IBM Developer
SKILLS NETWORK

Winning Space Race with Data Science

Erika Torres
May 13th, 2024

Outline

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

- Summary of methodologies

✓ SpaceX Data Collection API

✓ SpaceX Data Wrangling Prediction

✓ SpaceX Notebook for Peer Assignment

✓ SpaceX Exploring a Preparing Data

✓ SpaceX Launch Sites Locations Analysis with Folium

✓ SpaceX Machine Learning Prediction

- Summary of all results

✓ Exploratory Data Analysis Results

✓ Interactive Visual Analytics and Dashboards

✓ Predictive Analysis

Introduction

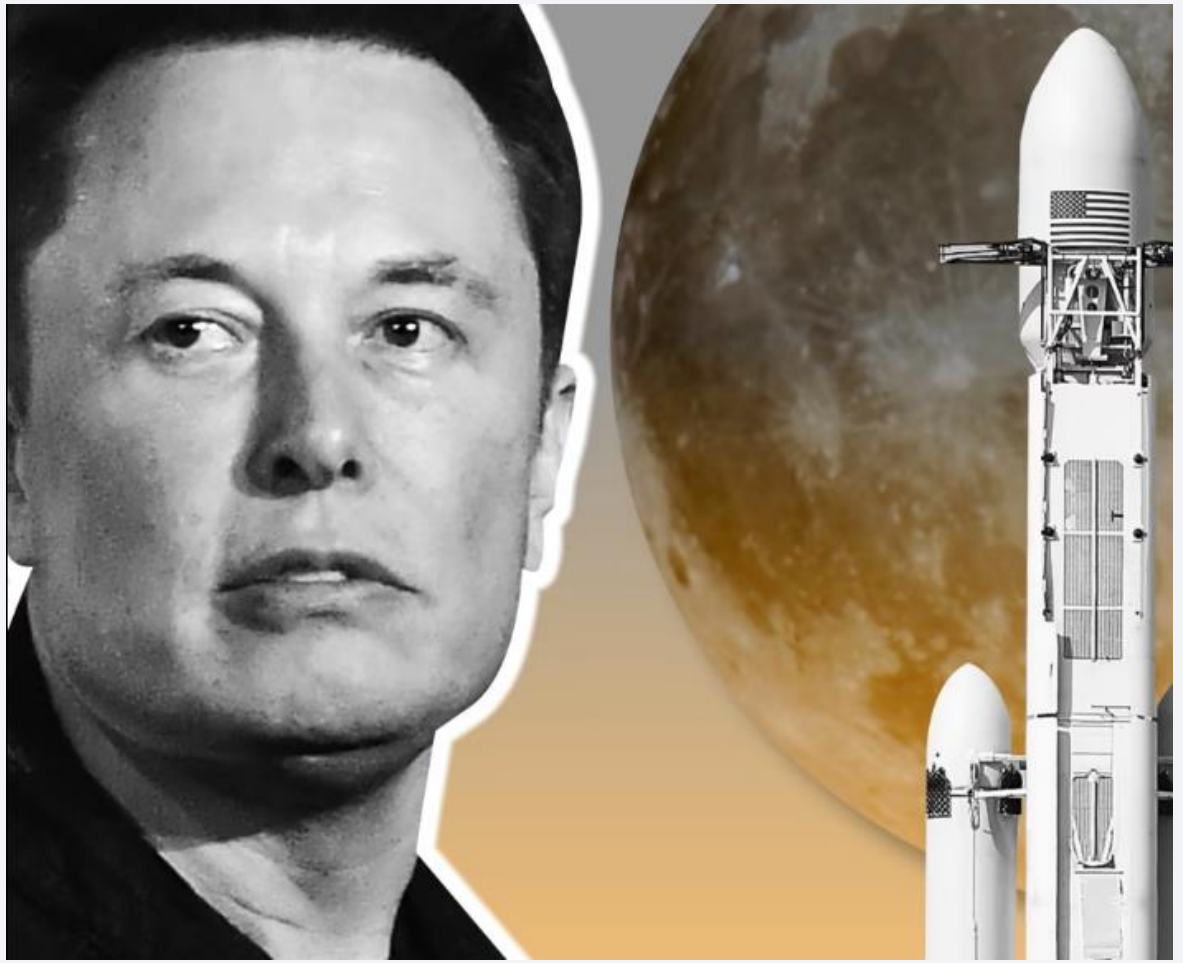
- Project background and context

SpaceX advertise 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 launch. This information can be used if an alternate company wants to did against SapaceX for rocket louch.

- Problems you want to find answers

We will predict if the Falcon 9 first stage will land successfully using data from Falcon 9 rocket launches advertised on its website.



Section 1

Methodology

Methodology

Executive Summary

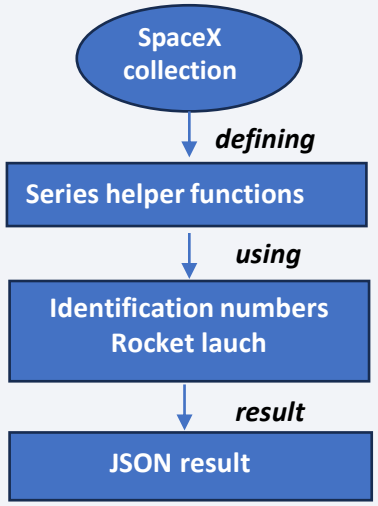
- Data collection methodology:
  - Data was collected using SpaceX API and web scraping from Wikipedia.
- Perform data wrangling
  - Describe how data was processed
- Perform exploratory data analysis (EDA) using visualization and SQL
- Perform interactive visual analytics using Folium and Plotly Dash
- Perform predictive analysis using classification models
  - How to build, tune, evaluate classification models

Data Collection

- Describe how data sets were collected.

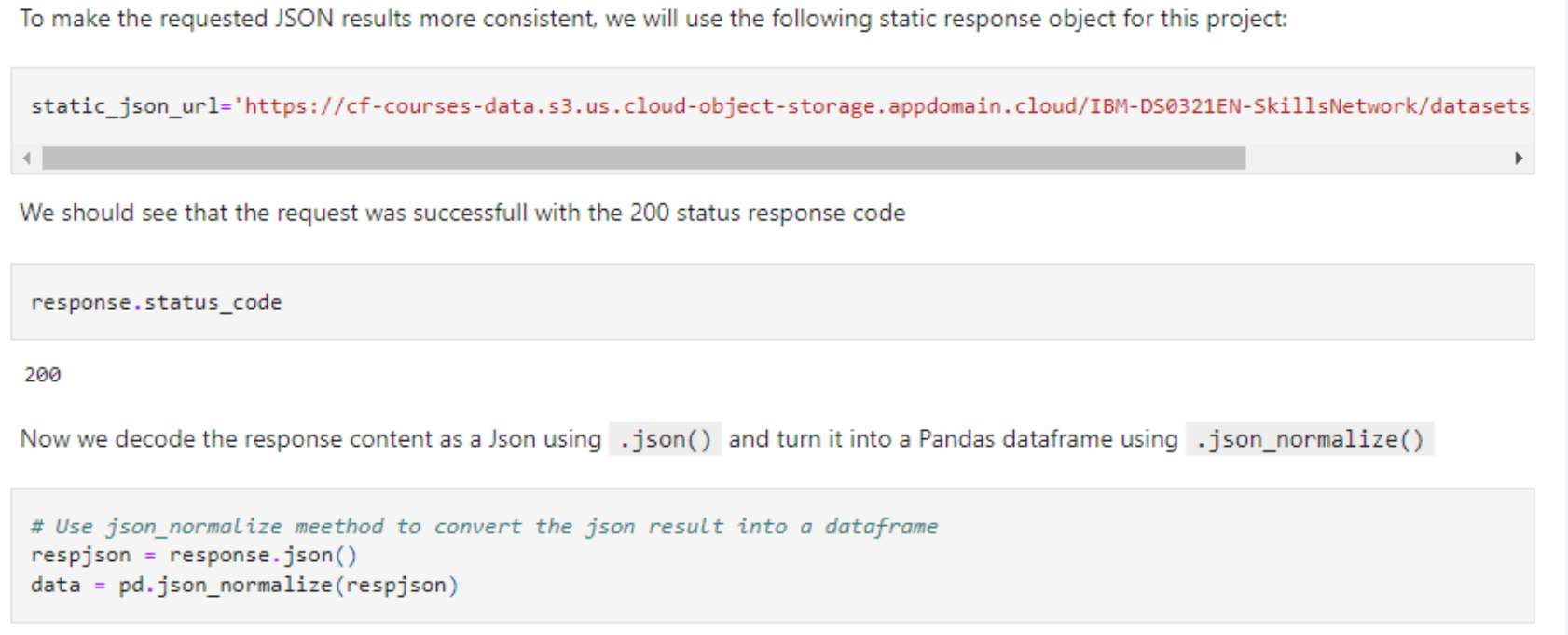
Data was first collected using API by making a get request to the SpaceX. This was done by firs defining a series helper functions tha would help in the use of the API to extract information using identification numbers in the launch data and then requesing rocket lauch data from the SpaceX API.

Finally to make the requested JSON result more consistent, the SpaceX lauch data was requested and parsed using the GET request and the decod the response content as a JSON result wich the converted into a Pandas data frame.



