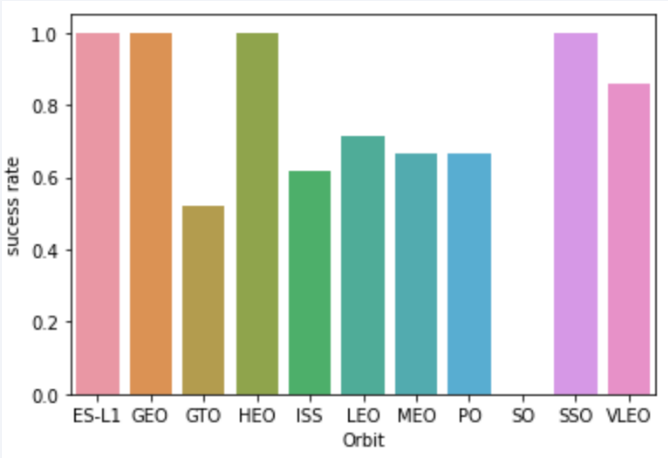
IBM Data Science Capstone Project – Space Y

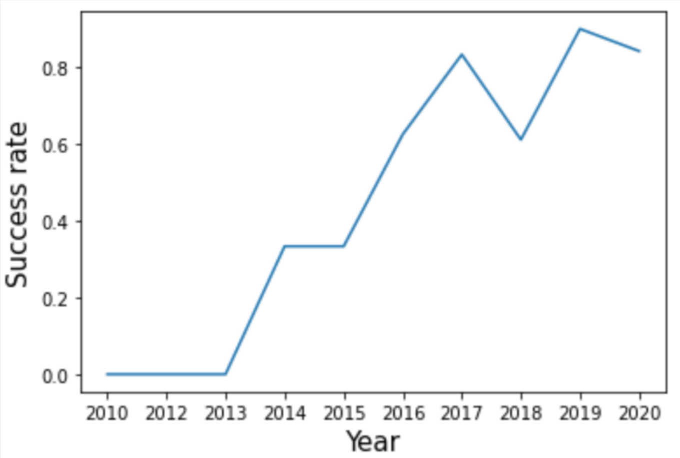
Outline

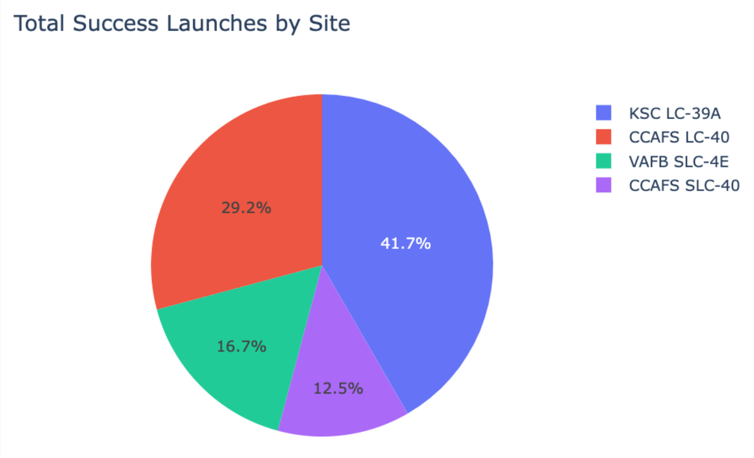
- Executive Summary
- Introduction
- Methodology
- Results
- Conclusion
- Appendix

Executive Summary

- We use data collection API to get SpaceX Data Sets
- We use exploratory data analysis to analyze data and visualize data
- We use Grid Search method to find the best Machine Learning Model to predict the classification of next landing







Introduction

Project background and context

We predicted that 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.

- **Problem statement that needed solving.**

1. What influences if the rocket will land successfully?
2. The effect each relationship with certain rocket variables will impact in determining the success rate of a successful landing.
3. What conditions does SpaceX have to achieve to get the best results and ensure the best rocket success landing rate.

Part 1

Methodology

Methodology

Executive Summary

- Data collection methodology:
  - SpaceX REST API
  - Web Scraping (Wikipedia)
- Perform data wrangling
  - Generate landing Class from Outcome column
- Perform exploratory data analysis (EDA) using visualization and SQL
- Perform interactive visual analytics using Folium and Plotly Dash
- Perform predictive analysis using classification models
  - Using GridSearchCV to find best fit model

Data Collection

REST API

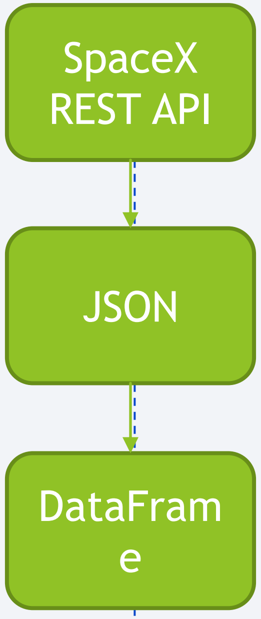
- SpaceX REST API
- JSON
- DataFrame

Web Scraping

- Wikipedia Page
- HTML
- DataFrame

Data Collection – SpaceX API

- SpaceX API repository
  https://github.com/r-spacex/SpaceX-API
- Main Endpoint
  https://api.spacexdata.com/v4/launches/past
- My Notebook
  https://github.com/gordonwong88/Story2/blob/main/1-jupyter-labs-spacex-data-collection-api.ipynb




```python
import requests
import pandas as pd

spacex_url = "https://api.spacexdata.com/v4/launches/past"
response = requests.get(spacex_url)
data = pd.json_normalize(response.json())
```

	static_fire_date_utc	static_fire_date_unix	net	window	rocket	success	failures	details	crew	ships	capsules	
0	2006-03-17T00:00:00.000Z	1.142554e+09	False	0.0	5e9d0d95eda69955f709d1eb	False	[{'time': 33, 'altitude': None, 'reason': 'merlin engine failure'}]	Engine failure at 33 seconds and loss of vehicle	[]	[]	[]	[5eb0e4b5b6c3bb000
1	None	NaN	False	0.0	5e9d0d95eda69955f709d1eb	False	[{'time': 301, 'altitude': 289, 'reason': 'harmonic oscillation leading to premature engine shutdown'}]	Successful first stage burn and transition to second stage, maximum altitude 289 km, Premature engine shutdown at T+7 min 30 s, Failed to reach orbit, Failed to recover first stage	[]	[]	[]	[5eb0e4b6b6c3bb000
2	None	NaN	False	0.0	5e9d0d95eda69955f709d1eb	False	[{'time': 140, 'altitude': 35, 'reason': 'residual stage-1 thrust led to collision between	Residual stage 1 thrust led to collision between stage 1 and stage 2	[]	[]	[]	[5eb0e4b6b6c3bb000 5eb0e4b6b6c3bb000

Data Collection - Scraping

- Wikipedia Falcon Page
  https://en.wikipedia.org/wiki/List_of_Falcon_9_and_Falcon_Heavy_launches

- My Notebook

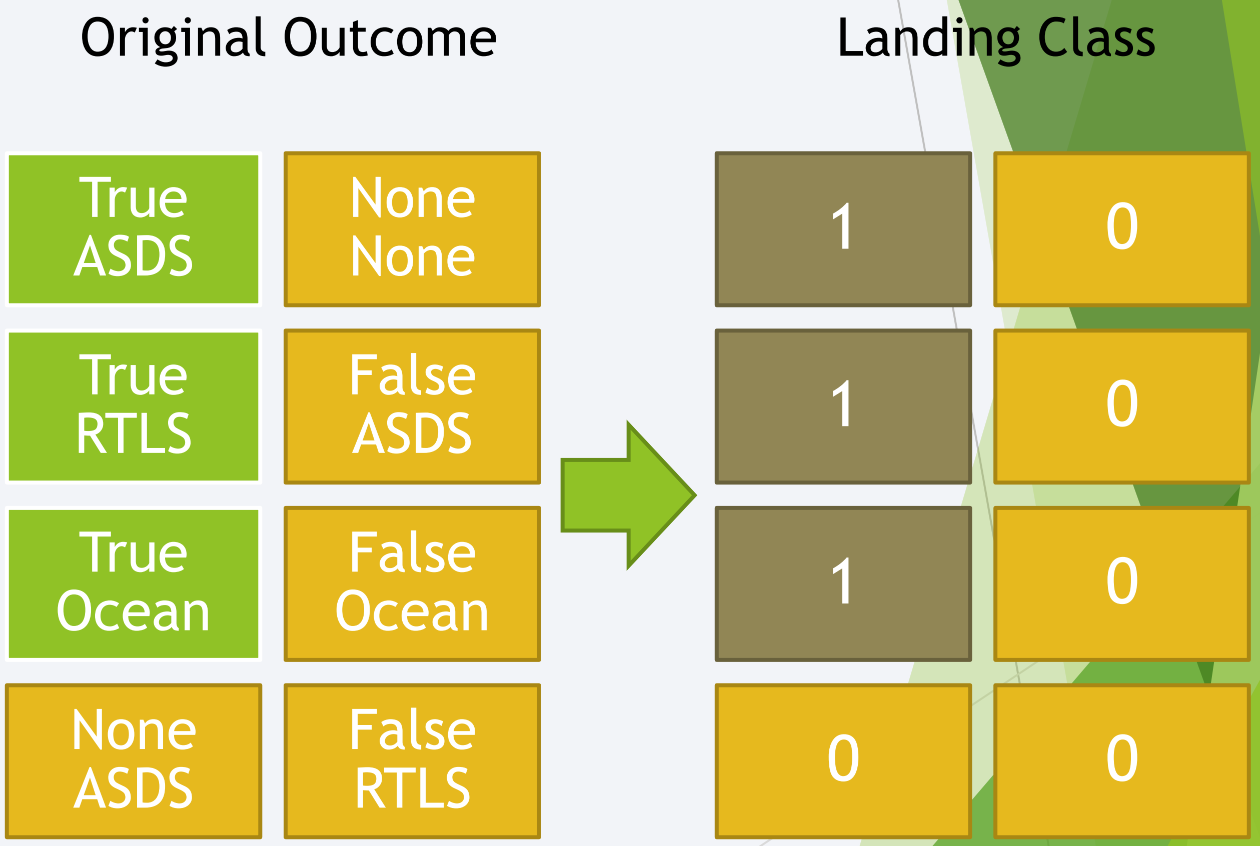
- https://github.com/gordonwong88/Story2/blob/main/2-jupyter-labs-webscraping.ipynb


```python
import requests
from bs4 import BeautifulSoup
url =
'https://en.wikipedia.org/wiki/List_of_Falcon_9_and_Falcon_Heavy_launches'
response = requests.get(url)
html_data = response.text
soup = BeautifulSoup(html_data)
```

