Space-X First Stage Reuse Rate

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OUTLINE

- Executive Summary
- Introduction
- Methodology
- Results
  - Visualization – Charts
  - Dashboard
- Discussion
  - Findings & Implications
- Conclusion
- Appendix

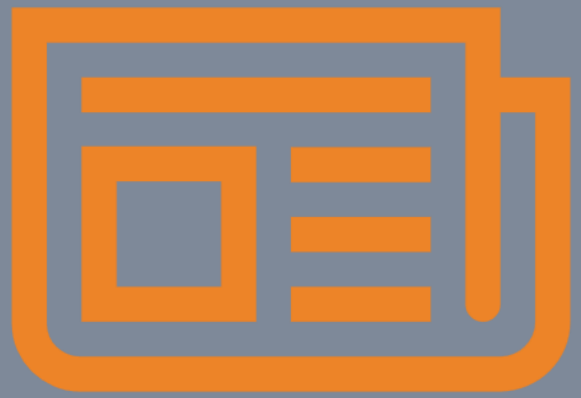
EXECUTIVE SUMMARY

- Important Cases of A Larger Success Margin
  - Payload between 2500 and 4000 kg
  - KSC LC-39A Launch Site with a 76.9% Success Rate
  - Time: as SpaceX has aged it has improved its chances dramatically, the first three years saw no success.
- The Booster Type May Play A Role In Success
- Two Major Keys To Cost Savings.
  - Land Transportation i.e. Train or Highway
  - Near Sea, presumably to reacquire wreckage and or a successfully landed rocket.
- Distance From Cities is not close

INTRODUCTION

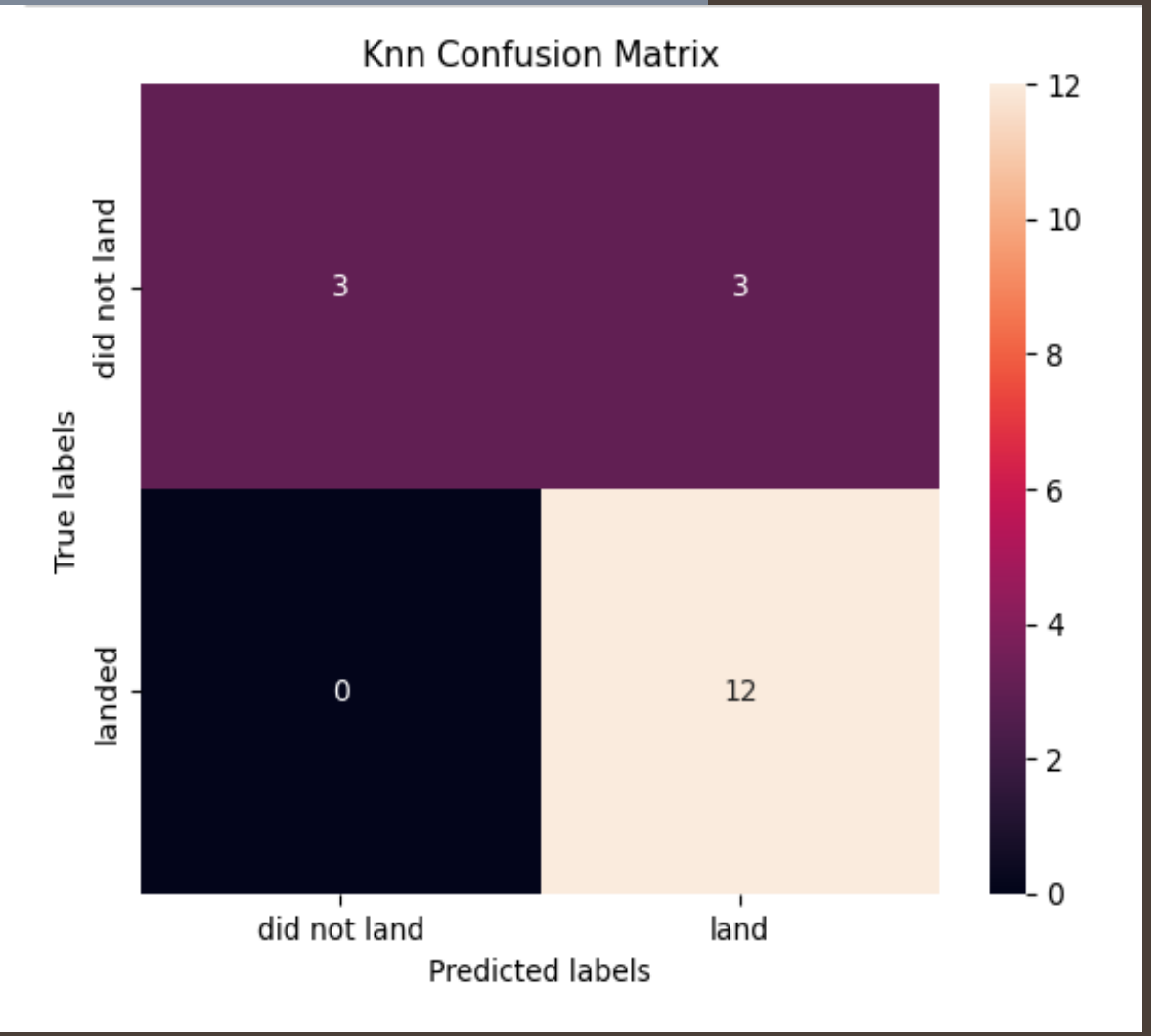
- Can information be gleamed about the chances of a successful landing.
- What factors contribute to a successful landing
- Under what circumstances does a successful landing take place
- Are there any lessons that can be learned by SpaceX to help SpaceY progress more quickly/efficiently

