SpaceX

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OUTLINE

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- Methodology
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  - Visualization – Charts
  - Dashboard
- Discussion
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EXECUTIVE SUMMARY

What was used to gather the data:

- Web scraping collected data from SpaceX API
- Exploratory data analysis, data wrangling, data visualization, and interactive visual analytics were used to analyze and visualize data
- Analysis revealed patterns and trends in SpaceX's launch history
- A machine learning prediction model was used to forecast future launch success rates based on historical data.

INTRODUCTION

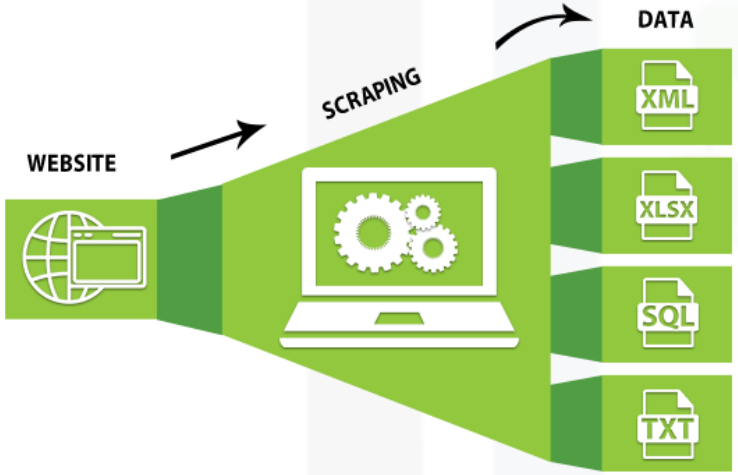
Objective:

- Use historical data from past launches to predict the success rate of future launches.

Questions we set out to answer:

- What is the best place to launch from?
- Can we predict the success of a launch?
- How do the materials affect success rate?

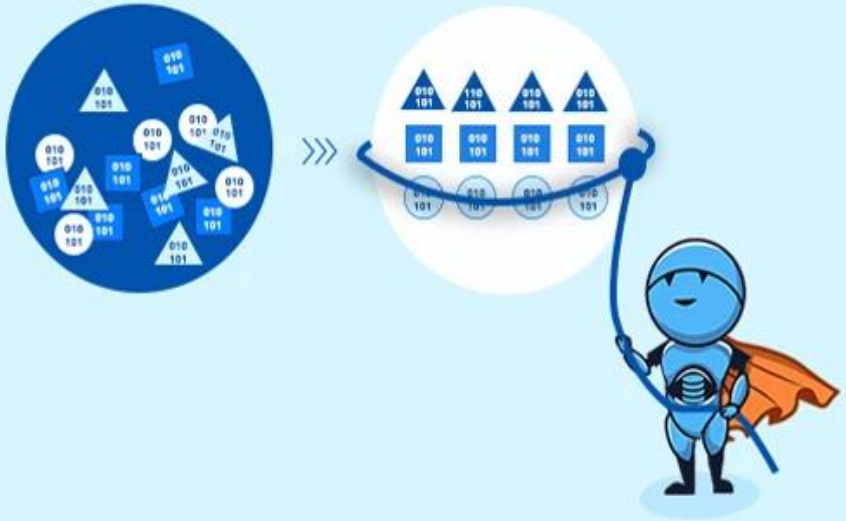
METHODOLOGY



Data Collection

- Used a Space X API:
  - https://api.spacexdata.com/v4/rockets/
- Web Scraping from this wiki page:
  - https://en.wikipedia.org/wiki/List_of_Falcon_9_and_Falcon_Heavy_launches_(2010%E2%80%932019)

METHODOLOGY



Data Wrangling

Used collected data to summarize the data

- Counts of take-off locations
- Counts of where the rockets orbited
- Counts of the outcomes of the missions

METHODOLOGY

Exploratory Data Analysis

- Visualized relationship between features
- Used SQL Queries on the data to gather data quickly
  - Examples:
  - Top 5 launch sites
  - total number of success and failures
  - Failed Landing outcomes, the Booster version, and launch site name

METHODOLOGY

Last methods were:

- Building an interactive map using Folium
  - Marked on a map launch and success/failure locations
- Building a Dashboard with Plotly Dash
  - Interactive dashboard to visualize data
- Using Predictive analysis:
  - Logistical regression
  - Decision tree
  - K-nearest-neighbor
  - Support vector machine