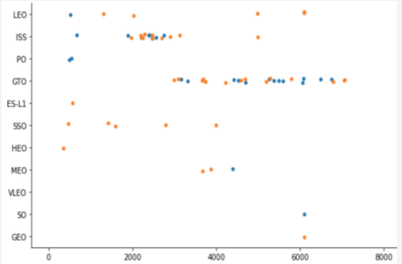
```html
<tr>
<th scope="col">Flight No.
</th>
<th scope="col">Date and<br/>time (<a href="/wiki/Coordinated_Universal_Time" title="Coordin
Time">UTC</a>)
</th>
<th scope="col"><a href="/wiki/List_of_Falcon_9_first-stage_boosters" title="List of Falcon
boosters">Version,<br/>Booster</a> <sup class="reference" id="cite_ref-booster_11-0"><a href
[b]</a></sup>
</th>
<th scope="col">Launch site
</th>
<th scope="col">Payload<sup class="reference" id="cite_ref-Dragon_12-0"><a href="#cite_note-
</th>
<th scope="col">Payload mass
</th>
<th scope="col">Orbit
</th>
<th scope="col">Customer
</th>
<th scope="col">Launch<br/>outcome
</th>
<th scope="col"><a href="/wiki/Falcon_9_first-stage_landing_tests" title="Falcon 9 first-sta
tests">Booster<br/>landing</a>
</th></tr>
```

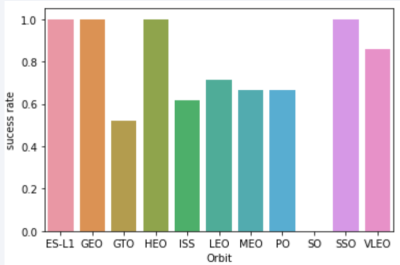
Data Wrangling

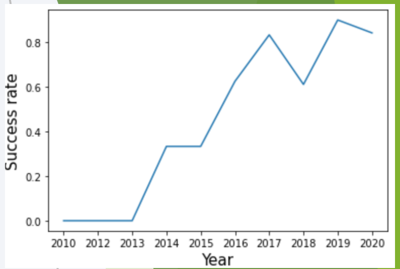
- My Notebook https://github.com/gordonwong88/Story2/blob/main/3-jupyter-spacex-data-wrangling.ipynb
- Transform raw data to **useful** data. For example, convert original outcome labels into landing class that represent landing classification which will be our new landing prediction target.
    - 1 for success
    - 0 for failure



EDA with Data Visualization







- My Visualization Notebook

- https://github.com/gordonwong88/Story2/blob/main/5-jupyter-labs-eda-dataviz.ipynb

Scatter Plot	To get relationship between variables, e.g.: FlightNumber vs. Orbit type Payload vs. Orbit type FlightNumber vs. PayloadMass FlightNumber vs. Launch Site
Bar Plot	To plot success rate of each orbit
Line Chart	To get the yearly average launch success trend

EDA with SQL

- My SQL Notebook https://github.com/gordonwong88/Story2/blob/main/4-jupyter-labs-eda-sql-coursera_sqllite.ipynb

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

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

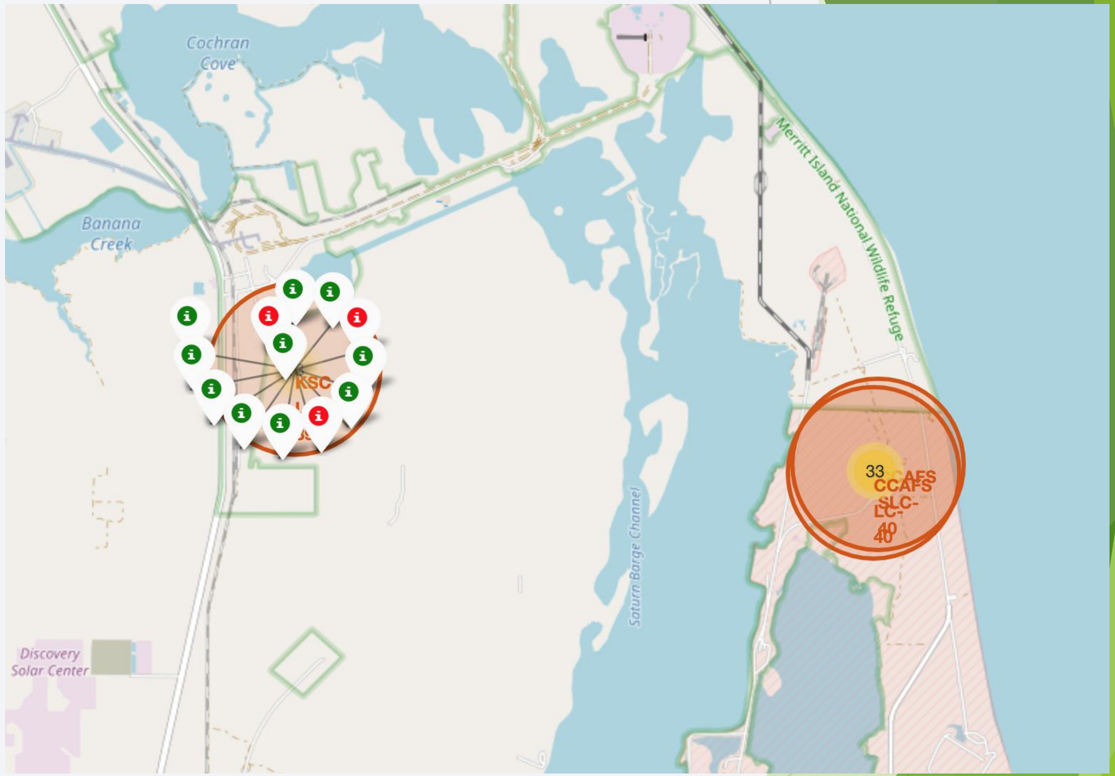
Landing _Outcome	landings
Success	20
No attempt	10
Success (drone ship)	8
Success (ground pad)	6
Failure (drone ship)	4
Failure	3
Controlled (ocean)	3
Failure (parachute)	2
No attempt	1

```
%sql select distinct Launch_Site from SPACEXTBL
```

- ✓ Query the names of the **unique launch sites** in the space mission
- ✓ Query the names of the **booster_versions** which have carried the maximum payload mass.
- ✓ List the total number of **successful** and **failure** mission outcomes
- ✓ List the names of the boosters which have **success in drone ship** and have **payload mass** in some range
- ✓ Rank the count of successful **landing_outcomes** in date range in descending order.

Build an Interactive Map with Folium

- Add **Circles** for Launch sites and **Markers** for labels
- Add **MarkerCluster** for successful and failed launches
- Add **Lines** for calculate distance between launch sites and their proximities

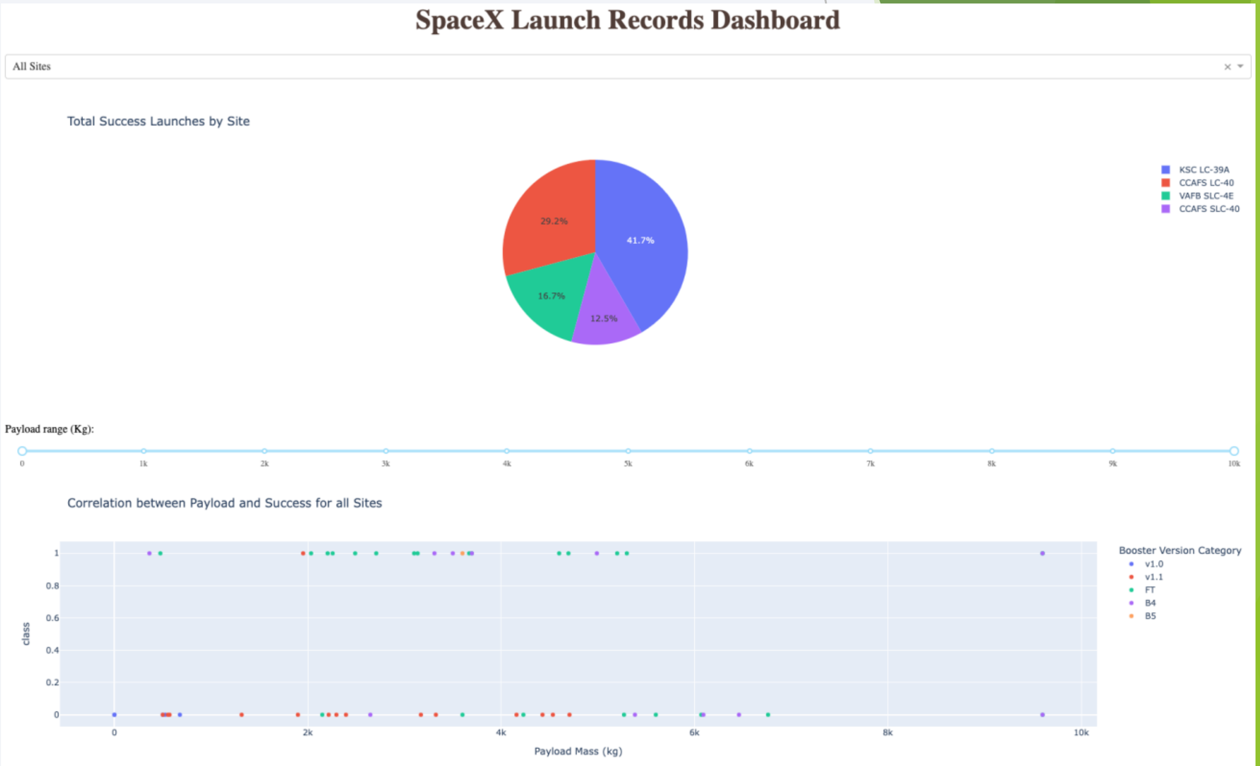


My Notebook

- https://github.com/gordonwong88/Story2/blob/main/6-jupyter_launch_site_location_folium.ipynb