Data Collection – SpaceX API

- Data collected using SpaceX API by making a get request to the SpaceX API then requested and parsed the SpaceX launch data using the GET request and decoded the response content as a Json result which was then converted into a Pandas data frame.
- Add the GitHub URL https://github.com/ErikaT17/SpaceX-Falcon/blob/main/1.%20Space-X%20Data%20Collection%20API.ipynb



To make the requested JSON results more consistent, we will use the following static response object for this project:

```
static_json_url='https://cf-courses-data.s3.us.cloud-object-storage.appdomain.cloud/IBM-DS0321EN-SkillsNetwork/datasets
```

We should see that the request was successfull with the 200 status response code

```
response.status_code
```

```
200
```

Now we decode the response content as a Json using `.json()` and turn it into a Pandas dataframe using `.json_normalize()`

```
# Use json_normalize meethod to convert the json result into a dataframe
respjson = response.json()
data = pd.json_normalize(respjson)
```

Data Collection - Scraping

- We applied web scrapping to webscrap Falcon 9 launch records with BeautifulSoup
- We parsed the table and converted it into a pandas dataframe.

1. Apply HTTP Get method to request the Falcon 9 rocket launch page

In [4]:
```
static_url = "https://en.wikipedia.org/w/index.php?title=List_of_Falcon_9_and_Falcon_Heavy_launches&oldid=1027686922"
```

In [5]:
```
# use requests.get() method with the provided static_url
# assign the response to a object
html_data = requests.get(static_url)
html_data.status_code
```

Out[5]:
```
200
```

2. Create a BeautifulSoup object from the HTML response

In [6]:
```
# Use BeautifulSoup() to create a BeautifulSoup object from a response text content
soup = BeautifulSoup(html_data.text, 'html.parser')
```

Print the page title to verify if the `BeautifulSoup` object was created properly

In [7]:
```
# Use soup.title attribute
soup.title
```

Out[7]:
```
<title>List of Falcon 9 and Falcon Heavy launches - Wikipedia</title>
```

3. Extract all column names from the HTML table header

In [10]:
```
column_names = []

# Apply find_all() function with `th` element on first_launch_table
# Iterate each th element and apply the provided extract_column_from_header() to get a column name
# Append the Non-empty column name (`if name is not None and len(name) > 0`) into a list called column_names

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

4. Create a dataframe by parsing the launch HTML tables
5. Export data to csv

Data Wrangling

- After obtaining and creating a Pandas DF from the collected data, data was filtered using the BoosterVersion column to only keep the Falcon 9 launches, then dealt with the missing data values in the LandingPad and PayloadMass columns. For the PayloadMas, missing data values were replaced using mean value of column.
- Performed some Exploratory Data Analysis to find some patterns in the data determine what would be the label for training supervised models.
- GitHub URL https://github.com/ErikaT17/SpaceX-Falcon/blob/main/2.%20Space-X%20Data%20Wrangling%20Prediction.ipynb

Using the `Outcome`, create a list where the element is zero if the corresponding row in `Outcome` is in the set `bad_outcome`; otherwise, it's one. Then assign it to the variable `landing_class`:

```
# landing_class = 0 if bad_outcome
# landing_class = 1 otherwise
df['Class'] = df['Outcome'].apply(lambda x: 0 if x in bad_outcomes else 1)
df['Class'].value_counts()
```

```
1    60
0    30
Name: Class, dtype: int64
```

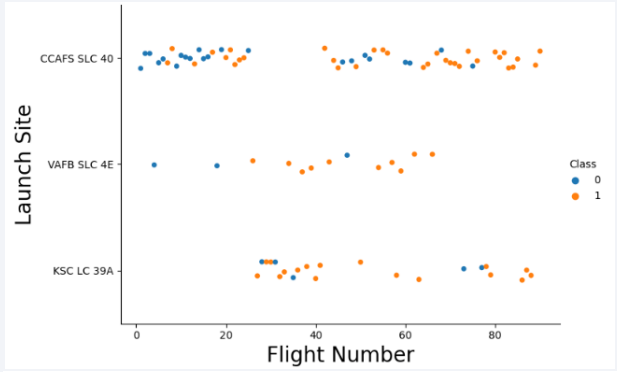
This variable will represent the classification variable that represents the outcome of each launch. If the value is zero, the first stage did not land successfully; one means the first stage landed Successfully

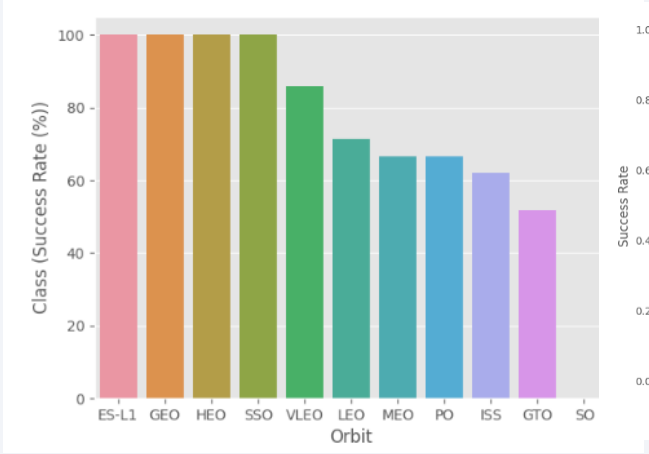
```
landing_class=df['Class']
df[['Class']].head(8)
```

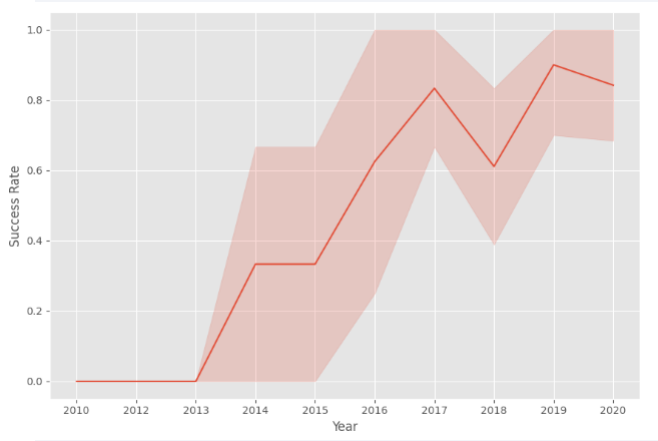
	Class
0	0
1	0
2	0
3	0
4	0
5	0
6	1
7	1

EDA with Data Visualization

- Performed data Analysis and Feature engineering using Pandas and Matplotlib.
  - Exploratory Data Analysis
  - Preparing Data Feature Engineering
- Used scatter plots to visualize the relationship between Flight Number and Launch Site, FlightNumber and Orbit type, Payload and Orbit type.
- Used bar chart to visualize the relationship between success rate of each orbit type.
- Line plot to visualize the launch success yearly trend.
- GitHub URL https://github.com/ErikaT17/SpaceX-Falcon/blob/main/4.%20Space-X%20Exploring%20and%20Preparing%20Data.ipynb







EDA with SQL

- The following SQL queries were performed for EDA

Display the names of the unique launch sites in the space mission

```
%sql SELECT DISTINCT LAUNCH_SITE as "Launch_Sites" FROM SPACEXTBL;
```

Display 5 records where launch sites begin with the string 'CCA'

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

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

```
%sql SELECT SUM(PAYLOAD_MASS__KG_) as "Total Payload Mass(Kgs)", Customer FROM 'SPACEXTBL' WHERE Customer = 'NASA (CRS)';
```

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

```
%sql SELECT AVG(PAYLOAD_MASS__KG_) as "Payload Mass Kgs", Customer, Booster_Version FROM 'SPACEXTBL' WHERE Booster_Version LIKE 'F9 v1.1%';
```

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