METHODOLOGY



- All data sourced came from the SpaceX Api via Skills Network or through Scraping Wikipedia
- Data Cleansing and Processing took place in Jupyter Notebook using a variety of packages.
- Data Visualizations were produced using Plotly/Dash, Seaborn, and Matplotlib
- Data Analysis was conducted using a number of Algorithms until the best results were found i.e.
  - Logistic Regression
  - Decision Tree
  - Support Vector Machine
  - K Nearest Neighbors ++ seems to be the best model

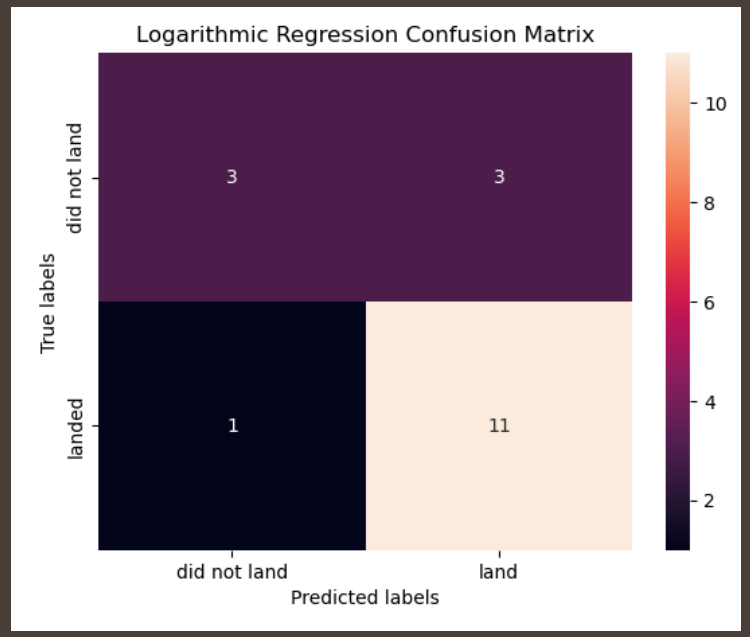
Optimal Parameters Were Found Using GridSearchCV For Each



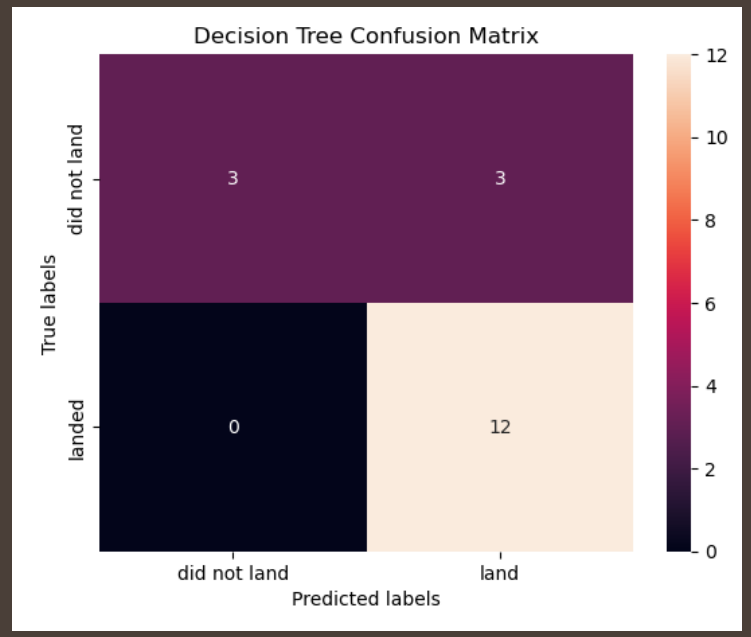
As Can Be Seen Here:
The Best Model: KNN
Could quite accurately determine a landing but false positives were abundant and essentially means you would have a 50/50 chance of accurately predicting a Failure. However, Landings seem quite easy to predict otherwise and the final result was an 83su[% chance of being correct. The failures of this model can be mitigated using the information further included in this presentation.