Build a Dashboard with Plotly Dash

- With a **Dropdown menu** and a **Pie Chart**, we can get success launches distribution by launch site
- Additionally, with a **Range Slider** and a **Scatter Plot**, we can analyze the correlation between Payload and Success for different launch sites



My Dashboard Python Link for Code:
https://github.com/gordonwong88/Story2/blob/main/spacex_dash_app.py

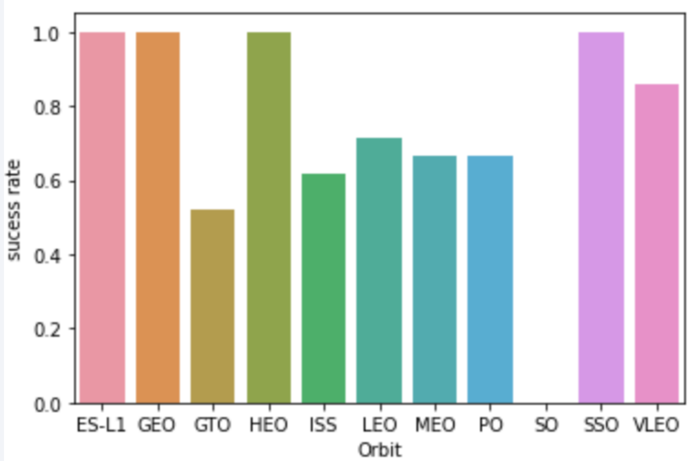
Predictive Analysis (Classification)

- ❑ **Prepare** data
- ❑ **Create** a column for the class
- ❑ **Standardize** the data
- ❑ **Split** into training data and test data
- ❑ **Define** model and parameters
- ❑ **Train** and **Grid Search** for best parameters
- ❑ **Evaluation**

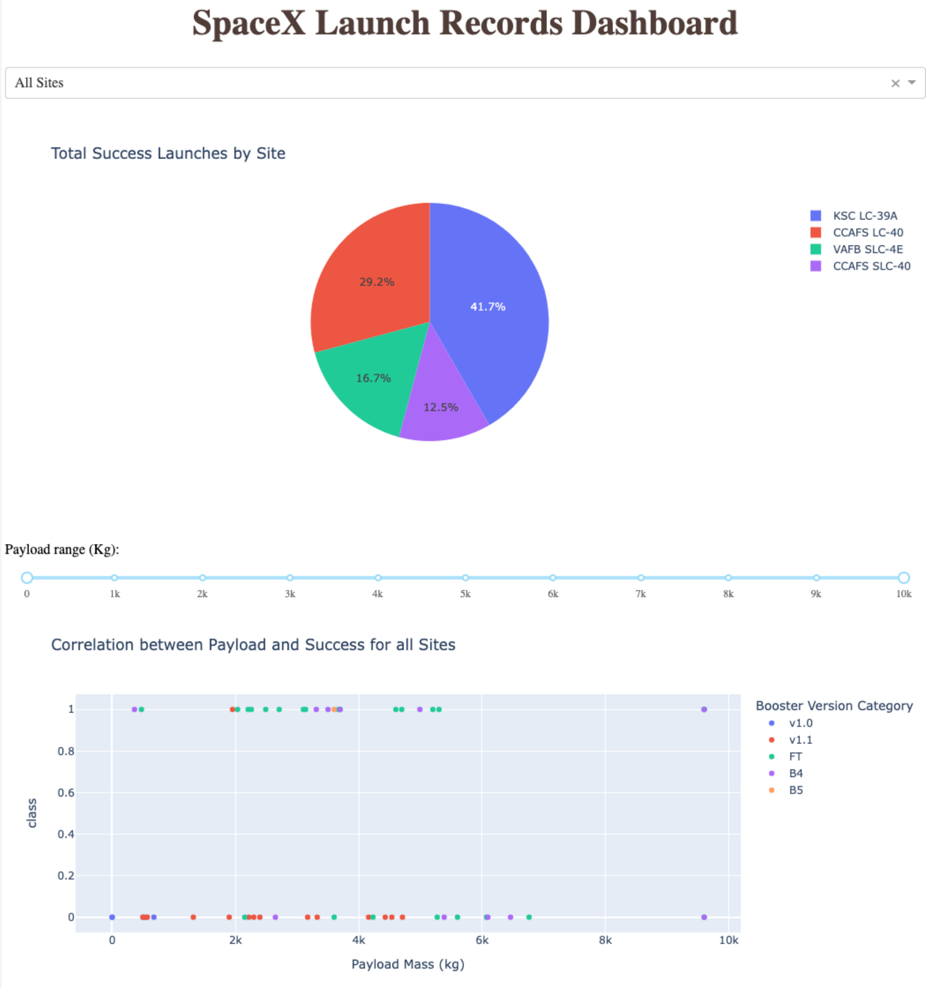
Preprocess Data	Define Model	Train Model	Evaluate Model
Data Cleaning	Choose Model	Tune Model	Accuracy Analysis
Data Transformation	Model Parameters	Grid Search	Model Plot
Dataset Splitting			

My Notebook
https://github.com/gordonwong88/Story2/blob/main/7-SpaceX_Machine_Learning_Prediction_Part_5.ipynb

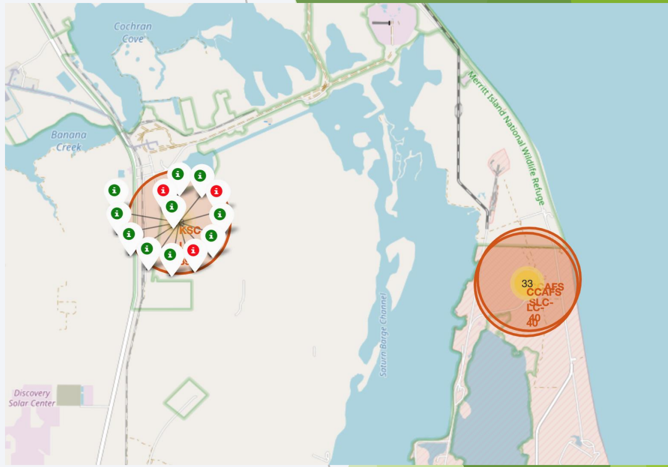
Results



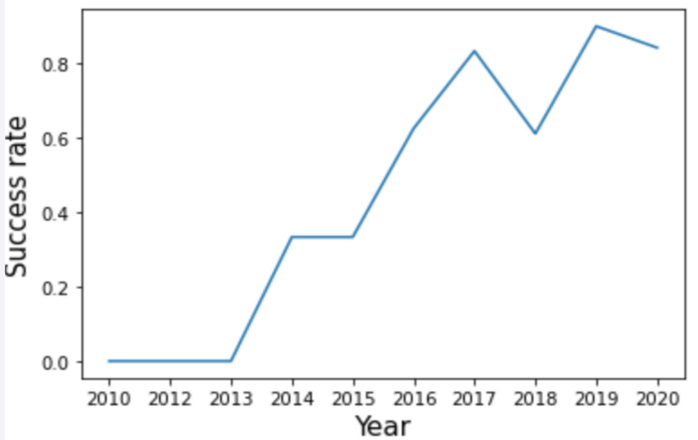
sucess rate
Orbit
ES-L1 GEO GTO HEO ISS LEO MEO PO SO SSO VLEO
0.0 0.2 0.4 0.6 0.8 1.0



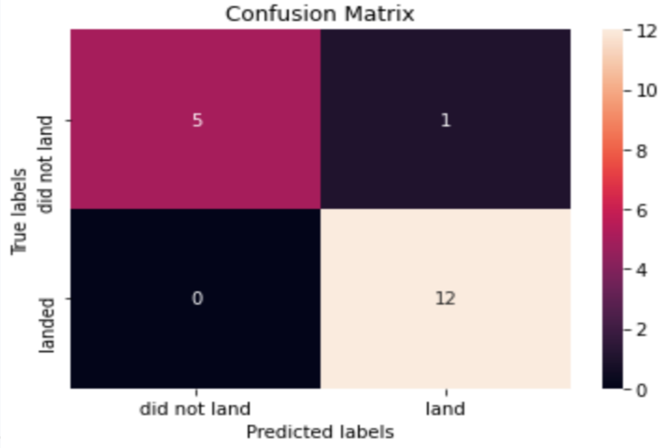
SpaceX Launch Records Dashboard
All Sites
Total Success Launches by Site
41.7%
29.2%
16.7%
12.5%
KSC LC-39A
CCAFS LC-40
VAFB SLC-4E
CCAFS SLC-40
Payload range (Kg):
0 1k 2k 3k 4k 5k 6k 7k 8k 9k 10k
Correlation between Payload and Success for all Sites
Booster Version Category
v1.0
v1.1
FT
B4
B5
class
Payload Mass (kg)



Cochran Cove
Banana Creek
KSC
33
CCAFS
Discovery Solar Center



Success rate
Year
2010 2012 2013 2014 2015 2016 2017 2018 2019 2020
0.0 0.2 0.4 0.6 0.8



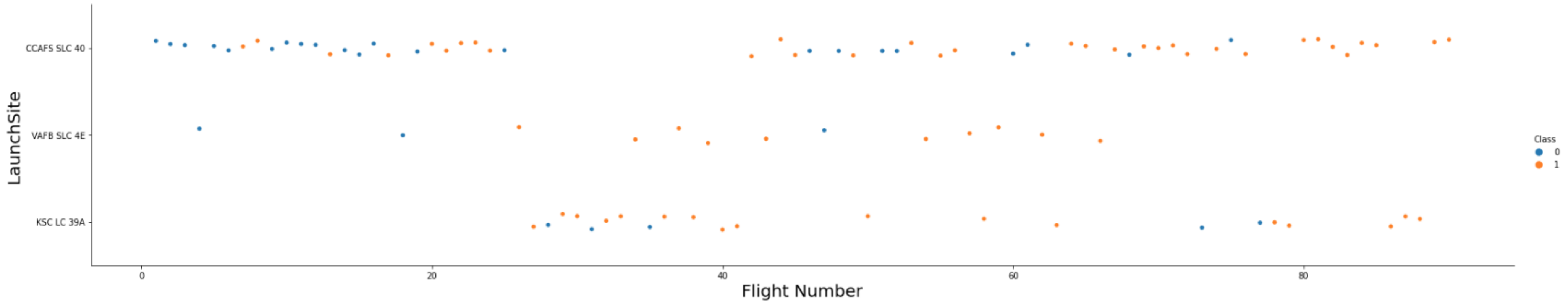
Confusion Matrix
True labels
Predicted labels
did not land
landed
did not land
land
5
1
0
12