```
%sql SELECT MIN(DATE) FROM 'SPACEXTBL' WHERE "Landing _Outcome" = "Success (ground pad)";
```

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

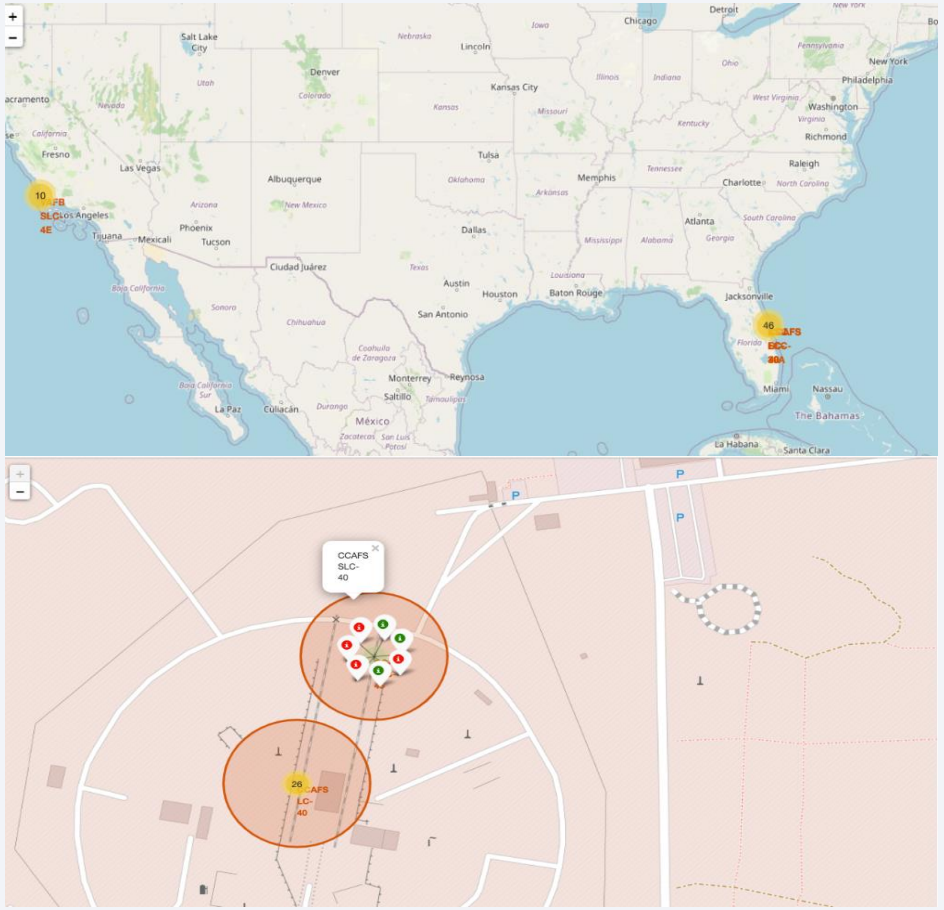
```
%sql SELECT DISTINCT BoosterVersion, Payload FROM SPACEXTBL WHERE "Landing _Outcome" = "Success (drone ship)" AND PAYLOAD_MASS__KG_ > 4000 AND PAYLOAD_MASS__KG_ < 6000;
```

EDA with SQL

- **GitHub URL** https://github.com/ErikaT17/SpaceX-Falcon/blob/main/3.%20Space-X%20Notebook%20for%20Peer%20Assigment.ipynb

Build an Interactive Map with Folium

- Created folium map to marked all the launch sites, and created map objets such as markers, circles, lines to mark the success or failure of launches for each launch site.
- Created a launch set outcomes(failure=0 or success=1).
- **GitHub URL** https://github.com/ErikaT17/SpaceX-Falcon/blob/main/5.%20Space-X%20Launch%20Sites%20Locations%20Analysis%20with%20Folium.ipynb



Build a Dashboard with Plotly Dash

- Built an interactive dashboard application with Plotly dash by:

➢ Add a Launch Site Drop-down Input Component

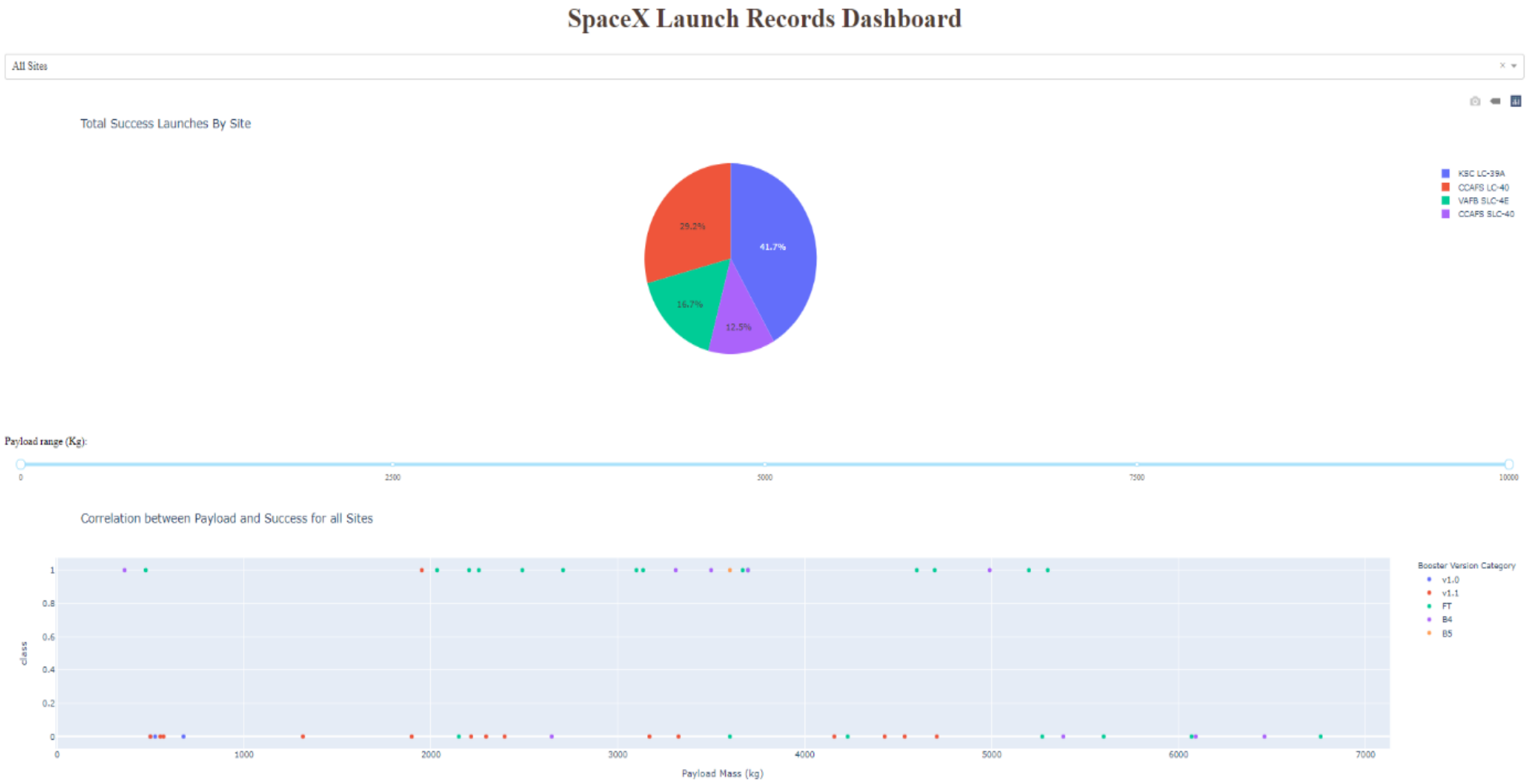
➢ Add a callback function to render success-pie- chart based on selected site dropdown

➢ Add a Range Slider to Select Payload

➢ Add a callback function to render the success-payload-scatter-chart scatter plot

- **GitHub URL** https://github.com/ErikaT17/SpaceX-Falcon/blob/main/6.%20Space-X%20Build%20a%20Dashboard%20with%20Ploty%20Dash.py

Build a Dashboard with Plotly Dash



Predictive Analysis (Classification)

- To perform exploratory data analysis and determine training labels, the following steps must be followed
- create a column for the class
- Standardize the data
- Split into training data and test data
- Find best Hyperparameter for SVM, Classification Trees and Logistic Regression
- Find the method performs best using test data

GitHub URL https://github.com/ErikaT17/SpaceX-Falcon/blob/main/7.%20Space-X%20Machine%20Learning%20Prediction.ipynb

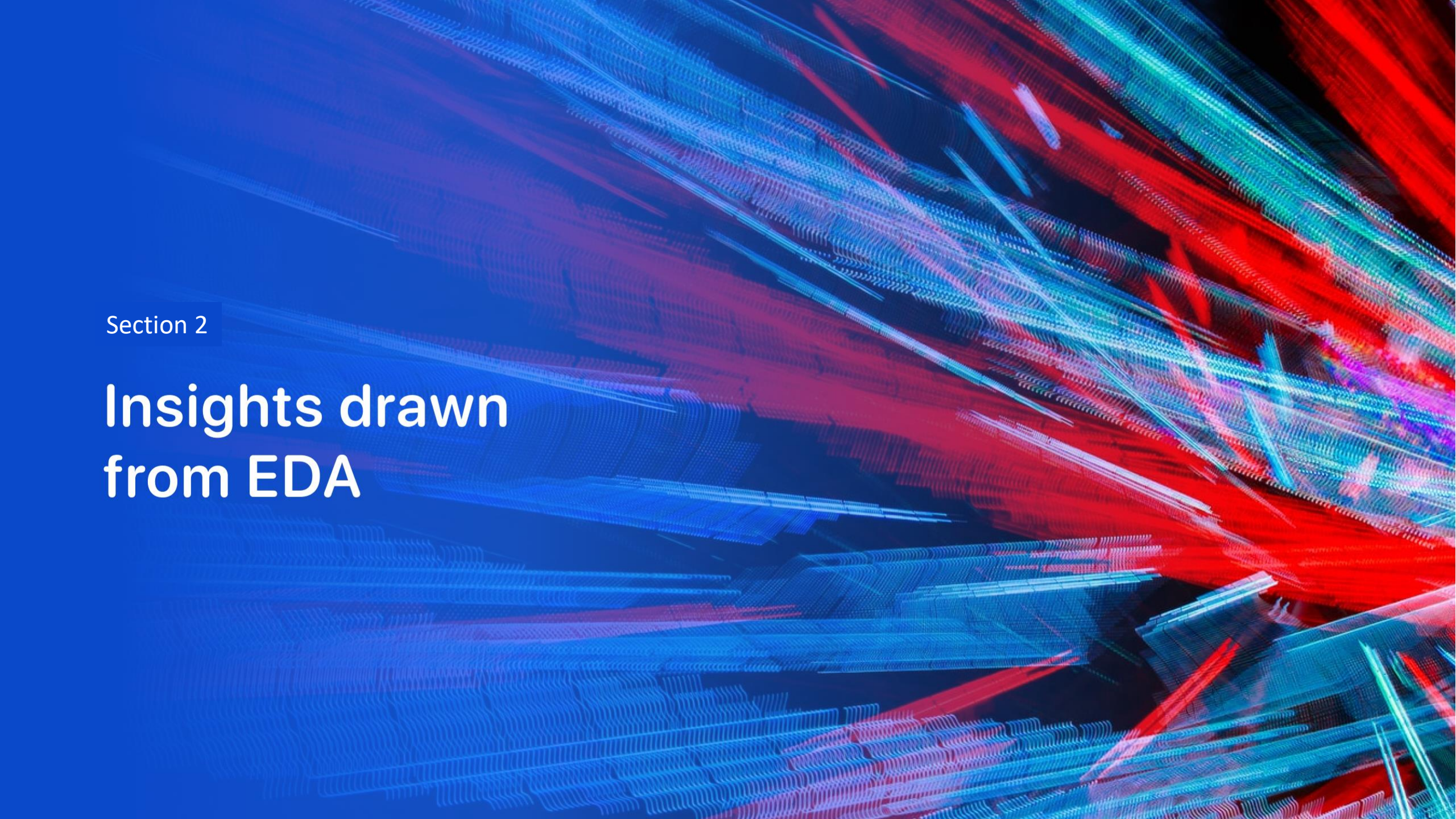
Results

- The table below shows the test data accuracy score for each of the methods comparing them to show wich performed best using the test data between SV, Clasification Trees, K nearest neighbors and Logistic Regresion

Out[68]:

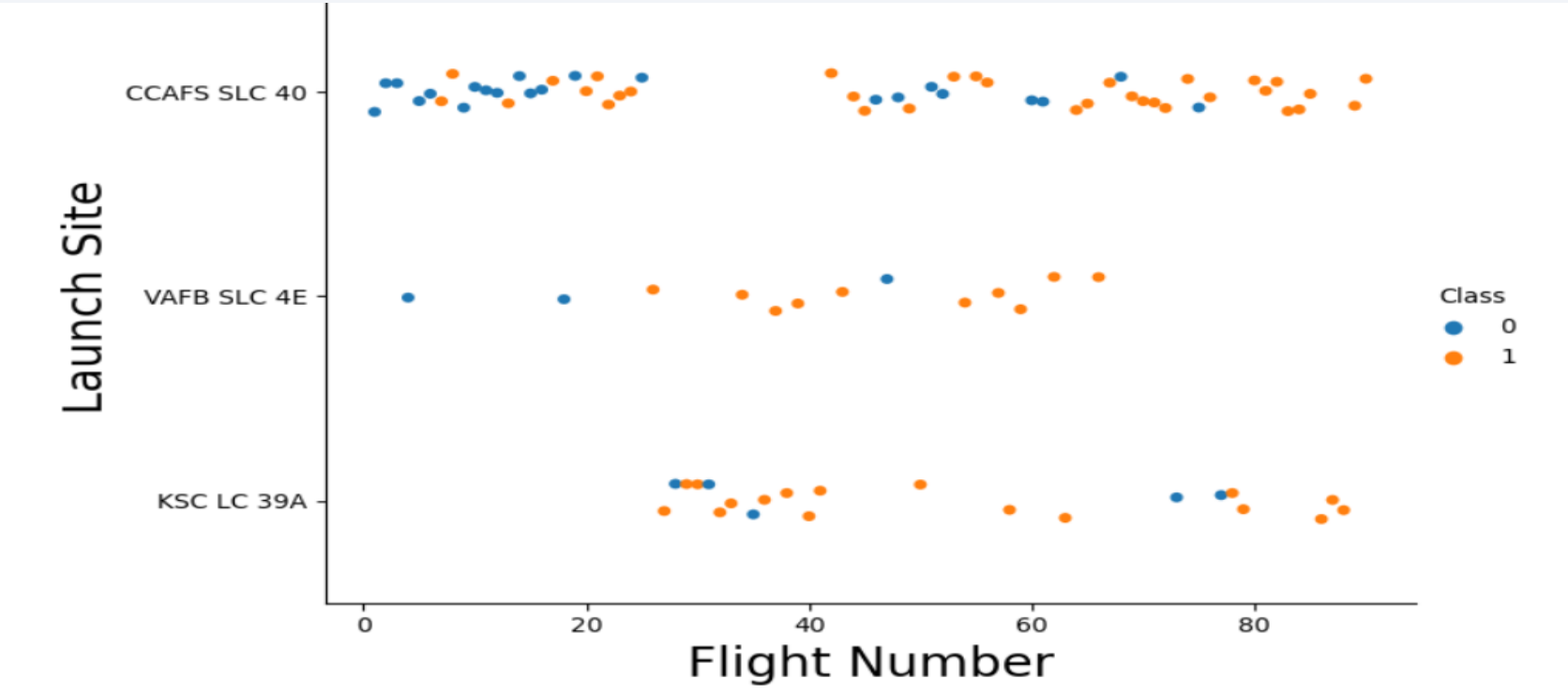
	0
Method	Test Data Accuracy
Logistic_Reg	0.833333
SVM	0.833333
Decision Tree	0.833333
KNN	0.833333

*All the methods perform equally on the test data: i.e. They all have the same accuracy of *0.833333* on the test Data*


Section 2
Insights drawn from EDA

Flight Number vs. Launch Site

- From the plot, we found that the larger the flight amount at a launch site, the greater the success rate at a launch site.

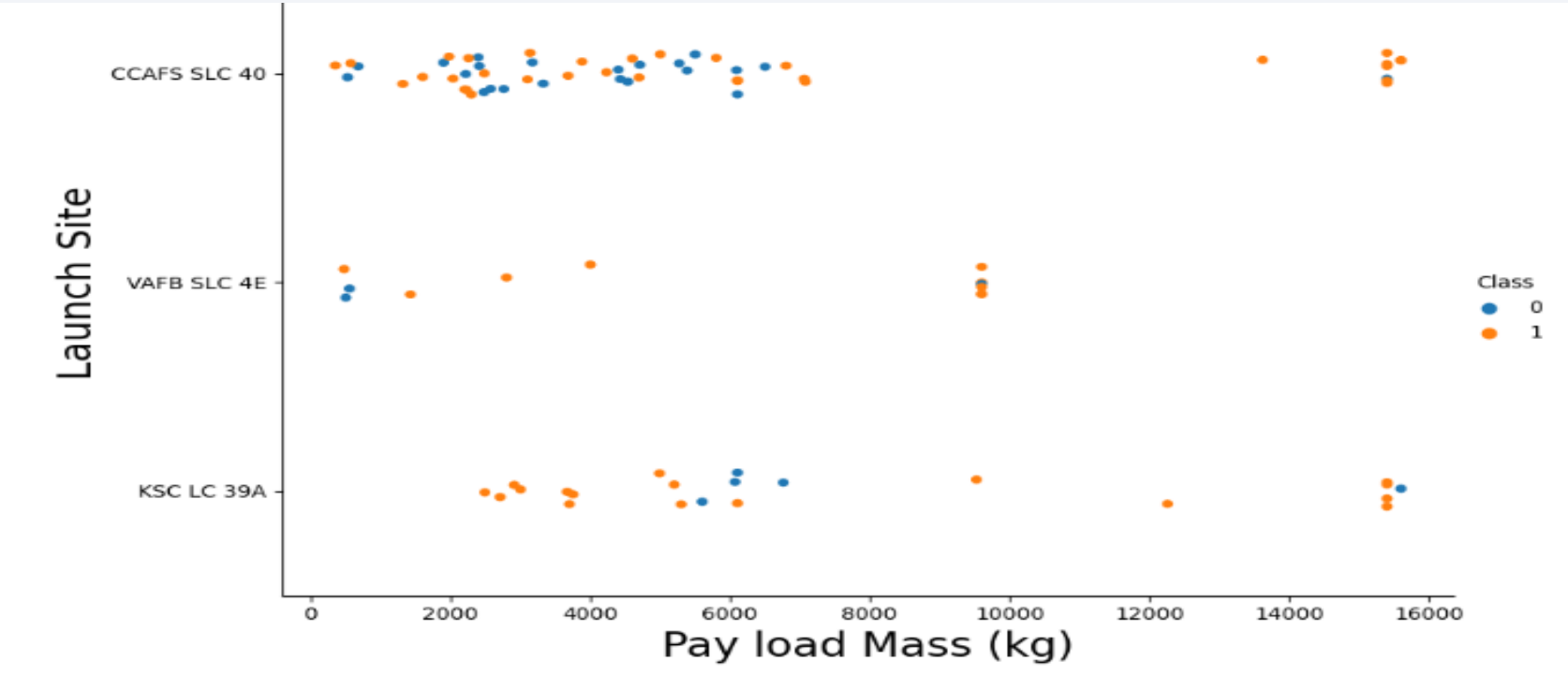