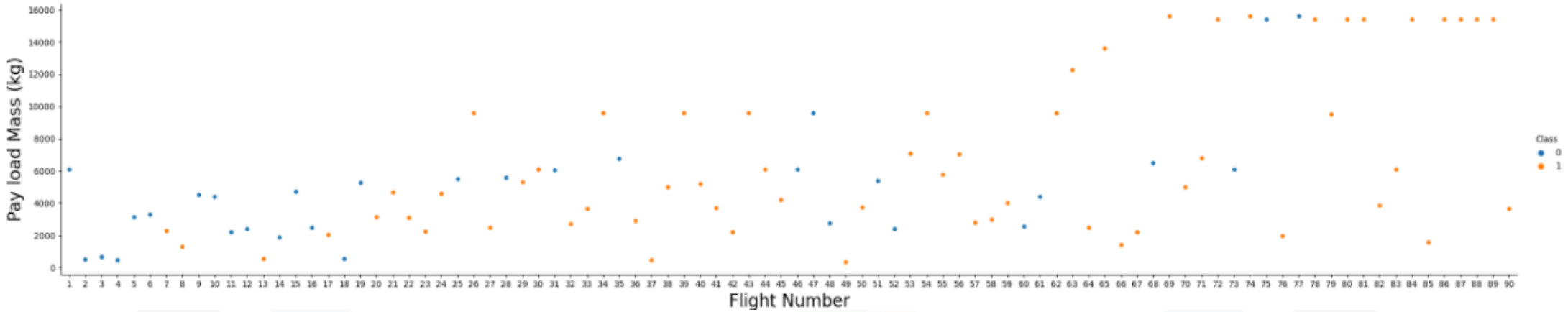
RESULTS

Exploratory Data Analysis results:

- SpaceX uses 4 launch Locations
- Average payload of F9 v1.1 booster is 2,928 kg
- First successful landing was in 2015
- Number of payload outcomes increase as years passed

RESULTS

Flight Number vs Payload Mass:

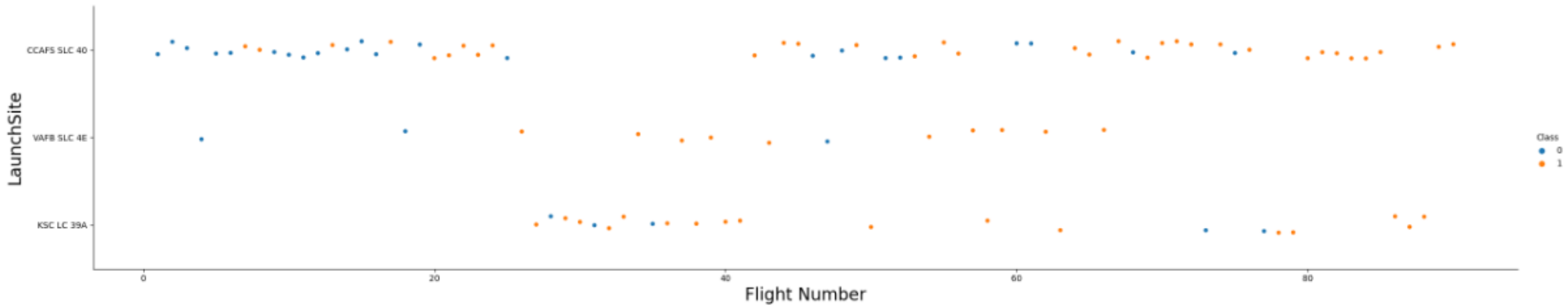


CCAFS LC-40 success rate: 60%

KSC LC-39A and VAFB SLC 4E success rate: 77%

RESULTS

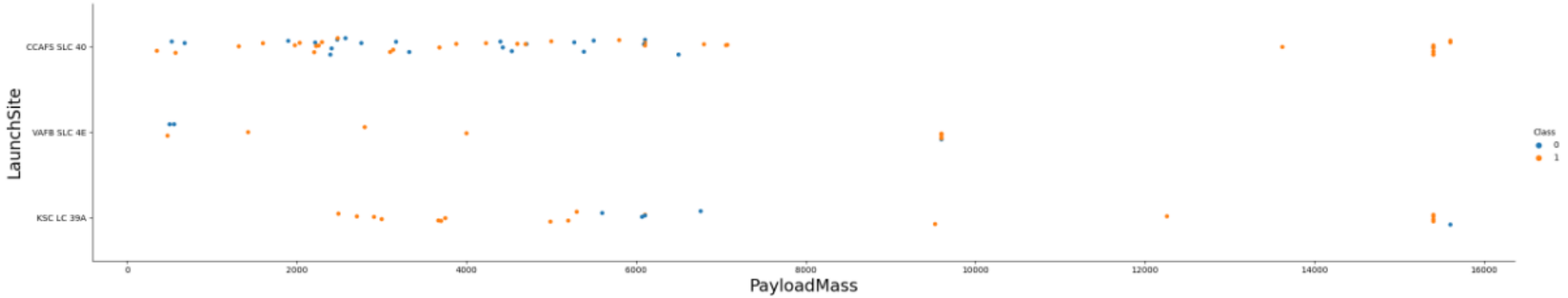
Flight Number vs Launch Site:



CCAFS LC-40 has been most successful recently

RESULTS

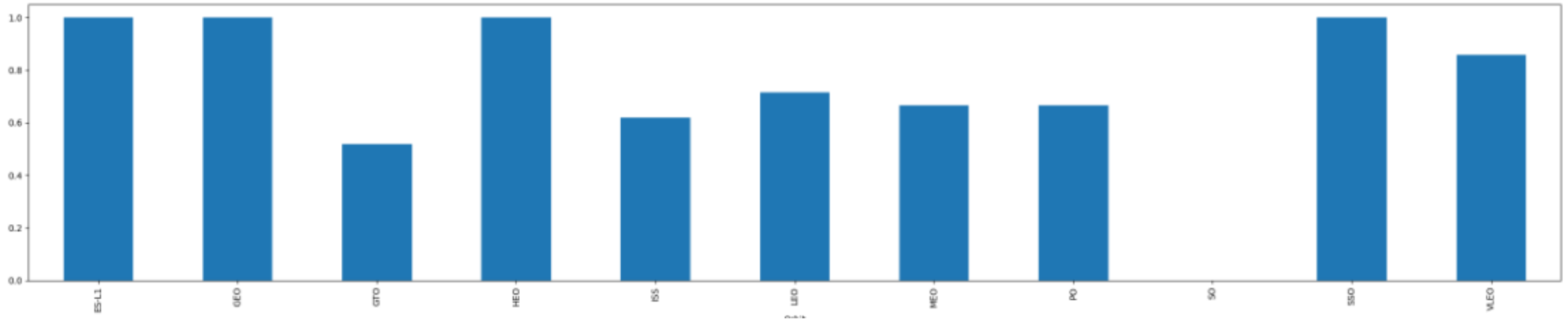
Payload Mass vs Launch Site:



Correlation between Launch sites and payload mass

RESULTS

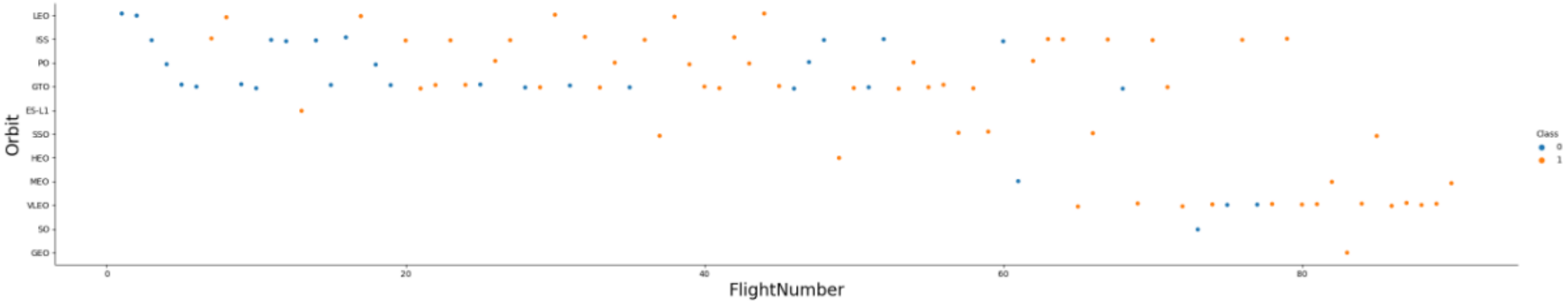
Orbit VS Success



Correlation between Orbit level and Success

RESULTS

Flight Number vs Orbit:



Different orbit levels verses success rates

SQL RESULTS

Distinct Launch Sites

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

SQL RESULTS

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

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

SQL RESULTS

TOTAL_PAYLOAD
111268

Total payload mass carried by boosters launched by NASA (CRS)

SQL RESULTS

AVG_PAYLOAD
2928.4

Average payload mass carried by booster version F9 v1.1

SQL RESULTS

FIRST_SUCCESS_GP
01-05-2017

First succesful landing outcome in ground pad was acheived.