Part 2

Insights from EDA

Flight Number vs. Launch Site

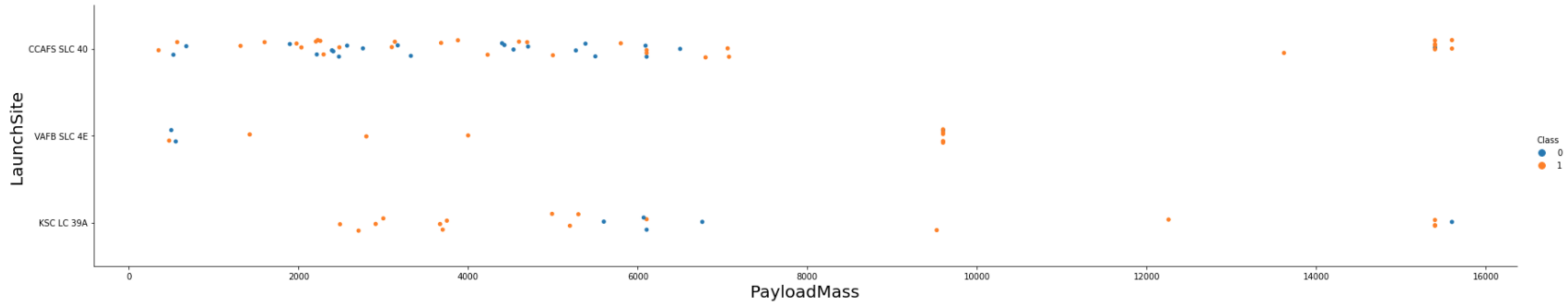
```
[4] # Plot a scatter point chart with x axis to be Flight Number and y axis to be the launch site, and hu
    sns.catplot(y="LaunchSite", x="FlightNumber", hue="Class", data=df, aspect = 5)
    plt.xlabel("Flight Number",fontsize=20)
    plt.ylabel("LaunchSite",fontsize=20)
    plt.show()
```



Explanation: We can see from the scatter plot that as flight number increases, there are more successful first stage landing. With small flight numbers, launches happens more in the site CCAFS SLC 40 and with much lower success rate. Although there are less launches in VAFB SLC 4E and KSC LC 39A, higher success rate can be seen in these two sites.

Payload vs. Launch Site

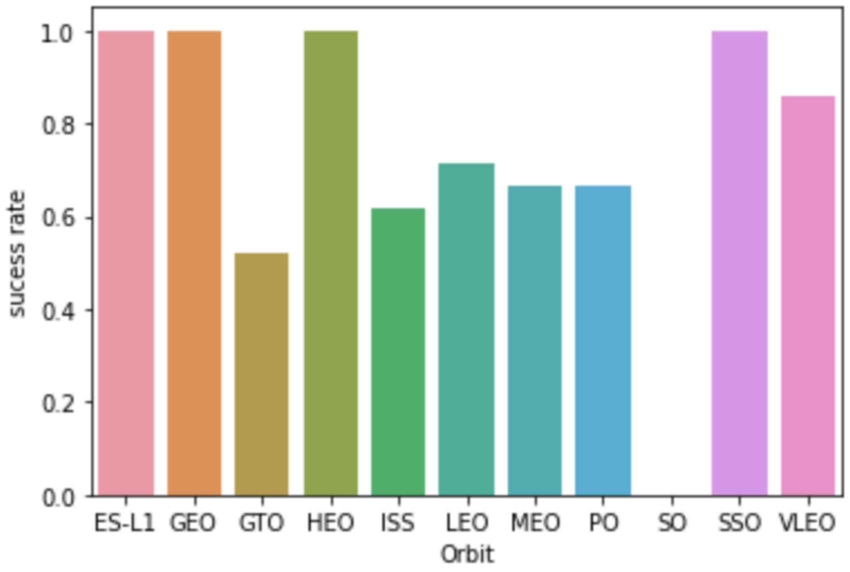
```
[5] # Plot a scatter point chart with x axis to be Pay Load Mass (kg) and y axis to be the launch site, a
    sns.catplot(y="LaunchSite", x="PayloadMass", hue="Class", data=df, aspect = 5)
    plt.xlabel("PayloadMass",fontsize=20)
    plt.ylabel("LaunchSite",fontsize=20)
    plt.show()
```



Explanation: With higher Payload the success rate is much higher. And in KSC LC39A launchsite we can see much higher success rate with low Payload whereas this rate is mucher lower in CCAFS SLC 40 launchsite. Besides, there no rockets launched in VAFB-SLC for Payload greater than 10000. Furthermore, with Payload more than 9500, we can see very high success rate overall.

Success Rate vs. Orbit Type

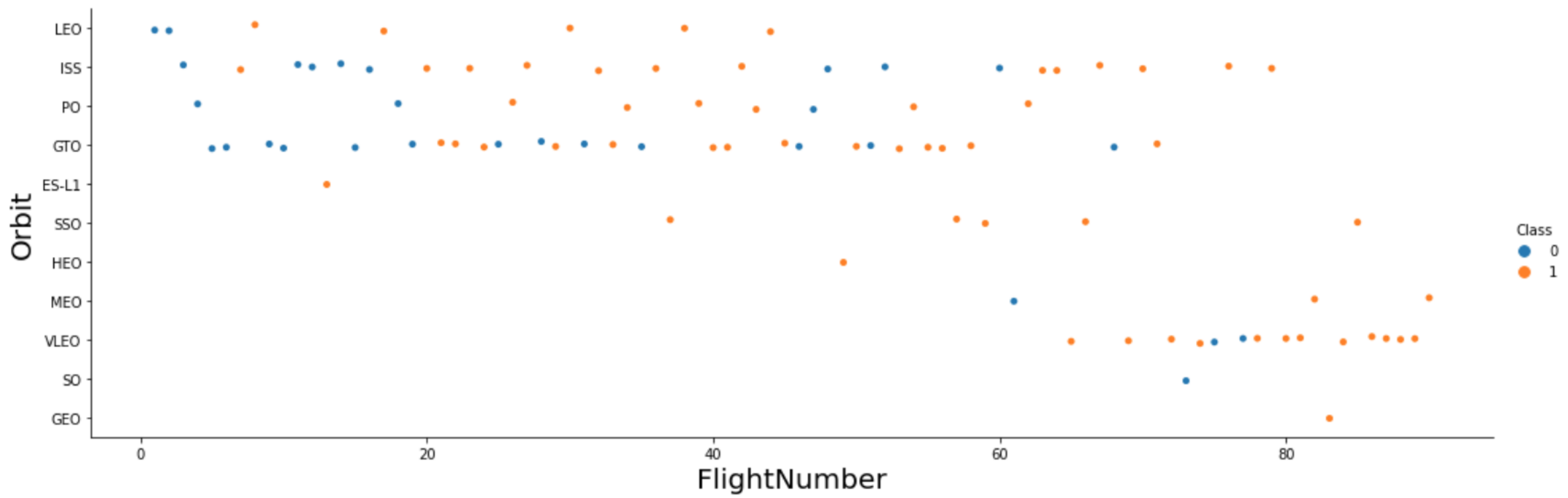
```
[ ]  sns.barplot(y='Class', x='Orbit', data=df_success_rate)
     plt.xlabel("Orbit",fontsize=10)
     plt.ylabel("sucess rate",fontsize=10)
     plt.show()
```



Explanation: From the Bar Plot we can see for Orbit type ES-L1, GEO, HEO, and SSO have the highest success rate, which is 100%. And we also find in SO orbit, the rate is zero.

Flight Number vs. Orbit Type

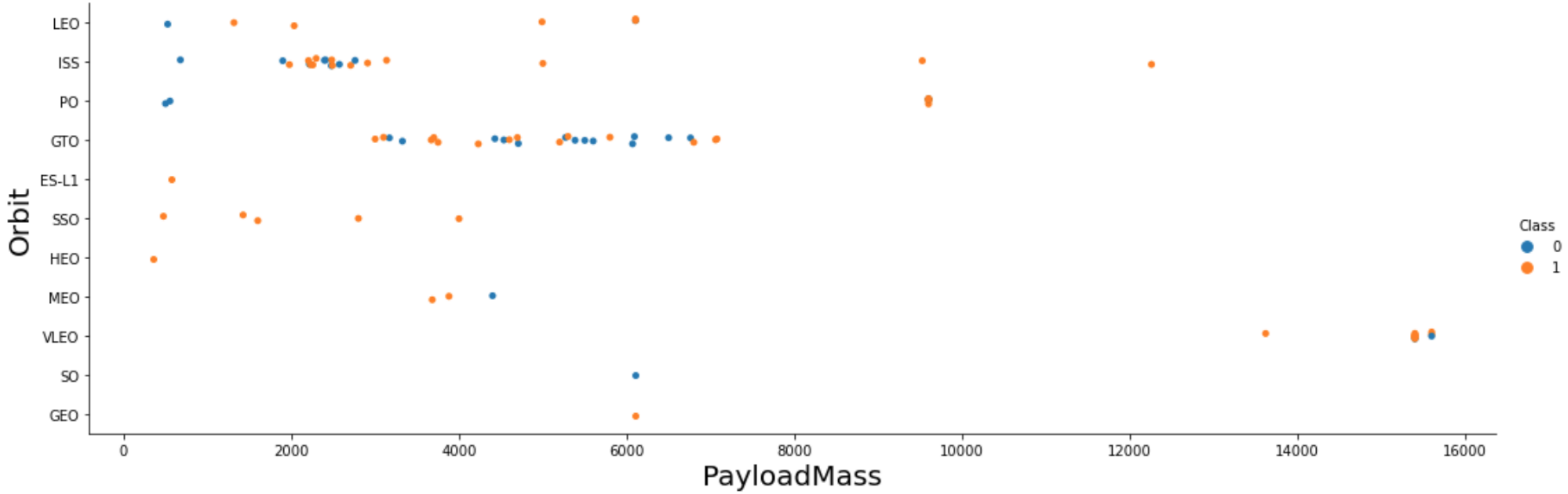
```
[9] # Plot a scatter point chart with x axis to be FlightNumber and y axis to be the Orbit, and hue to be
    sns.catplot(y="Orbit", x="FlightNumber", hue="Class", data=df, aspect = 3)
    plt.xlabel("FlightNumber",fontsize=20)
    plt.ylabel("Orbit",fontsize=20)
    plt.show()
```



Explanation: In ES-L1, GEO, HEO, and SSO orbits, all launches are successful. There is clear relationship between flight number and success rate in LEO orbit since as flightnumber increases, the success rate increases. In contrast, there is no such obvious relationship in GTO orbit.

