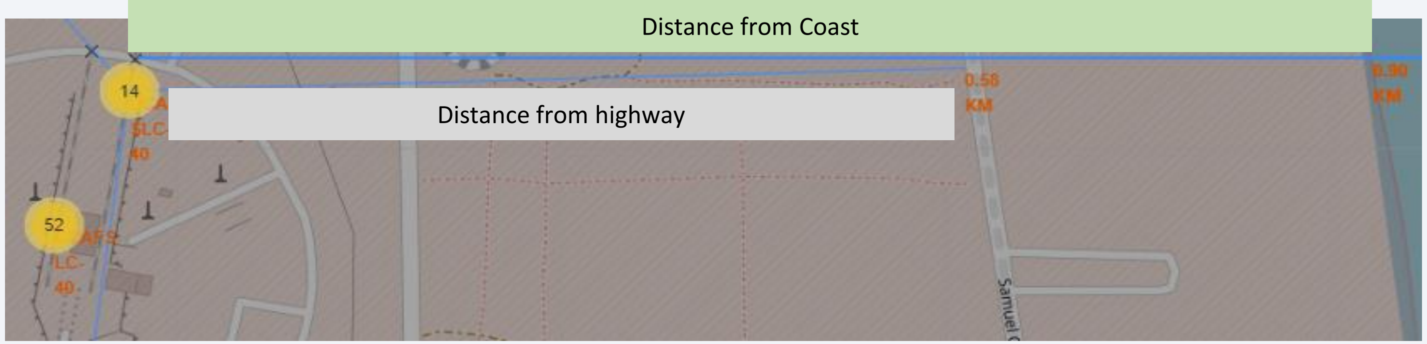


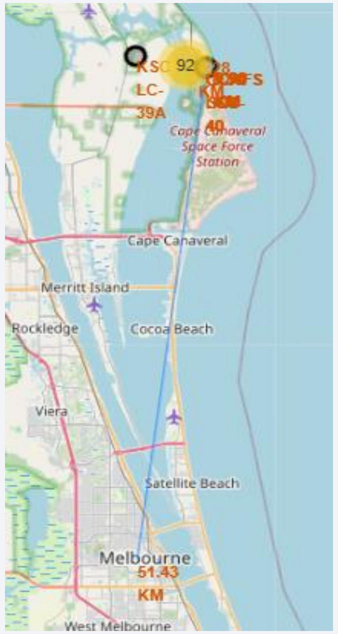


Green Marker shows successful launches sites
Red Marker shows Failures launch sites

SpaceX – Distance between launch site to its proximities

Overall Overview





Distance from main city

- **Are launch sites in close proximity to railways?**

  My Findings:- Closest distance to railway being 1.28 km, comparatively its bit further from launch site. That is to avoid accidents and danger to human lives.
- **Are launch sites in close proximity to highways?**

  My Findings:- Closest distance to hihgway being 0.58 km, comparatively its the most closest from launch site. May be for the ease of transport of goods and services and reduce logistical cost.
- **Are launch sites in close proximity to coastline?**

  My Findings:- Closest distance to coastline being 0.90 km, comparatively its quiet close from launch site too. Is because to ensure that no components are shed over populated areas which will not endanger human lives or adjacent lauch pads.
- **Do launch sites keep certain distance away from cities?**