SQL RESULTS

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

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

SQL RESULTS

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

Total number of successful and failure mission outcomes.

SQL RESULTS

Names of the 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

SQL RESULTS

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

Records which will display the month names, failure landing outcomes in drone ship ,booster versions, launch site for the months in year 2015.

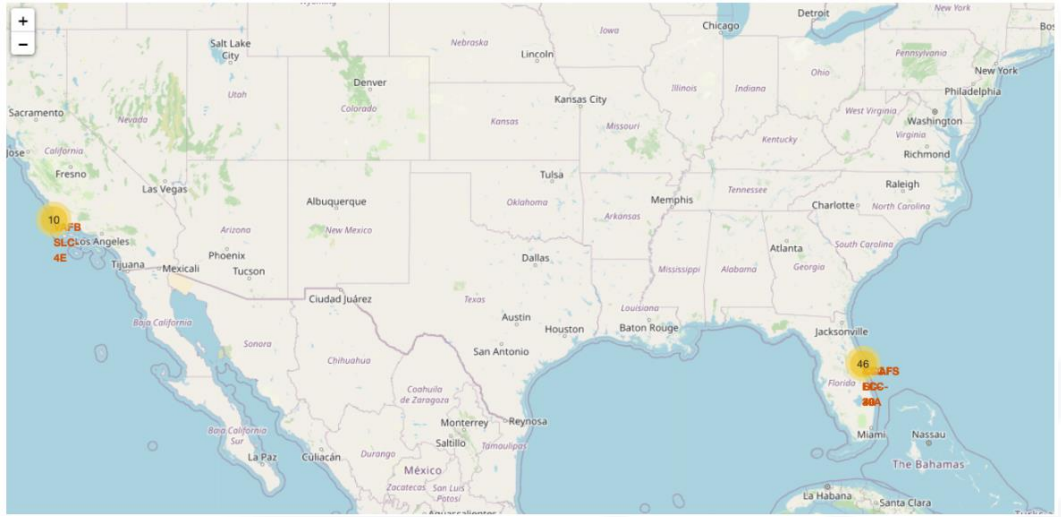
SQL RESULTS

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

Landing _Outcome	QTY
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

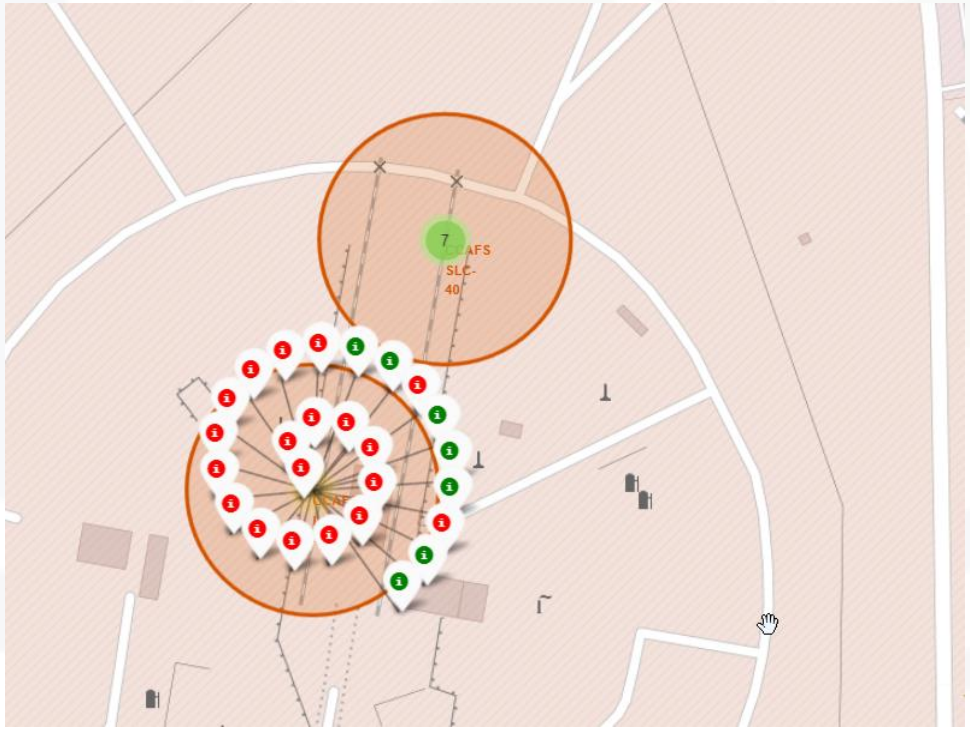
RESULTS

Folium Map:
Most launches are on the east coast
All are close to water



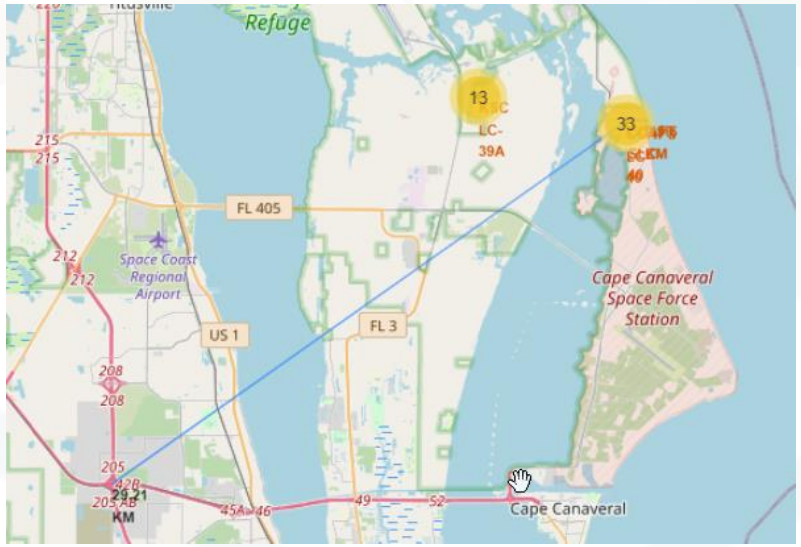
RESULTS

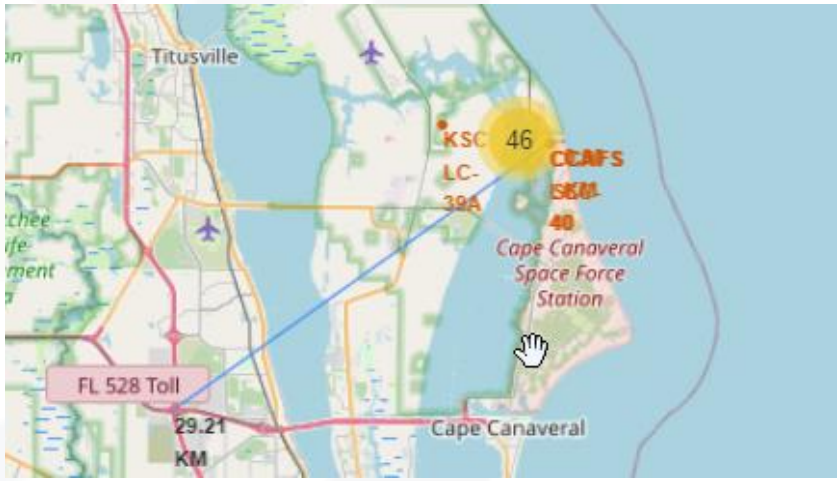
Folium Map:
Green is success, red is fail