Payload vs. Orbit Type

```
[ ] # Plot a scatter point chart with x axis to be Payload and y axis to be the Orbit, and hue to be the class v
    sns.catplot(y="Orbit", x="PayloadMass", hue="Class", data=df, aspect = 3)
    plt.xlabel("PayloadMass",fontsize=20)
    plt.ylabel("Orbit",fontsize=20)
    plt.show()
```

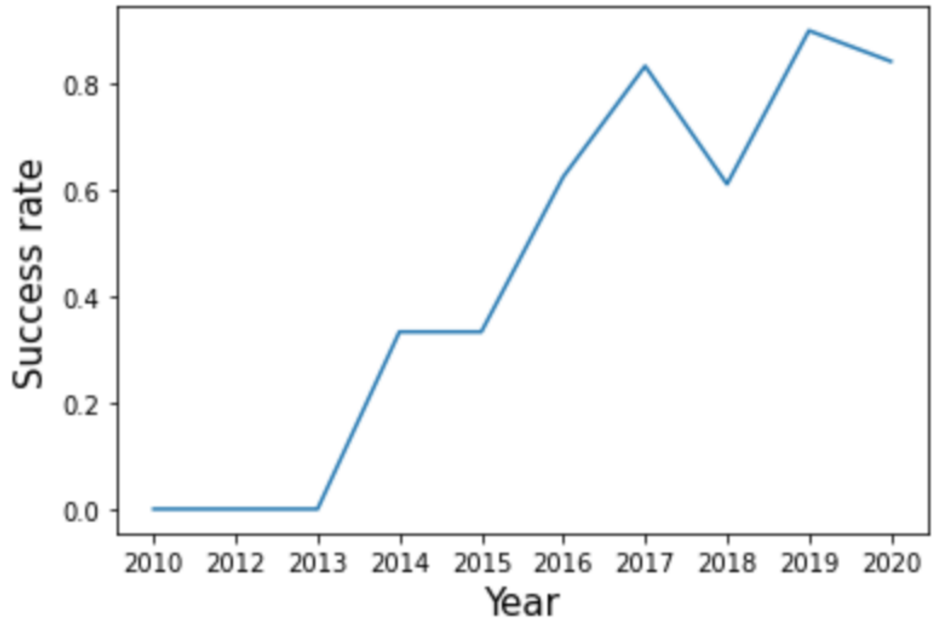


Explanation: With heavy payloads the successful landing or positive landing rate are more for Polar,LEO and ISS.

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

```
[14] sns.lineplot(y='Class', x='Year', data=df_year_success)
     plt.xlabel("Year",fontsize=15)
     plt.ylabel("Success rate",fontsize=15)
     plt.show()
```



Explanation: you can observe that the sucess rate since 2013 kept increasing till 2020

All Launch Site Names

Four Launch Sites:

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

```
%sql select distinct Launch_Site from SPACEXTBL
```

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

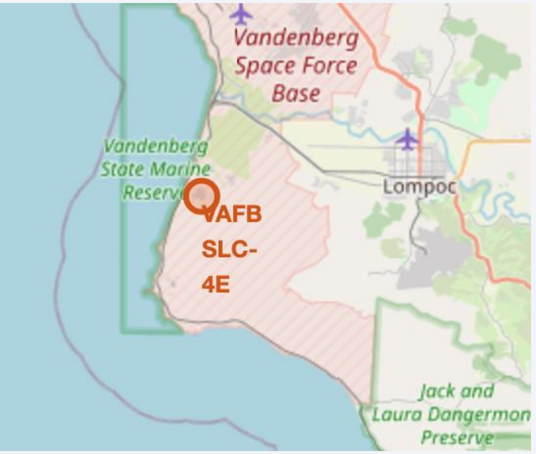
Launch_Site
CCAFS LC-40
VAFB SLC-4E
KSC LC-39A
CCAFS SLC-40

1 in western coast

- VAFB SLC-4E

3 in eastern coast

- KSC LC-39A
- CCAFS SLC-40
- CCAFS LC-40



Launch Site Names Begin with 'CCA'

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

```
%sql select * from SPACEXTBL 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
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

Explanation: these 5 launches happened in LEO orbit, and four of them were from customer NASA.

Total Payload Mass

```
[9]  %sql select sum(PAYLOAD_MASS__KG_) from SPACEXTBL where Customer like 'NASA%'

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

sum(PAYLOAD_MASS__KG_)
99980

Explanation: The total payload carried by boosters from NASA is **99980**.

Average Payload Mass by F9 v1.1

```
[ ] %sql select avg(PAYLOAD_MASS__KG_) from SPACEXTBL where Booster_Version like 'F9 v1.1%'

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

avg(PAYLOAD_MASS__KG_)
2534.6666666666665

Explanation: the average payload mass carried by booster version F9 v1.1 is **2534.67**.

First Successful Ground Landing Date

```
%sql select min(Date) from SPACEXTBL where "Landing _Outcome" = "Success (ground pad)"
```

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

min(Date)
01-05-2017

Explanation: the first successful landing outcome on ground pad is **01-05-2017**.

Successful Drone Ship Landing with Payload between 4000 and 6000

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

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

```
%%sql

select Booster_Version from SPACEXTBL
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

Explanation:

- the total number of **successful** mission outcomes is **100**
- the total number of **failure** mission outcomes is **1**

```
[10] %%sql

     select count(*) from SPACEXTBL
     where "Mission_Outcome" like "Success%"

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

count(*)
100

```
[11] %%sql

     select count(*) from SPACEXTBL
     where "Mission_Outcome" like "Failure%"

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

count(*)
1

Boosters Carried Maximum Payload

Names of the booster which have carried the maximum payload mass:

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

```
%%sql

select Booster_Version from SPACEXTBL
where PAYLOAD_MASS__KG_ = (select max(PAYLOAD_MASS__KG_) from SPACEXTBL)
```

```
 * 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

```
[14] %%sql

     select substr(Date, 4, 2) as Month, Booster_Version, Launch_Site from SPACEXTBL
     where substr(Date,7,4)='2015' and "Landing _Outcome" = "Failure (drone ship)"

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

Month	Booster_Version	Launch_Site
01	F9 v1.1 B1012	CCAFS LC-40
04	F9 v1.1 B1015	CCAFS LC-40

Failed landing_outcomes in drone ship, their booster versions, and launch site names for in year 2015:

Month	Booster_Version	Launch_Site
01	F9 v1.1 B1012	CCAFS LC-40
04	F9 v1.1 B1015	CCAFS LC-40

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

Rank the count of landing outcomes between the date 2010-06-04 and 2017-03-20:

Landing _Outcome	landings
Success	20
No attempt	10
Success (drone ship)	8
Success (ground pad)	6
Failure (drone ship)	4
Controlled (ocean)	3
Failure	3
Failure (parachute)	2
No attempt	1

```
%%sql

select "Landing _Outcome",
    count("Landing _Outcome") as landings
from SPACEXTBL
where Date >= "04-06-2010" and Date <= "20-03-2017"
group by "Landing _Outcome"
order by landings desc
```

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

Landing _Outcome	landings
Success	20
No attempt	10
Success (drone ship)	8
Success (ground pad)	6
Failure (drone ship)	4
Controlled (ocean)	3
Failure	3
Failure (parachute)	2
No attempt	1