Now try to explain the patterns you found in the Flight Number vs. Launch Site scatter point plots.

We can deduce that, as the flight number increases in each of the 3 launcg sites, so does the success rate. For instance, the success rate for the VAFB SLC 4E launch site is 100% after the Flight number 50. Both KSC LC 39A and CCAFS SLC 40 have a 100% success rates after 80th flight.

Payload vs. Launch Site

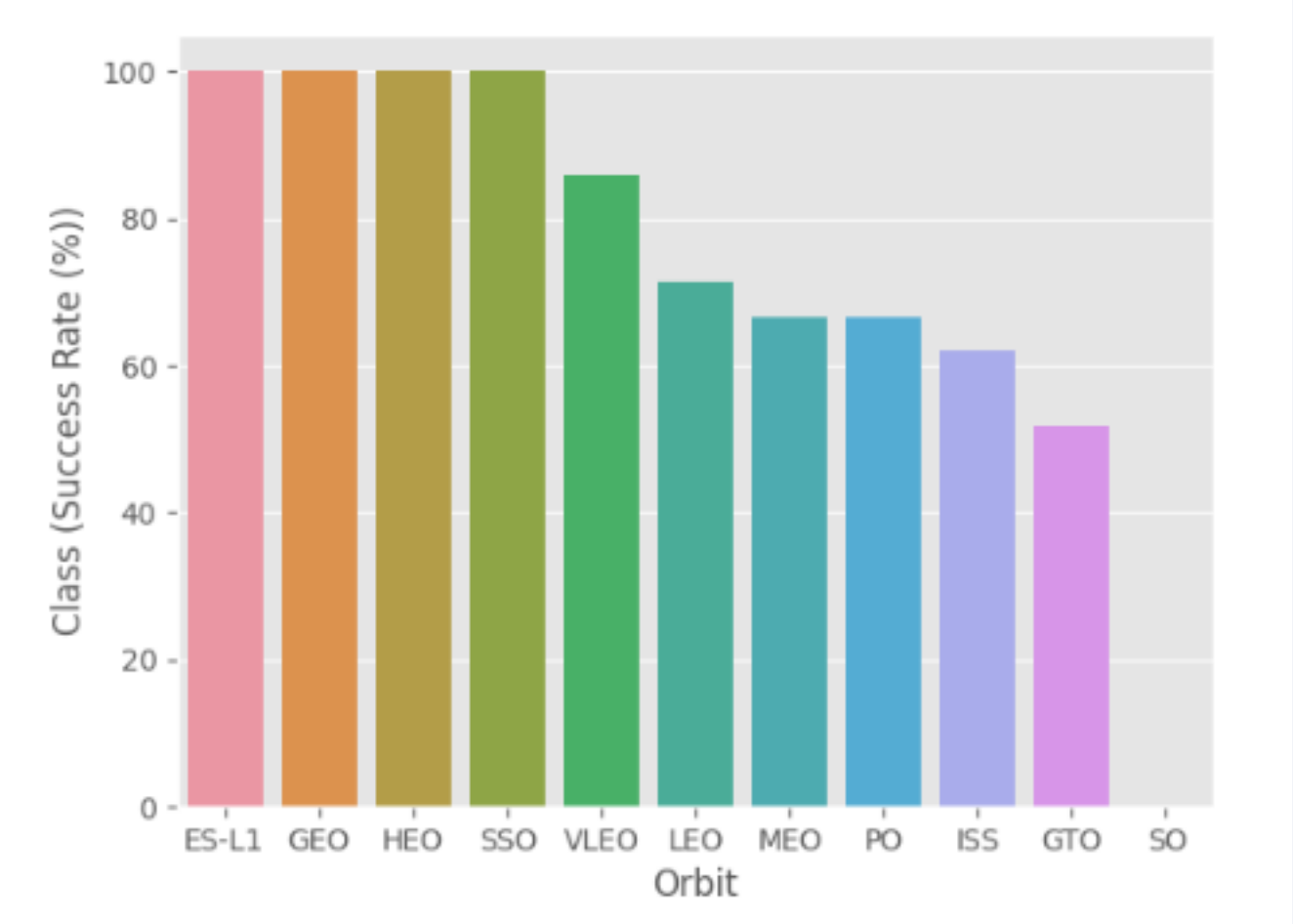
- The great the payload mass for lounch site CCAFS SLC 40 the hinher the success rate for the rocket.



Now if you observe Payload Vs. Launch Site scatter point chart you will find for the VAFB-SLC launchsite there are no rockets launched for heavypayload mass(greater than 10000).

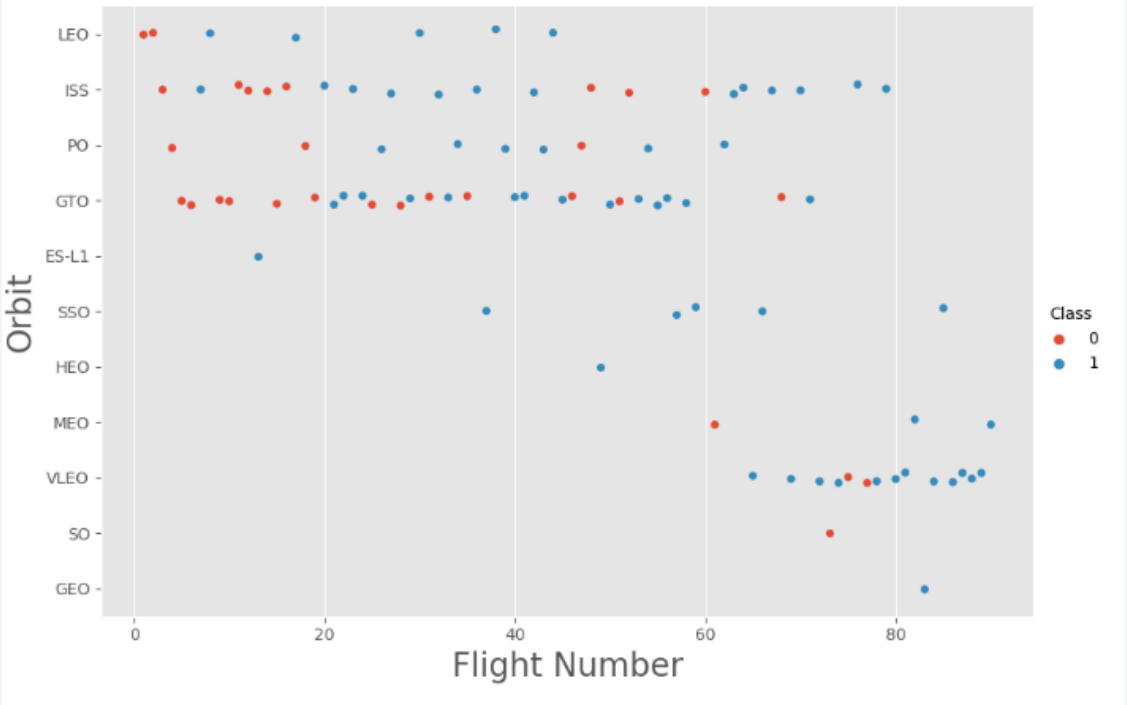
Success Rate vs. Orbit Type

- From the plot, we can see that ES-L1, GEO, HEO, SSO, VLEO had the most success rate.
- *Analyze the ploted bar chart try to find which orbits have high sucess rate.*
- *Orbits ES-L1, GEO, HEO & SSO have the highest success rates at 100%, with SO orbit having the lowest success rate at ~50%. Orbit SO has 0% success rate.*



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.

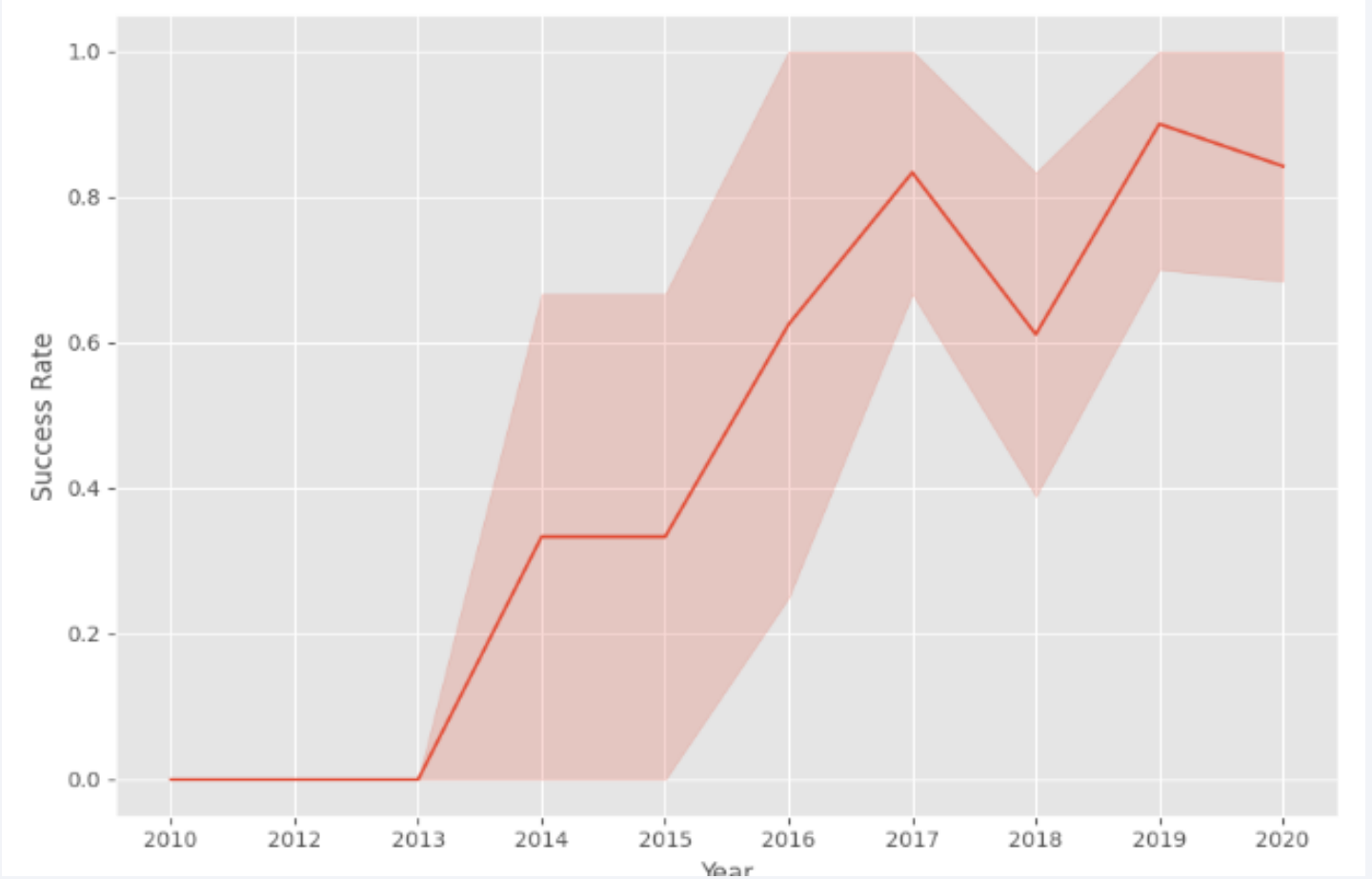


Payload vs. Orbit Type

- With heavy payloads the successful landing or positive landing rate are more for Polar,LEO and ISS.
- However for GTO we cannot distinguish this well as both positive landing rate and negative landing(unsuccessful mission) are both there here.

Launch Success Yearly Trend

- From the plot, we can observe that success rate since 2013 kept on increasing till 2020.



All Launch Site Names

- We used the key word **DISTINCT** to show only unique launch sites from the SpaceX data.

Task 1

Display the names of the unique launch sites in the space mission

In [31]:
```
%sql SELECT DISTINCT LAUNCH_SITE as "Launch_Sites" FROM SPACEXTBL;
```

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

Out[31]:

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

Launch Site Names Begin with 'CCA'

- Find 5 records where launch sites begin with ‘CCA’
- Used ‘LIKE’ command with ‘%’ wildcard in ‘WHERE’ clause to select and dispay a table of all records where launch sites begin with the string 'CCA'

Display 5 records where launch sites begin with the string 'CCA'

In [72]:
```
%sql SELECT * FROM 'SPACEXTBL' WHERE Launch_Site LIKE 'CCA%' LIMIT 5;
```

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

Out[72]:

Date	Time (UTC)	Booster_Version	Launch_Site	Payload	PAYLOAD_MASS__KG_	Orbit	Customer	Mission_Outcome	Landing _Outcome
04-06-2010	18:45:00	F9 v1.0 B0003	CCAFS LC-40	Dragon Spacecraft Qualification Unit	0	LEO	SpaceX	Success	Failure (parachute)
08-12-2010	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)
22-05-2012	07:44:00	F9 v1.0 B0005	CCAFS LC-40	Dragon demo flight C2	525	LEO (ISS)	NASA (COTS)	Success	No attempt