Other Models' Performance

Score of: .7777R



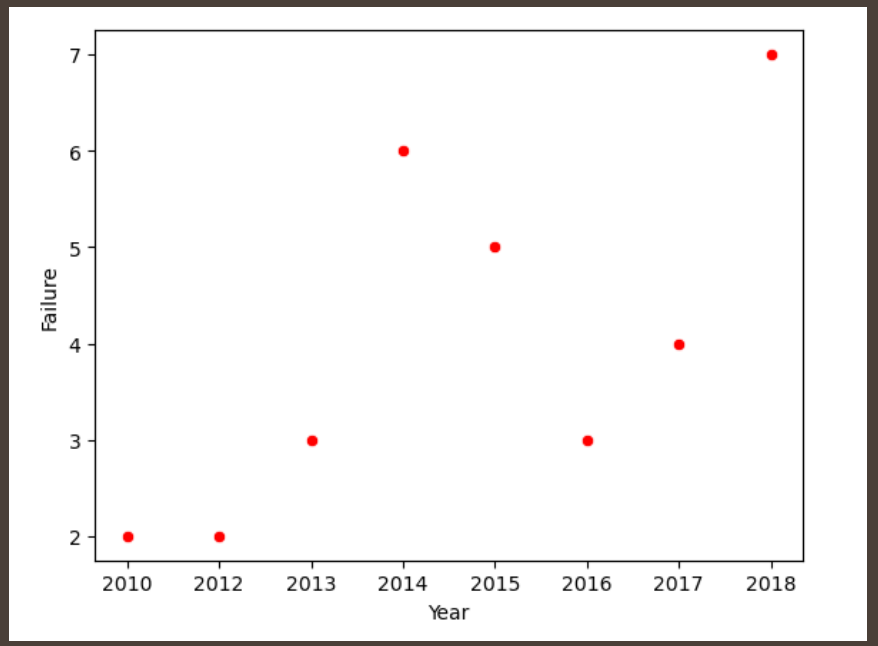
Score of: .8333R



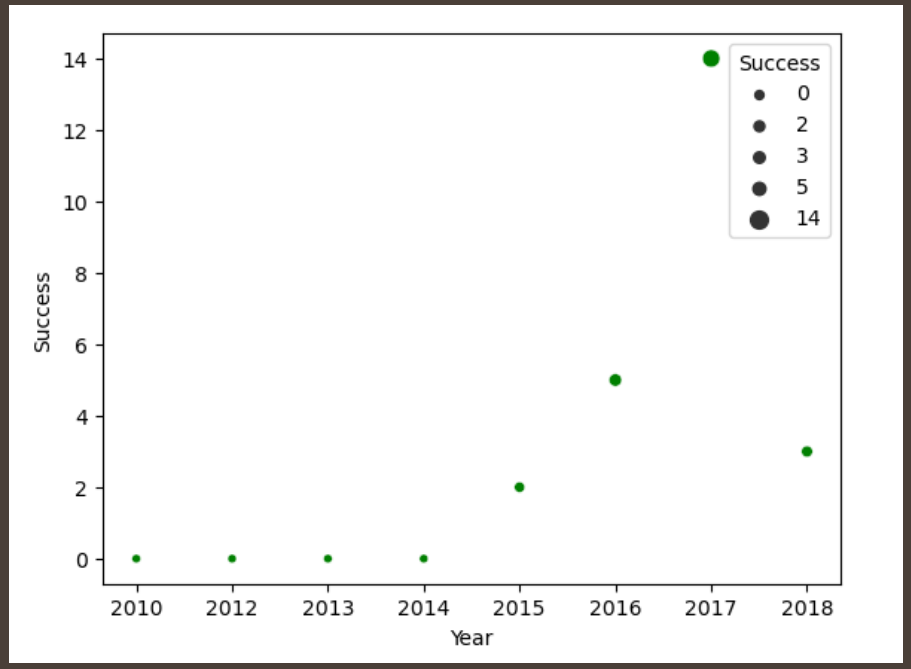
TRENDS

Year	Success	Failure
2010	0	2
2012	0	2
2013	0	3
2014	0	6
2015	2	5
2016	5	3
2017	14	4
2018	3	7