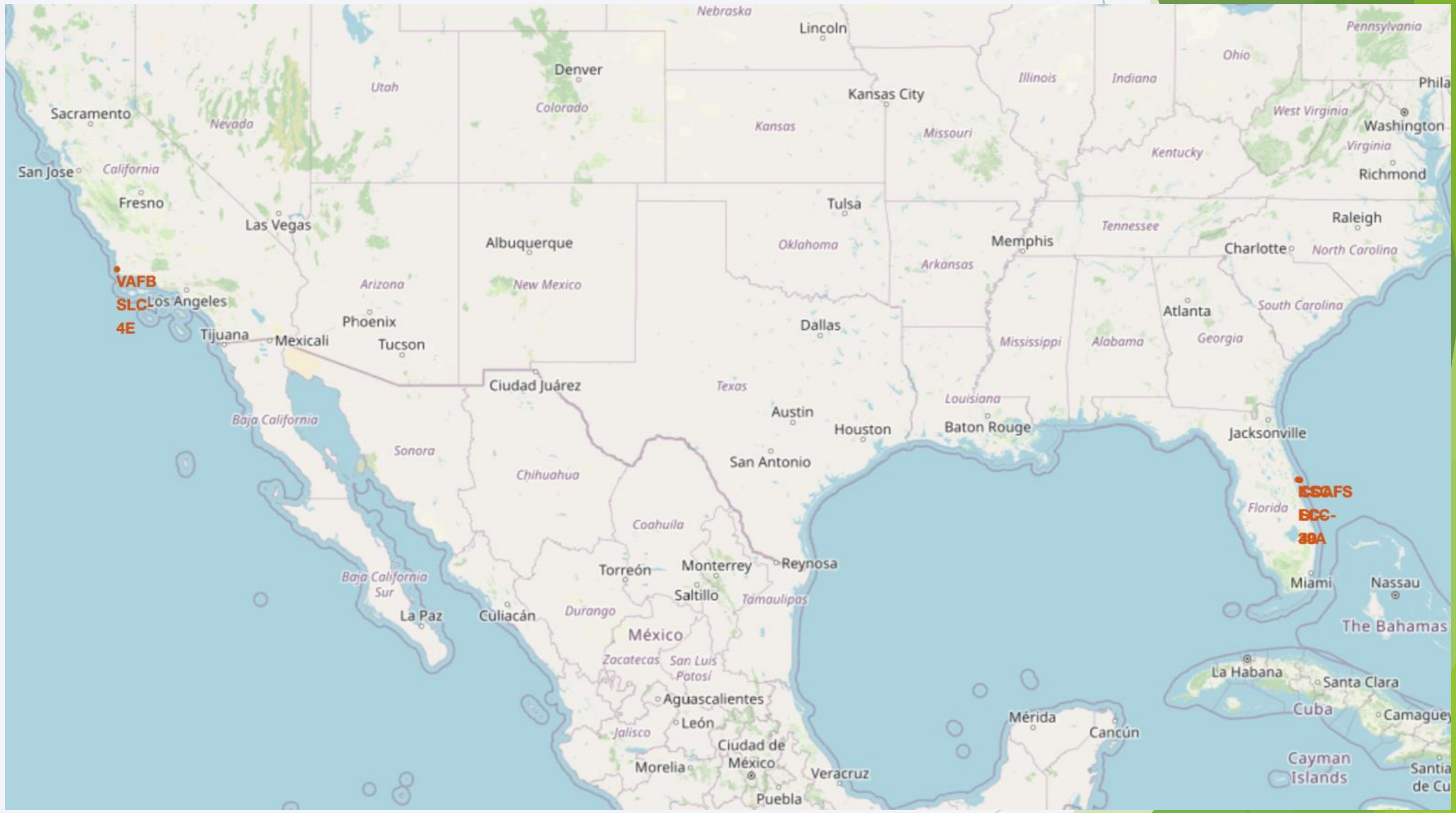
Part 3

Lauch Sites Proximities Analysis

Locations of Launch Sites on Maps

- Three in the east
- One in the west
- All in the south

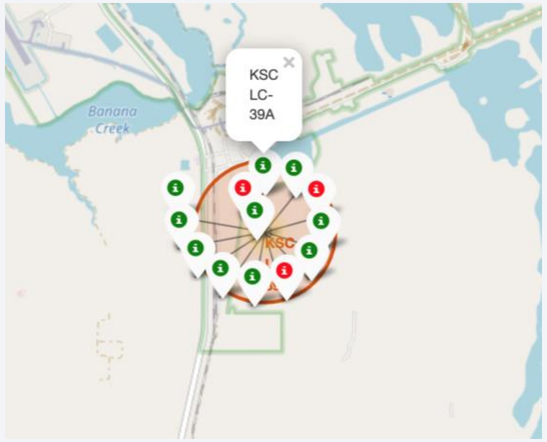
Launch Site	Lat	Long
CCAFS LC-40	28.56230197	-80.57735648
CCAFS SLC-40	28.56319718	-80.57682003
KSC LC-39A	28.57325457	-80.64689529
VAFB SLC-4E	34.63283416	-120.6107455

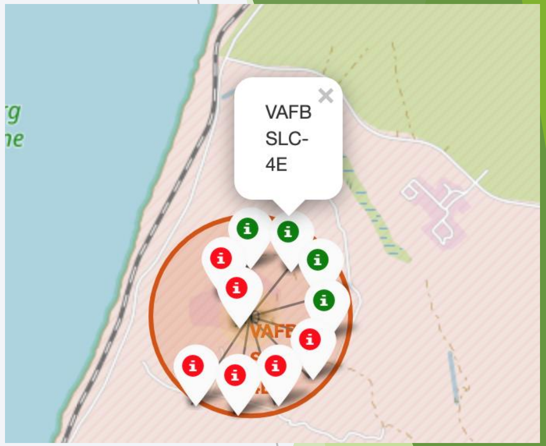


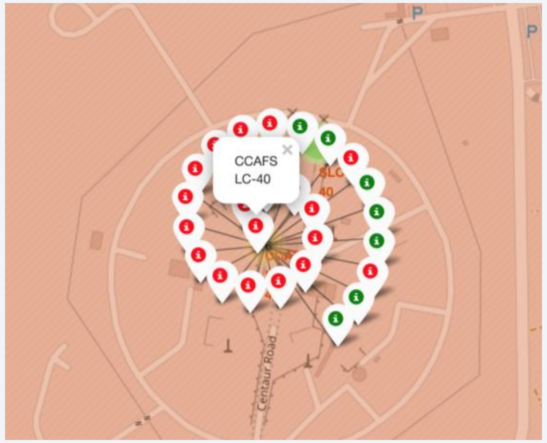
Display Launch Outcome by Color

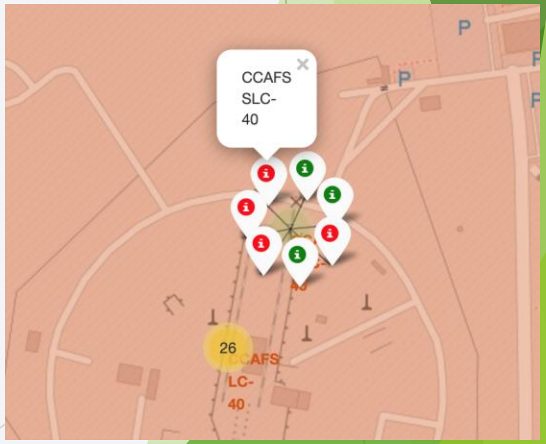
From the color labels, we can easily see

- KSC LC-39A has a rather higher success rate
- Whereas CCAFS LC-40 and CCAFS SLC-40 have much lower rate



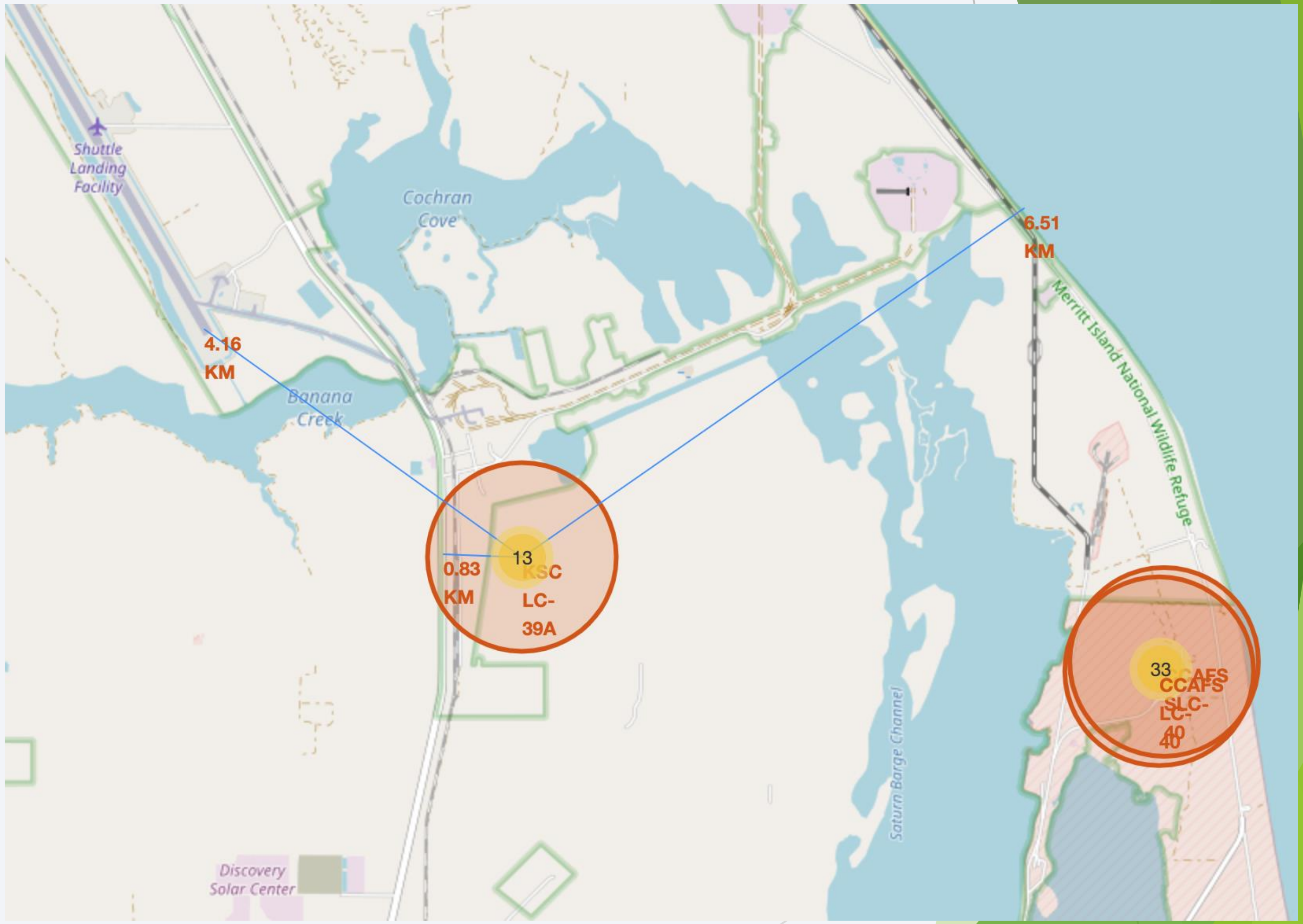






Show Distance to Proximities

- The distance from KSC LC-39A to the nearest shuttle landing facility is about 4.16 km.
- The distance from KSC LC-39A to the nearest highway is less than 1 km.
- The distance from KSC LC-39A to the coastline is around 6.5 km.