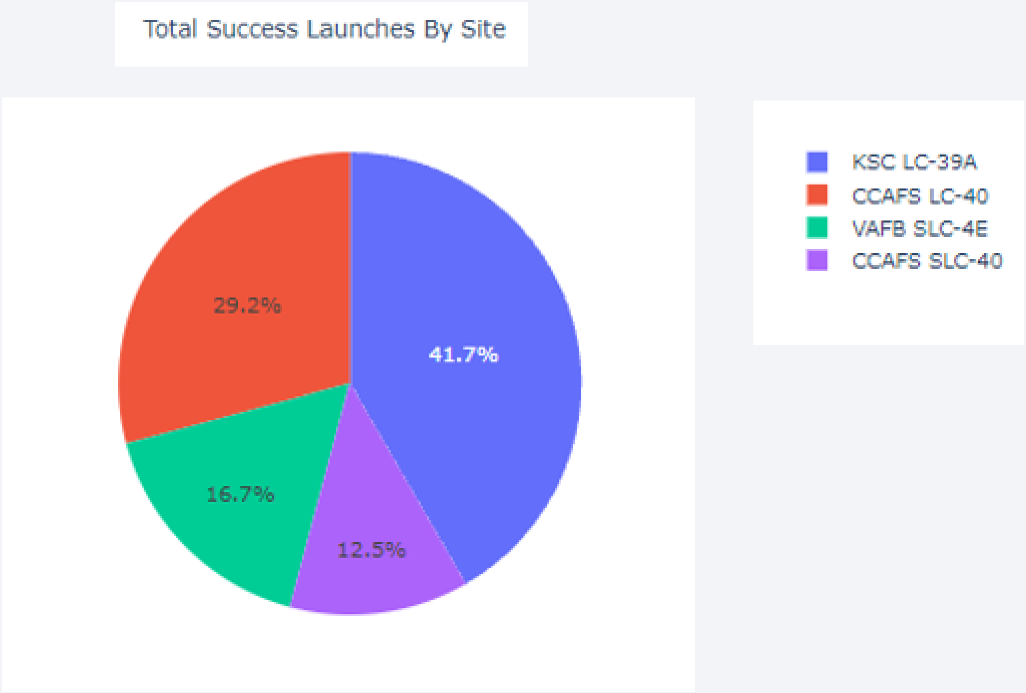
  My Findings:- yes, launch sites has maintained enough distance away from cities to avoid high risk to population and livelihoods in case of catastrophic failure.

Section 5

Build a Dashboard with Plotly Dash

DASHBOARD – Pie Chart_SpaceX All Success Launch sites

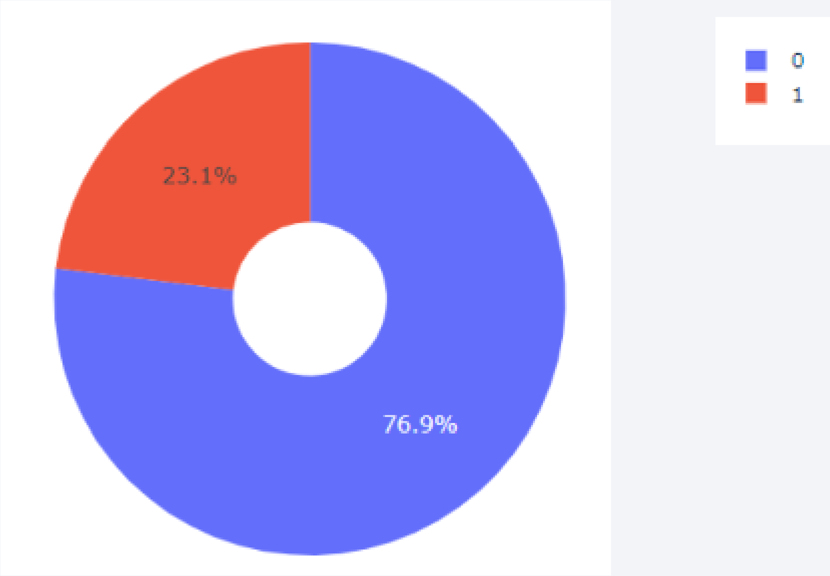
Pie Chart - Total Success Launches by site



The given pie chart shows that KSC LC-39A is the most successful launch sites with 41.7% whereas CCAFS SLC-40 is the least successful launch sites with 12.5%.