08-10-2012	00:35:00	F9 v1.0 B0006	CCAFS LC-40	SpaceX CRS-1	500	LEO (ISS)	NASA (CRS)	Success	No attempt
01-03-2013	15:10:00	F9 v1.0 B0007	CCAFS LC-40	SpaceX CRS-2	677	LEO (ISS)	NASA (CRS)	Success	No attempt

Total Payload Mass

- Calculate the total payload carried by boosters from NASA
- Used the ‘SUM()’ function to return and dispaly the total sum of ‘PAYLOAD_MASS_KG’ column for Customer ‘NASA(CRS)’

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

In [17]:
```
%sql SELECT SUM(PAYLOAD_MASS__KG_) as "Total Payload Mass(Kgs)", Customer FROM 'SPACEXTBL' WHERE Customer = 'NASA (CRS)';
```

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

Out[17]:

Total Payload Mass(Kgs)	Customer
45596	NASA (CRS)

Average Payload Mass by F9 v1.1

- Calculate the average payload mass carried by booster version F9 v1.1
- Used the ‘AVG()’ function to return and dispaly the average payload mass carried by booster version F9 v1.1

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

In [19]:
```
%sql SELECT AVG(PAYLOAD_MASS__KG_) as "Payload Mass Kgs", Customer, Booster_Version FROM 'SPACEXTBL' WHERE Booster_Version
```

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

Out[19]:

Payload Mass Kgs	Customer	Booster_Version
2534.6666666666665	MDA	F9 v1.1 B1003

First Successful Ground Landing Date

- Find the dates of the first successful landing outcome on ground pad
- Used the ‘MIN()’ function to return and dispaly the first (oldest) date when first successful landing outcome on ground pad ‘ Success (ground pad)’ happened.

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

Hint:Use min function

In [21]:
```
%sql SELECT MIN(DATE) FROM 'SPACEXTBL' WHERE "Landing _Outcome" = "Success (ground pad)";
```

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

Out[21]:

MIN(DATE)
01-05-2017

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
- Used 'Select Distinct' statement to return and list the 'unique' names of boosters with operators >4000 and <6000 to only list booster with payloads between 4000-6000 with landing outcome of 'Success (drone ship)'.

In [26]:
```
# %sql SELECT * FROM 'SPACEXTBL'
```

In [27]:
```
%sql SELECT DISTINCT Booster_Version, Payload FROM SPACEXTBL WHERE "Landing _Outcome" = "Success (drone ship)" AND PAYLOAD_
```

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

Out[27]:

Booster_Version	Payload
F9 FT B1022	JCSAT-14
F9 FT B1026	JCSAT-16
F9 FT B1021.2	SES-10
F9 FT B1031.2	SES-11 / EchoStar 105

Total Number of Successful and Failure Mission Outcomes

- Calculate the total number of successful and failure mission outcomes
- Used the ‘COUNT()’ together with the ‘GROUP BY’ statement to return total number of missions outcomes

List the total number of successful and failure mission outcomes