RESULTS

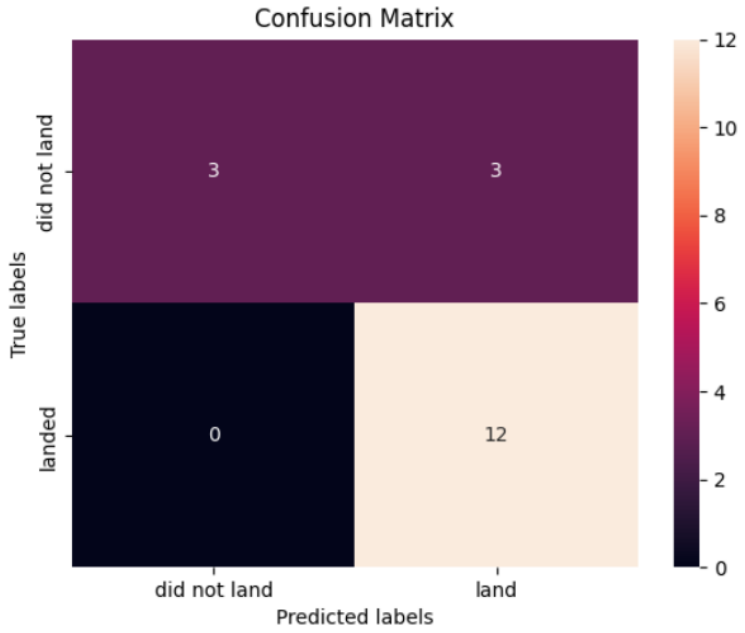
Folium Map:
Distances to ocean, highway, and airport