DASHBOARD – Pie Chart_SpaceX launch site with highest launch success ratio

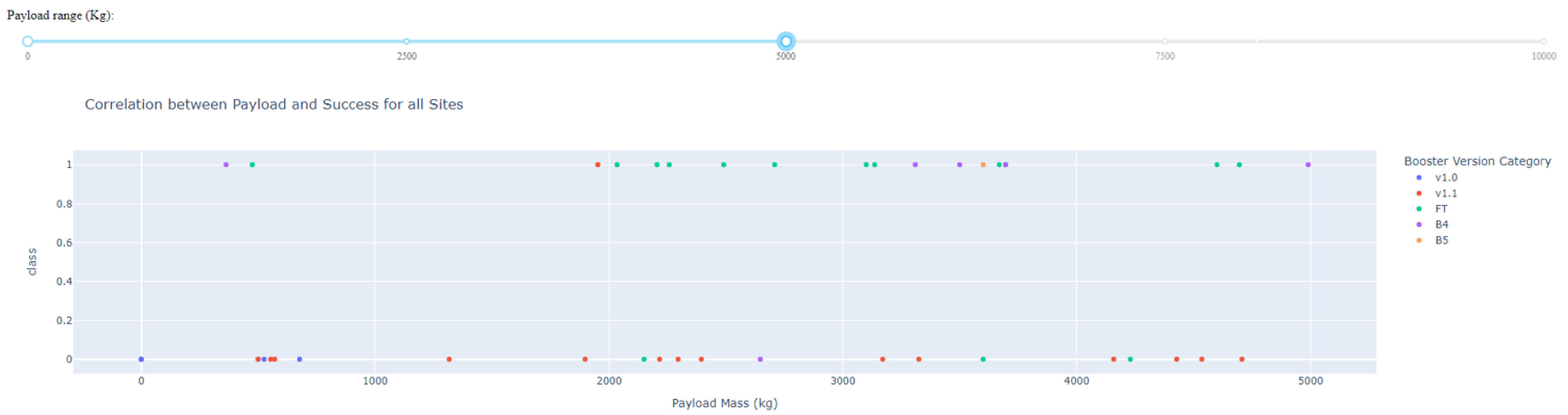
KSC LC-39A Launch site



The given pie chart shows that KSC LC-39A launch site had the highest success ratio of 76.9% with failure ratio of 23.1%.

Dashboard - Payload vs. Launch Outcome scatter plot for all sites with range slider

- Payload range 0kg – 5000kg



- When Payload range is selected from 0kg to 5000 kg, '**FT**' booster version has the largest success rate.

Dashboard - Payload vs. Launch Outcome scatter plot for all sites with range slider – Contd….

- Payload range 2500kg – 10000kg

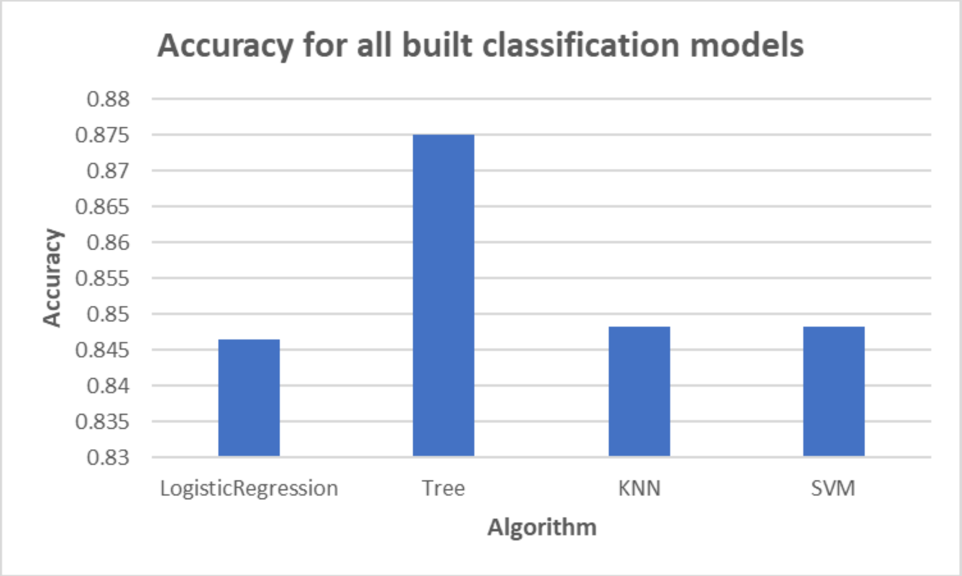
- When Payload range is selected from 2500kg to 10000kg, we can observe that as the payload range increases, the success rate decreases. Hence, we can conclude that there is a strong correlation between Payload Mass and Success rate (class).