In [28]:
```
%sql SELECT "Mission_Outcome", COUNT("Mission_Outcome") as Total FROM SPACEXTBL GROUP BY "Mission_Outcome";
```

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

Out[28]:

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

Boosters Carried Maximum Payload

- List the names of the booster which have carried the maximum payload mass
- Using a Subquerry to return and pass the Max payload and used it list all the boosters that have carried the Max payload of 15600kgs

List the names of the booster_versions which have carried the maximum payload mass. Use a subquery

In [30]:
```
%sql SELECT "Booster_Version",Payload, "PAYLOAD_MASS__KG_" FROM SPACEXTBL WHERE "PAYLOAD_MASS__KG_" = (SELECT MAX("PAYLOAD_
```

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

Out[30]:

Booster_Version	Payload	PAYLOAD_MASS__KG_
F9 B5 B1048.4	Starlink 1 v1.0, SpaceX CRS-19	15600
F9 B5 B1049.4	Starlink 2 v1.0, Crew Dragon in-flight abort test	15600
F9 B5 B1051.3	Starlink 3 v1.0, Starlink 4 v1.0	15600
F9 B5 B1056.4	Starlink 4 v1.0, SpaceX CRS-20	15600
F9 B5 B1048.5	Starlink 5 v1.0, Starlink 6 v1.0	15600
F9 B5 B1051.4	Starlink 6 v1.0, Crew Dragon Demo-2	15600
F9 B5 B1049.5	Starlink 7 v1.0, Starlink 8 v1.0	15600
F9 B5 B1060.2	Starlink 11 v1.0, Starlink 12 v1.0	15600
F9 B5 B1058.3	Starlink 12 v1.0, Starlink 13 v1.0	15600
F9 B5 B1051.6	Starlink 13 v1.0, Starlink 14 v1.0	15600
F9 B5 B1060.3	Starlink 14 v1.0, GPS III-04	15600
F9 B5 B1049.7	Starlink 15 v1.0, SpaceX CRS-21	15600

2015 Launch Records

- List the failed landing_outcomes in drone ship, their booster versions, and launch site names for in year 2015
- Used the ‘subsrt()’ in the select statement to get the month and year from the date column where substr(Date,7,4)='2015' for year and Landing_outcome was ‘Failure (drone ship’) and return the records nmatching the filter.

List the records which will display the month names, failure landing_outcomes in drone ship ,booster versions, launch_site for the months in year 2015.

Note: SQLLite does not support monthnames. So you need to use substr(Date, 4, 2) as month to get the months and substr(Date,7,4)='2015' for year.

In [68]:
```
%sql SELECT substr(Date,7,4), substr(Date, 4, 2),"Booster_Version", "Launch_Site", Payload, "PAYLOAD_MASS__KG_", "Mission_O
```

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

Out[68]:

substr(Date,7,4)	substr(Date, 4, 2)	Booster_Version	Launch_Site	Payload	PAYLOAD_MASS__KG_	Mission_Outcome	Landing _Outcome
2015	01	F9 v1.1 B1012	CCAFS LC-40	SpaceX CRS-5	2395	Success	Failure (drone ship)
2015	04	F9 v1.1 B1015	CCAFS LC-40	SpaceX CRS-6	1898	Success	Failure (drone ship)

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

Rank the count of successful landing_outcomes between the date 04-06-2010 and 20-03-2017 in descending order.