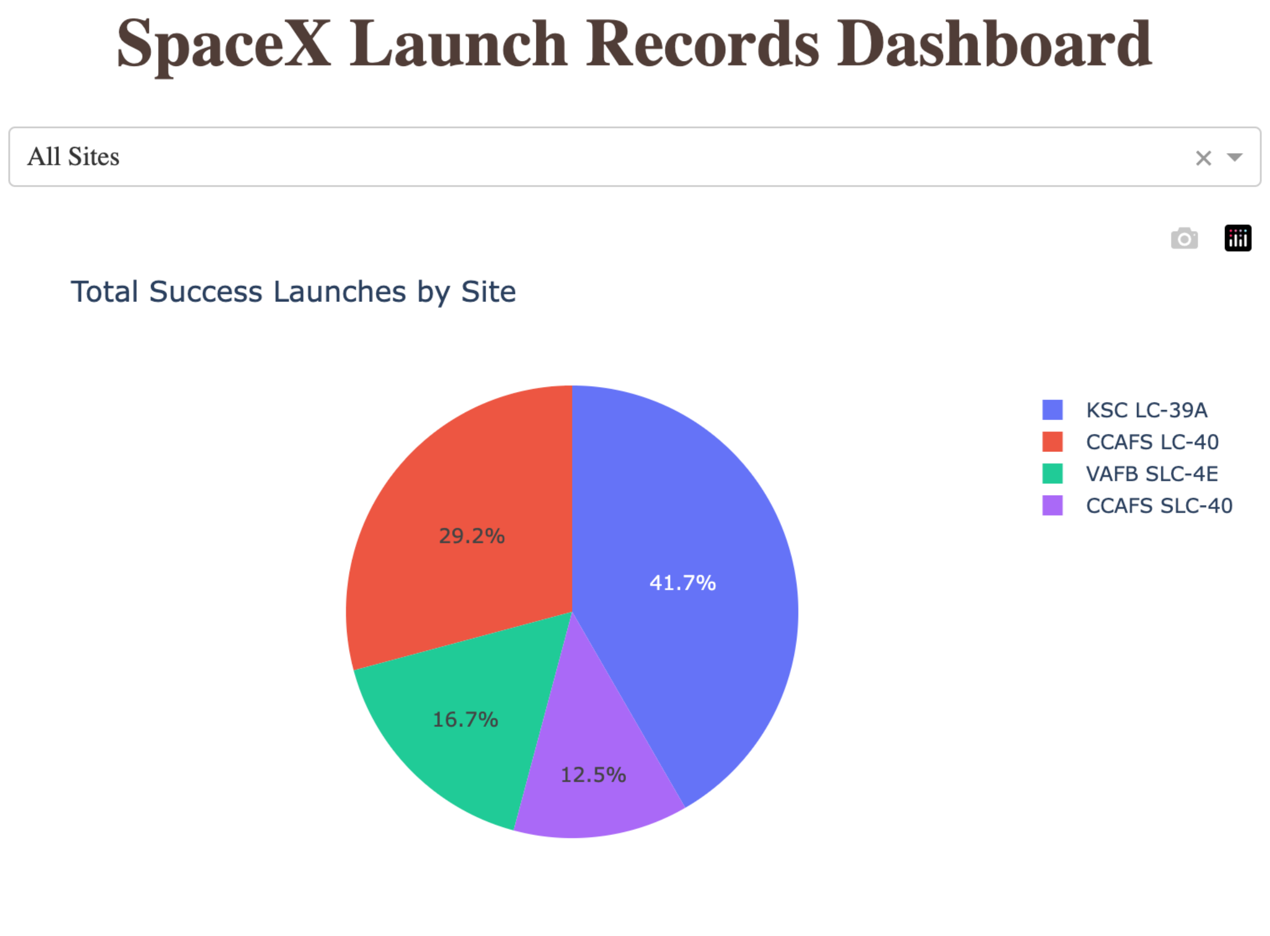
Part 4

Building Dashboard using Plotly Dash

Total Success Launches for All Sites

Total Success Launches for All Sites is

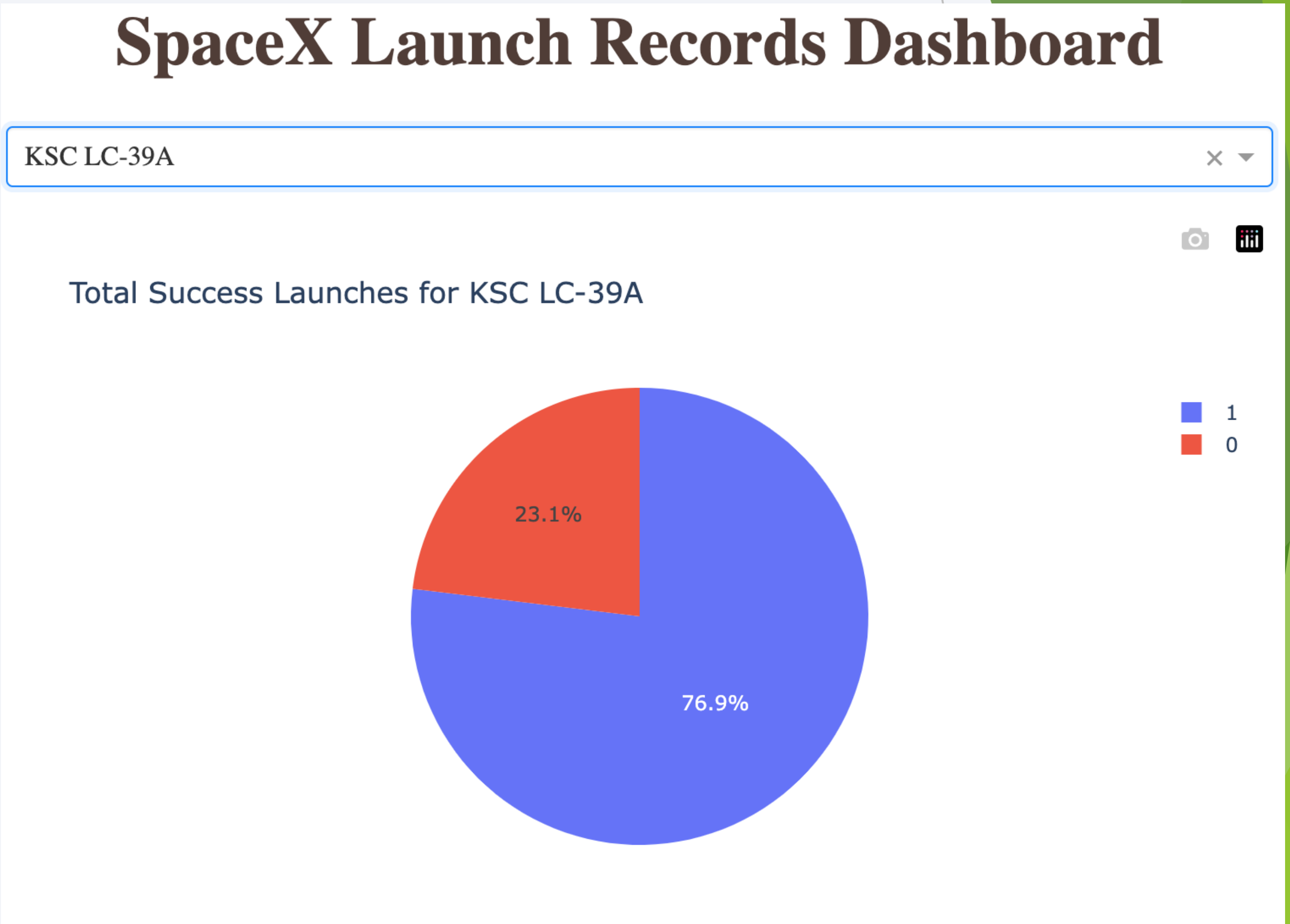
- CCAFS LC-40: 29.2%
- VAFB SLC-4E: 16.7%
- KSC LC-39A: 41.7%
- CCAFS SLC-40: 12.5%



Success Ratio for KSC LC-39A

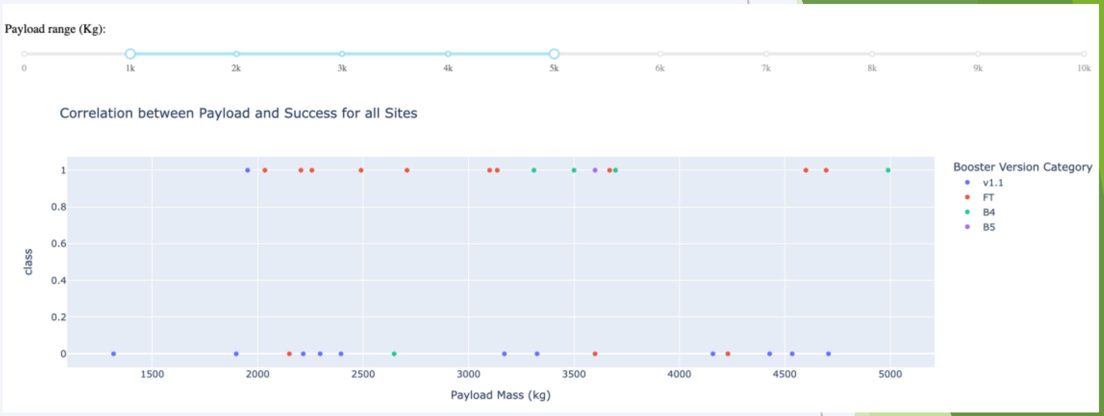
The launch site with highest launch success ratio is **KSC LC-39A.**

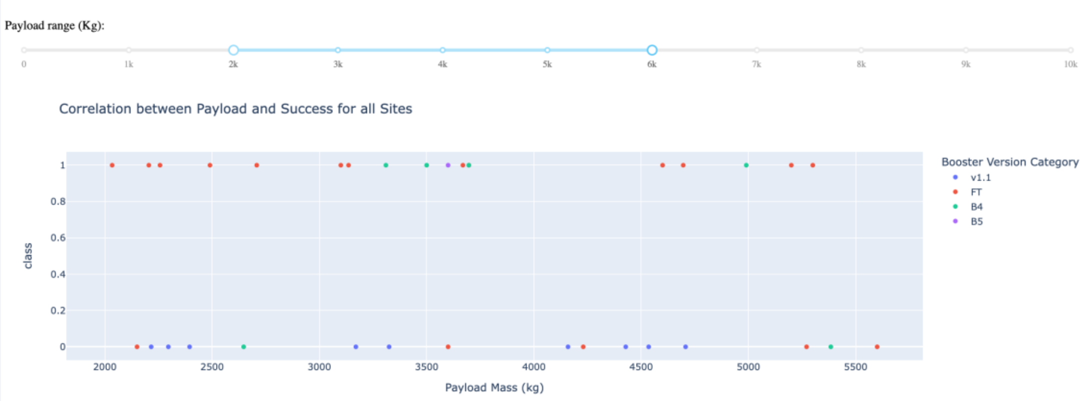
It has a success rate of **76.9%.**



Correlation Between Payload and Success

- ❑ Payload range in **[3000, 4000]** has the largest success rate.
- ❑ Booster version of **FT** has the largest success rate.