Section 6

Predictive Analysis (Classification)

Classification Accuracy

- Visualize the built model accuracy for all built classification models, in a bar chart

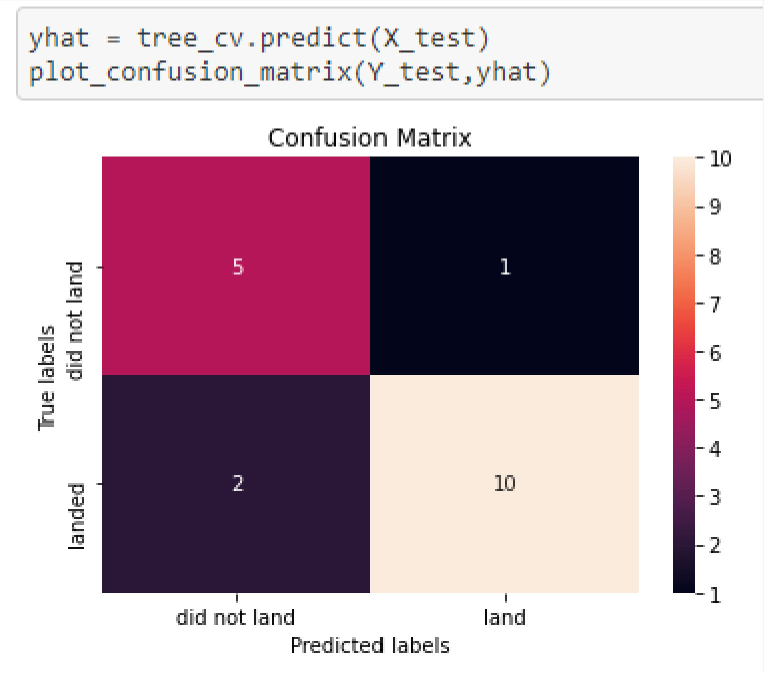


	Algorithm	Accuracy
0	LogisticRegression	0.846428571
1	Tree	0.875
2	KNN	0.848214286
3	SVM	0.848214286

- Tree model has the highest classification accuracy with 0.875. However, after tuning the hyperparameters on decision tree classifier, we achieved 83.33% accuracy on the test data.

Confusion Matrix

- Confusion Matrix of best performing model :- Tree Model



The given confusion matrix illustrates that
True Positive (TP) = 10; meaning 10 predicted value were correctly classified by the model

True Negative (TN) = 5; meaning 5 negative predicted values were correctly classified by the model.

False Positive (FP) = 1; meaning 1 negative predicted value were incorrectly classified as positive by the model. Also known as Type 1 error.

False Negative (FN) = 2; meaning 2 positive predicted values were incorrectly classified as negative value by the model. Also known as Type 2 error.

Conclusions

- Our findings shows that KSC LC-39A had the most successful launch site rates among all other sites.
- We discovered that Orbit GEO, HEO, SSO and ES-L1 have the best success rate
- We observed that success rates for SpaceX launch sites is directly proportional to years, which means as time increased, success rate also increased.
- We also observed that lower the payload mass, higher booster version success ratio
- Our findings shows that Tree Classifier Algorithm is the best classifier for Machine learning Prediction of SpaceX first stage landing.

Thank you!