```
In [74]: %sql SELECT * FROM SPACEXTBL WHERE "Landing _Outcome" LIKE 'Success%' AND (Date BETWEEN '04-06-2010' AND '20-03-2017') ORDE
```

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

Out[74]:

Date	Time (UTC)	Booster_Version	Launch_Site	Payload	PAYLOAD_MASS__KG_	Orbit	Customer	Mission_Outcome	Landing _Outcome
19-02-2017	14:39:00	F9 FT B1031.1	KSC LC-39A	SpaceX CRS-10	2490	LEO (ISS)	NASA (CRS)	Success	Success (ground pad)
18-10-2020	12:25:57	F9 B5 B1051.6	KSC LC-39A	Starlink 13 v1.0, Starlink 14 v1.0	15600	LEO	SpaceX	Success	Success
18-08-2020	14:31:00	F9 B5 B1049.6	CCAFS SLC-40	Starlink 10 v1.0, SkySat-19, -20, -21, SAOCOM 18	15440	LEO	SpaceX, Planet Labs, PlanetIQ	Success	Success
18-07-2016	04:45:00	F9 FT B1025.1	CCAFS LC-40	SpaceX CRS-9	2257	LEO (ISS)	NASA (CRS)	Success	Success (ground pad)
18-04-2018	22:51:00	F9 B4 B1045.1	CCAFS SLC-40	Transiting Exoplanet Survey Satellite (TESS)	362	HEO	NASA (LSP)	Success	Success (drone ship)
17-12-2019	00:10:00	F9 B5 B1056.3	CCAFS SLC-40	JCSat-18 / Kacific 1, Starlink 2 v1.0	6956	GTO	Sky Perfect JSAT, Kacific 1	Success	Success


Section 3
Launch Sites
Proximities Analysis

Markers of all launch sites on global

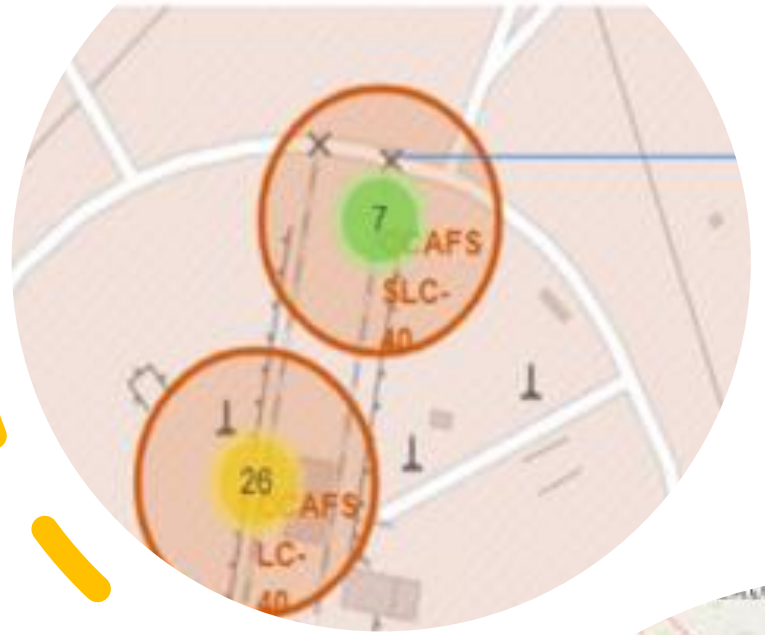
- All launch sites are in proximity to the Equator, (located southwards of the US map). Also all the launch sites are in very close proximity to the coast.

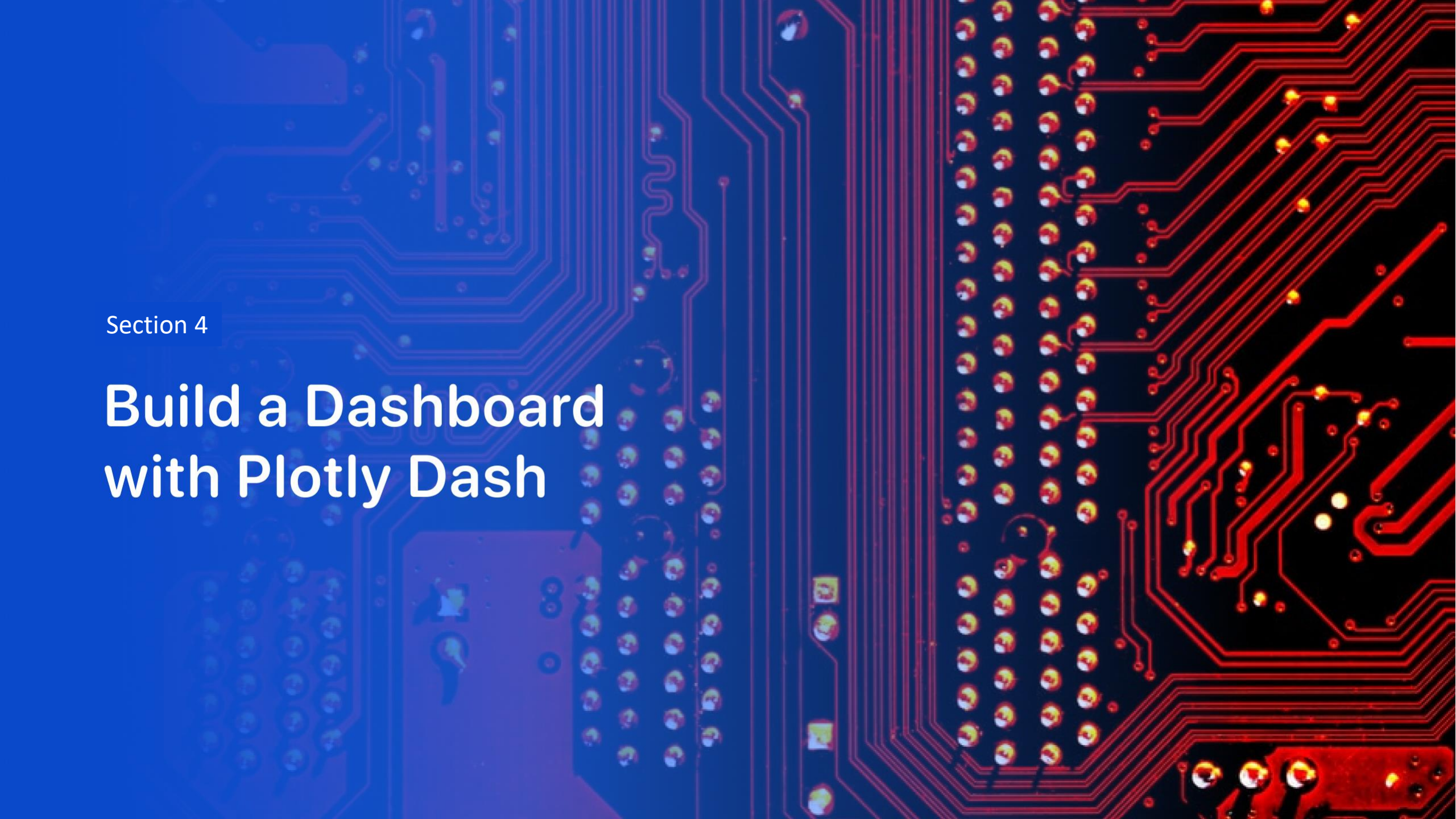
Markers showing launch sites with color labels

In the Eastern coast (Florida) Launch site KSC LC-39A has relatively high success rates compared to CCAFS SLC-40 & CCAFS LC-40.

Launch sites distance on the map

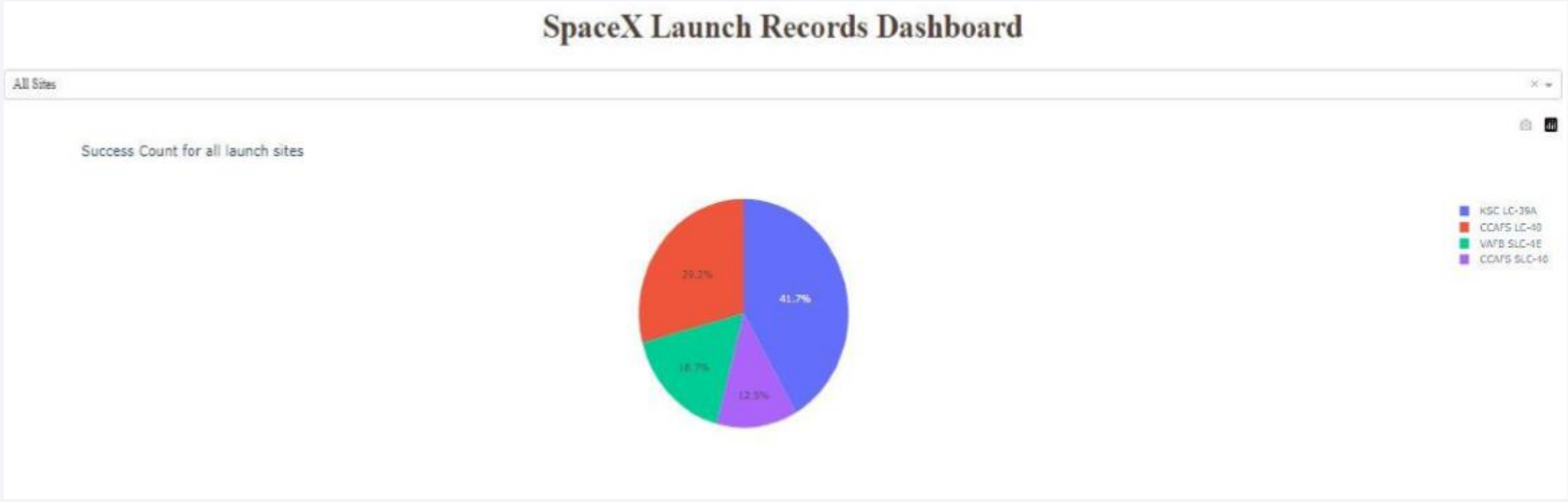
- In the West Coast (Californai) Launch site VAFB SLC-4E has relatively lower success rates 4/10 compared to KSC LC39A launch site in the Eastern Coast of Florida
- Launch site CCAFS SLC-40 proximity to coastline is 0.86km




Section 4
Build a Dashboard with Plotly Dash

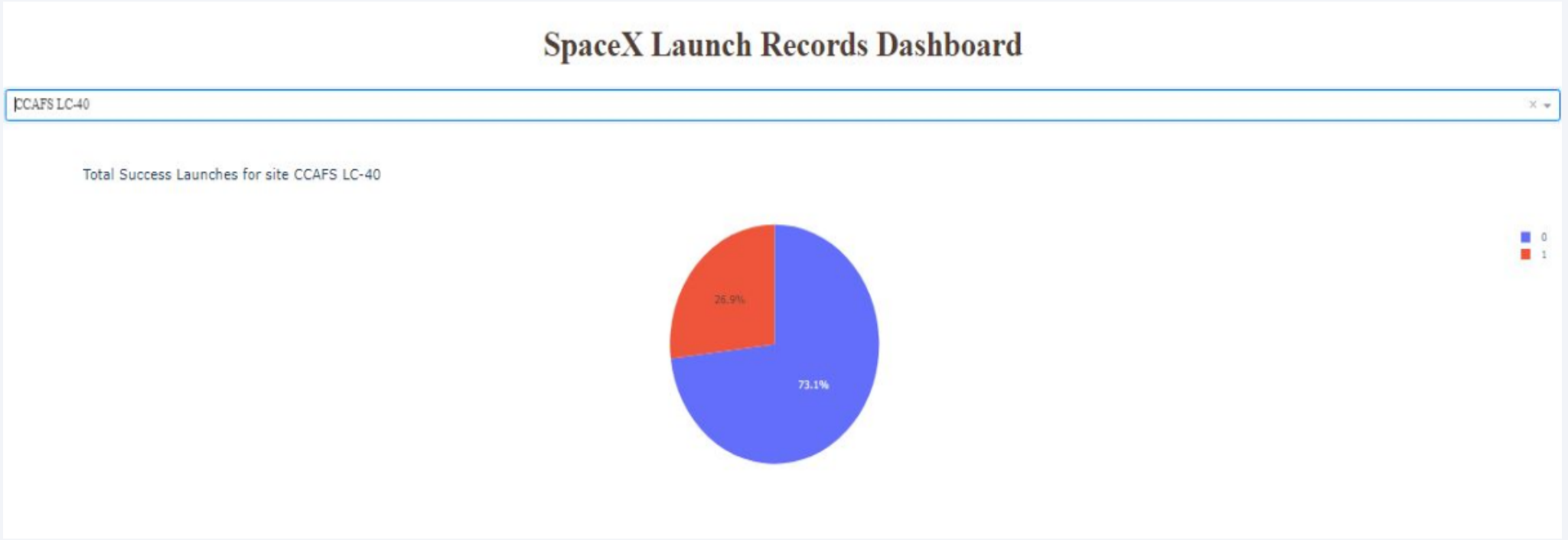
Pie chart showing the success percentage achieved by each launch site

- Launch site KSC LC-39A has the highest launch success rate at 42% followed by CCAFS LC-40 at 29%, VAFB SLC-4E at 17% and lastly launch site CCAFS SLC-40 with a success rate of 13%