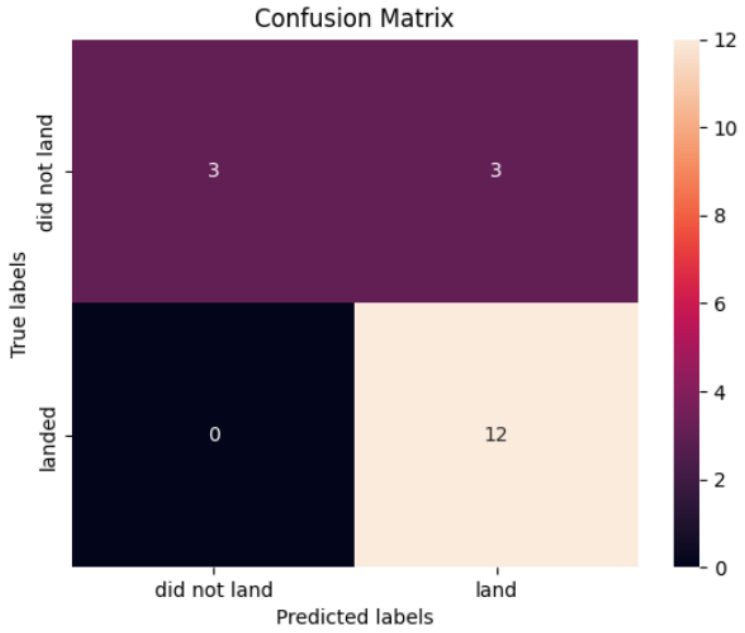
RESULTS

Predictive analysis:
Using the LogReg data



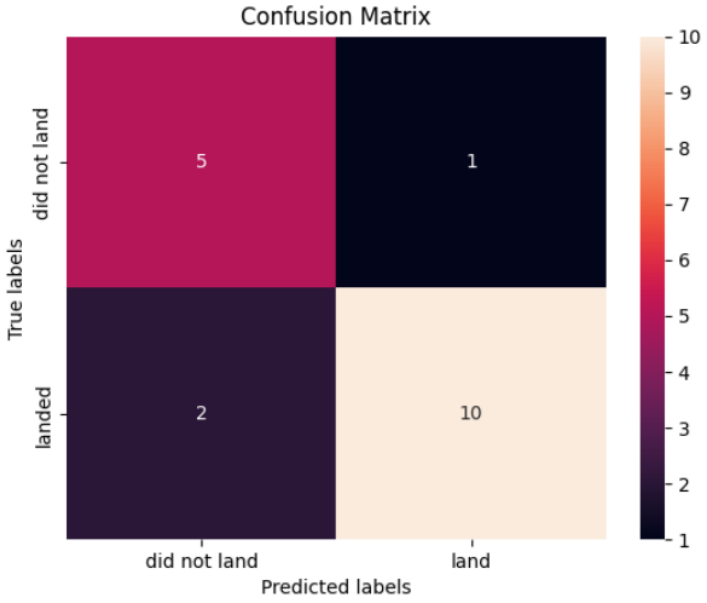
RESULTS

Predictive analysis:
Using the SVM data



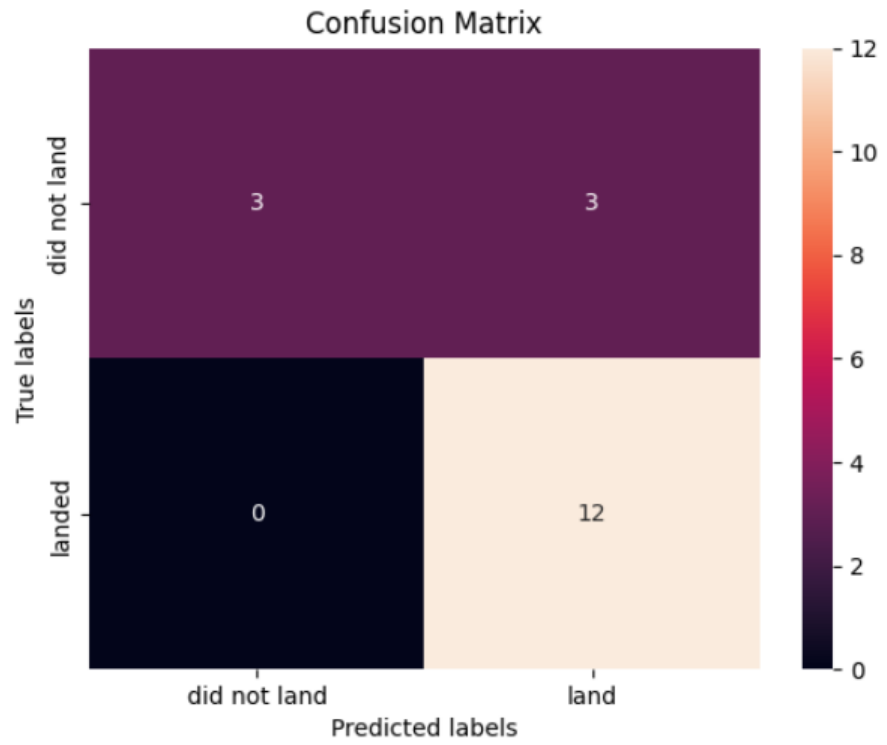
RESULTS

Predictive analysis:
Using the tree_cv data



RESULTS

Predictive analysis:
Using the knn_cv data

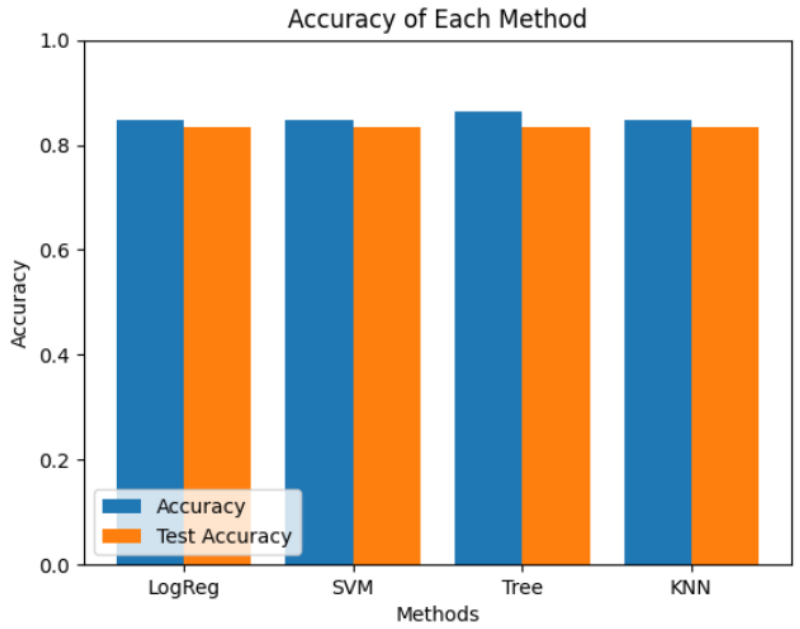


RESULTS

Predictive analysis:

Accuracy of predictive analysis was 86.4%

Test accuracy was 83.3%



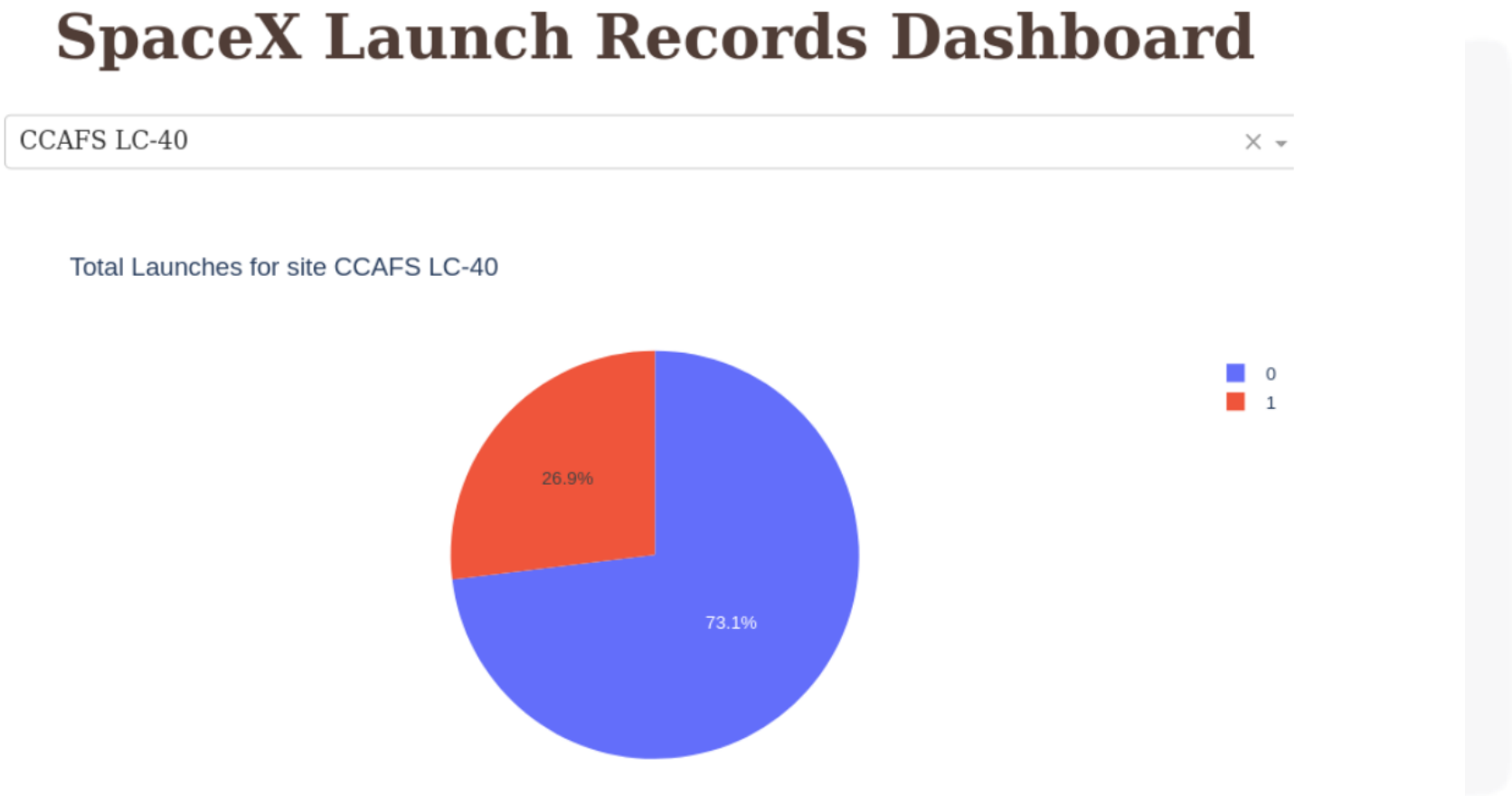
DASHBOARD

https://u9cmgrigsby-8050.theiadocker-2-labs-prod-theiak8s-4-tor01.proxy.cognitiveclass.ai/

DASHBOARD TAB 1

DASHBOARD TAB 2

DASHBOARD TAB 3



OVERALL FINDINGS & IMPLICATIONS

Findings

- Success increased over time
- Some launch sites were more successful, some improved more than others
- No correlation of mass versus success

Implications

- The data query of results
- One site has more successes, another shows more successes as time passes
- The graphs don't show an obvious trend of mass affecting the outcome

CONCLUSION

- Successful outcomes increased over time
- Payload and Orbit levels don't seem to affect the outcomes according to these findings
- We can predict future outcomes to a 86% accuracy rate

APPENDIX

- Success rates increasing until dipping in 2020