Part 5

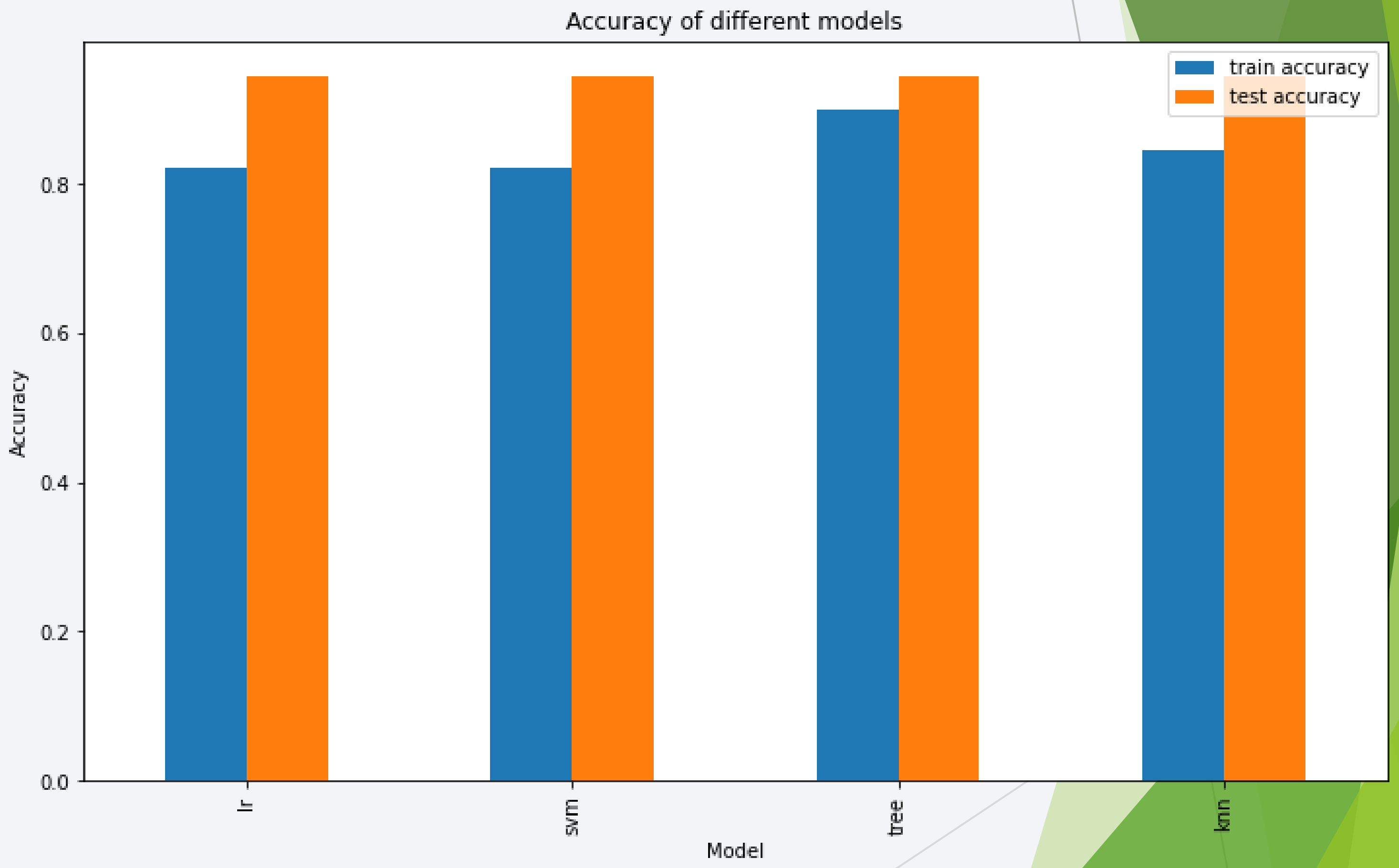
Predictive Analysis (Classification)

Classification Accuracy

- **Decision Tree model** has the highest classification accuracy

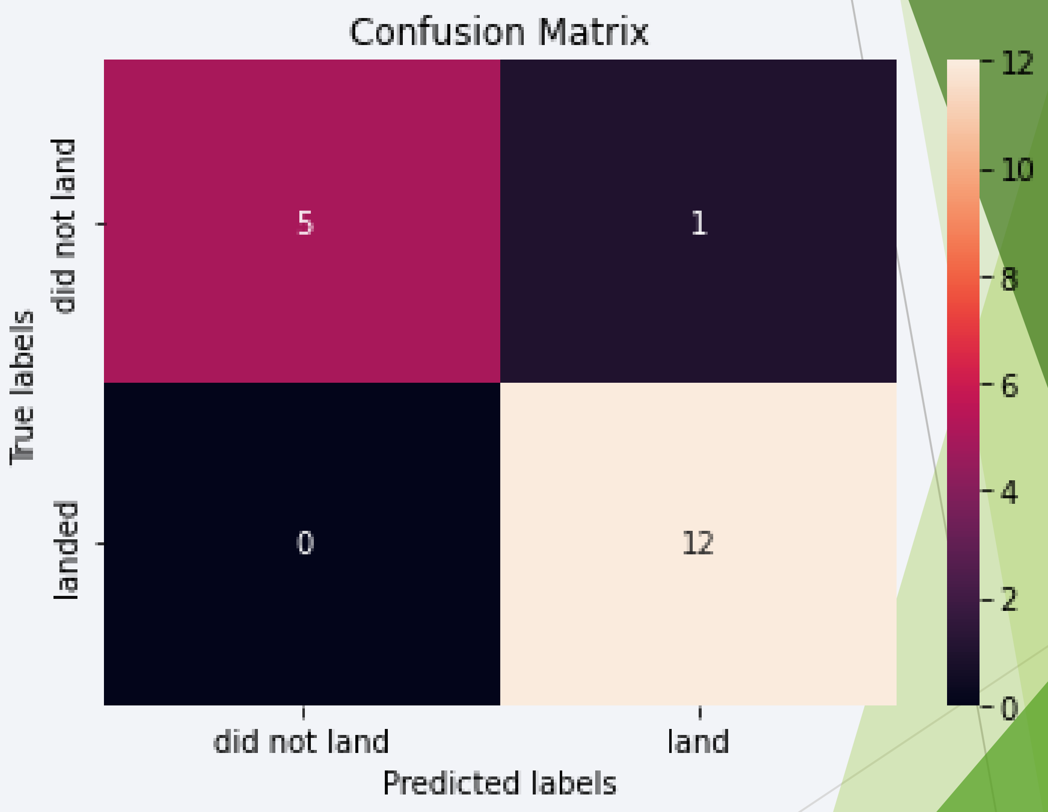
- training accuracy 0.9, **testing accuracy 0.94**

- Parameter: {'criterion': 'gini', 'max_depth': 8, 'max_features': 'auto', 'min_samples_leaf': 2, 'min_samples_split': 10, 'splitter': 'random'}



Confusion Matrix

- ❑ Decision Tree model can distinguish between the different classes.
- ❑ The major problem is **false positives**.



Conclusions

- The dataset has 90 rows of data, with 83 columns. With 80/20 split, we have 72 rows of training data and 18 rows of testing data.
- And enhanced by GridSearchCV, we trained four models which have all best performance on test data set.
- Of these models, we can choose Decision Tree as our best model for predicting landing outcome of rocket.
- By the decision tree, we might have some problem with false positives which probably will impact our estimation of next bid for rocket launch.
- We can see that KSC LC-39A had the most successful launches from all the sites
- Orbit GEO,HEO,SSO,ES-L1 has the best Success Rate

The shortfall in Model Training

- The dataset only has 90 rows of data, but with 83 columns.
- With 80/20 split, we only have 72 records of training data.
- We have **more features than samples**! In this case, training model will lead to some unwanted results, such as **overfitting**.
- And we only have 18 test samples. Too few to find out problems.

	FlightNumber	PayloadMass	Flights	Block	ReusedCount	Orbit_ES-L1
0	1.0	6104.959412	1.0	1.0	0.0	0.0
1	2.0	525.000000	1.0	1.0	0.0	0.0
2	3.0	677.000000	1.0	1.0	0.0	0.0
3	4.0	500.000000	1.0	1.0	0.0	0.0
4	5.0	3170.000000	1.0	1.0	0.0	0.0
...	...	...	...	...	...	...
85	86.0	15400.000000	2.0	5.0	2.0	0.0
86	87.0	15400.000000	3.0	5.0	2.0	0.0
87	88.0	15400.000000	6.0	5.0	5.0	0.0
88	89.0	15400.000000	3.0	5.0	2.0	0.0
89	90.0	3681.000000	1.0	5.0	0.0	0.0

90 rows × 83 columns

The Shortfall in Model Training (continued)

- **How to handle this issue?**
- Get more data, or add regularization, or dimension reduction
- **May have a try**: since in the EDA we have found some **correlation** between some variables, maybe we can just get rid of some unimportant columns.
- Try **PCA** to reduce dimension.

	FlightNumber	PayloadMass	Flights	Block	ReusedCount	Orbit_ES-L1
0	1.0	6104.959412	1.0	1.0	0.0	0.0
1	2.0	525.000000	1.0	1.0	0.0	0.0
2	3.0	677.000000	1.0	1.0	0.0	0.0
3	4.0	500.000000	1.0	1.0	0.0	0.0
4	5.0	3170.000000	1.0	1.0	0.0	0.0
...	...	...	...	...	...	...
85	86.0	15400.000000	2.0	5.0	2.0	0.0
86	87.0	15400.000000	3.0	5.0	2.0	0.0
87	88.0	15400.000000	6.0	5.0	5.0	0.0
88	89.0	15400.000000	3.0	5.0	2.0	0.0
89	90.0	3681.000000	1.0	5.0	0.0	0.0

90 rows × 83 columns