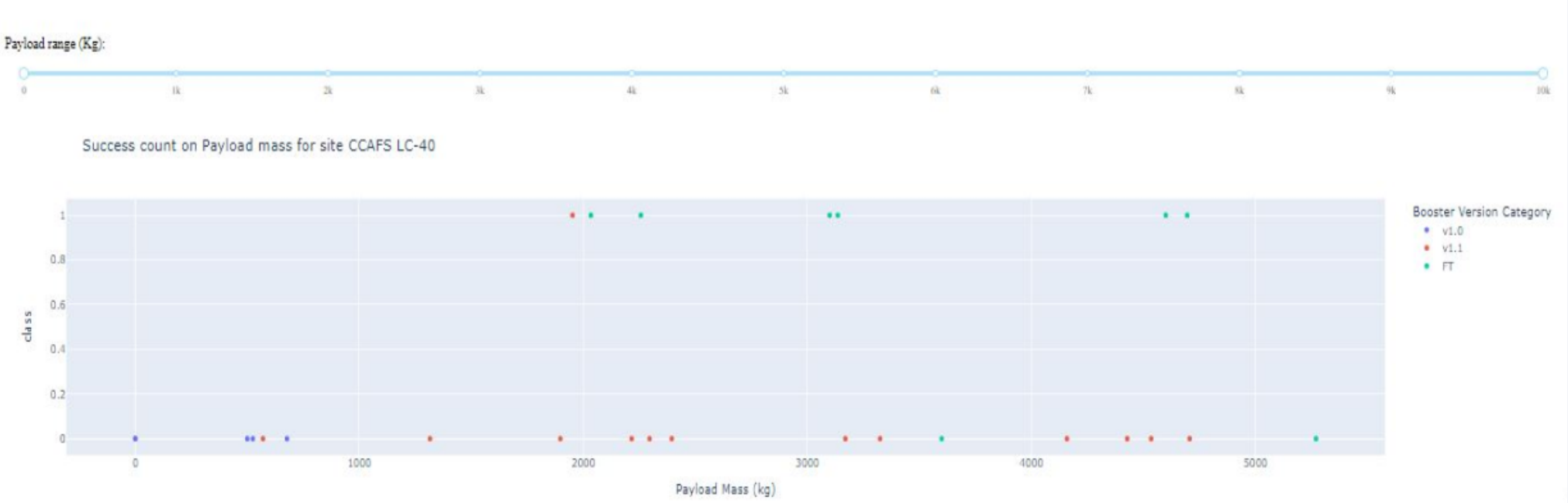
Pie chart showing the Launch site with the highest launch success ratio

- Launch site CCAFS LC-40 had the 2nd highest success ratio of 73% success against 27% failed launches



Scatter plot of Payload vs Launch Outcome for all sites, with different payload selected in the range slider

- For Launch site CCAFS LC-40 the booster version FT has the largest success rate from a payload mass of >2000kg



Section 5

Predictive Analysis (Classification)

Classification Accuracy

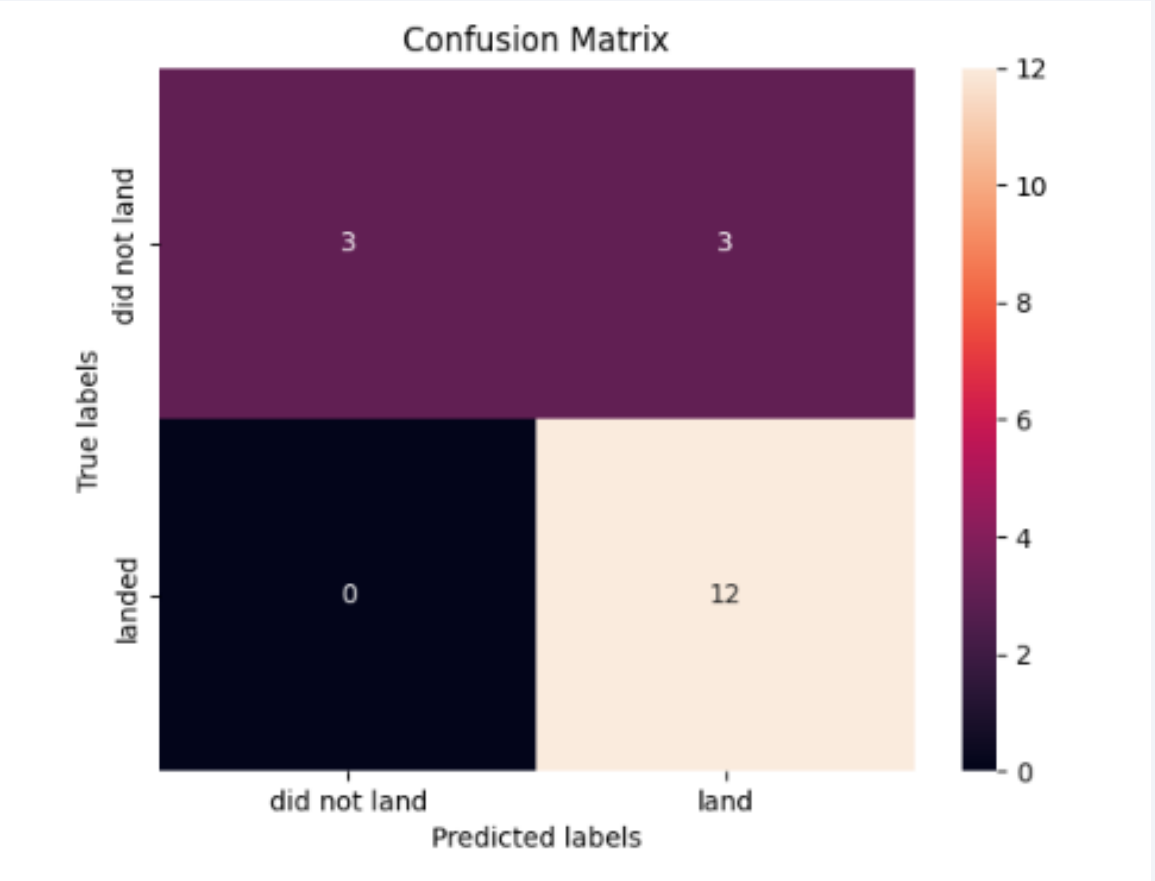
- All the methods perform equally on the test data: i.e. They all have the same accuracy of *0.833333* on the test Data

Out[68]:

	0
Method	Test Data Accuracy
Logistic_Reg	0.833333
SVM	0.833333
Decision Tree	0.833333
KNN	0.833333

Confusion Matrix

- All the 4 classification model had the same confusion matrixes and were able equally distinguish between the different classes. The major problem is false positives for all the models (unsuccessful landing marked as successful landing by the classifier).



Conclusions

- Different launch sites have different success rates. CCAFS LC-40, has a success rate of 60 %, while KSC LC-39A and VAFB SLC 4E has a success rate of 77%.
- The Decision tree classifier is the best machine learning algorithm for this task
- We can deduce that, as the flight number increases in each of the 3 launcg sites, so does the success rate. For instance, the success rate for the VAFB SLC 4E launch site is 100% after the Flight number 50. Both KSC LC 39A and CCAFS SLC 40 have a 100% success rates after 80th flight
- Launch success rate started to increase in 2013 till 2020.
- If you observe Payload Vs. Launch Site scatter point chart you will find for the VAFB-SLC launchsite there are no rockets launched for heavypayload mass(greater than 10000).
- Orbits ES-L1, GEO, HEO & SSO have the highest success rates at 100%, with SO orbit having the lowest success rate at ~50%. Orbit SO has 0% success rate.
- 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.

Thank you!