Failures By Year



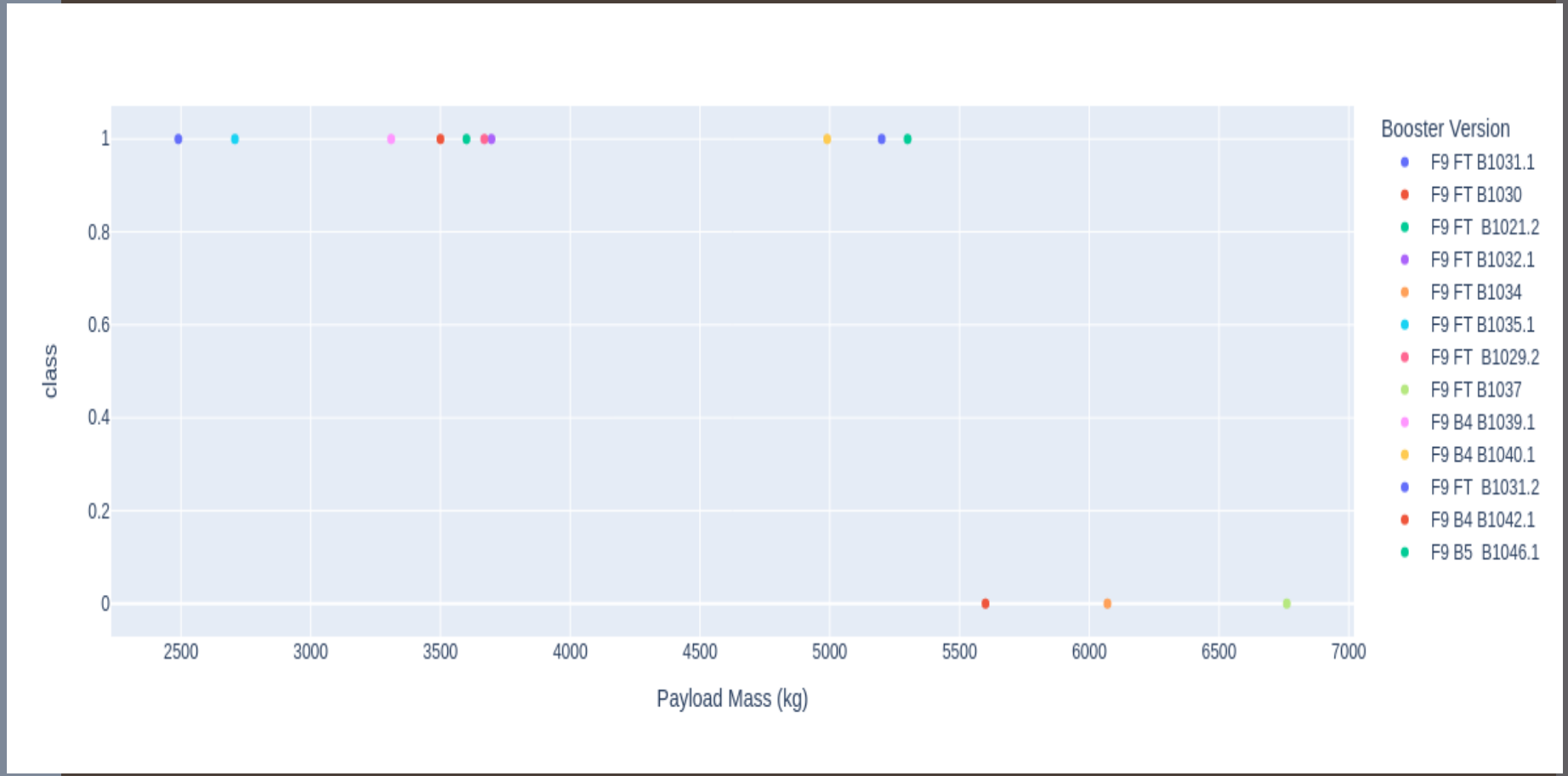
Success By Year



Successful Landing Trends

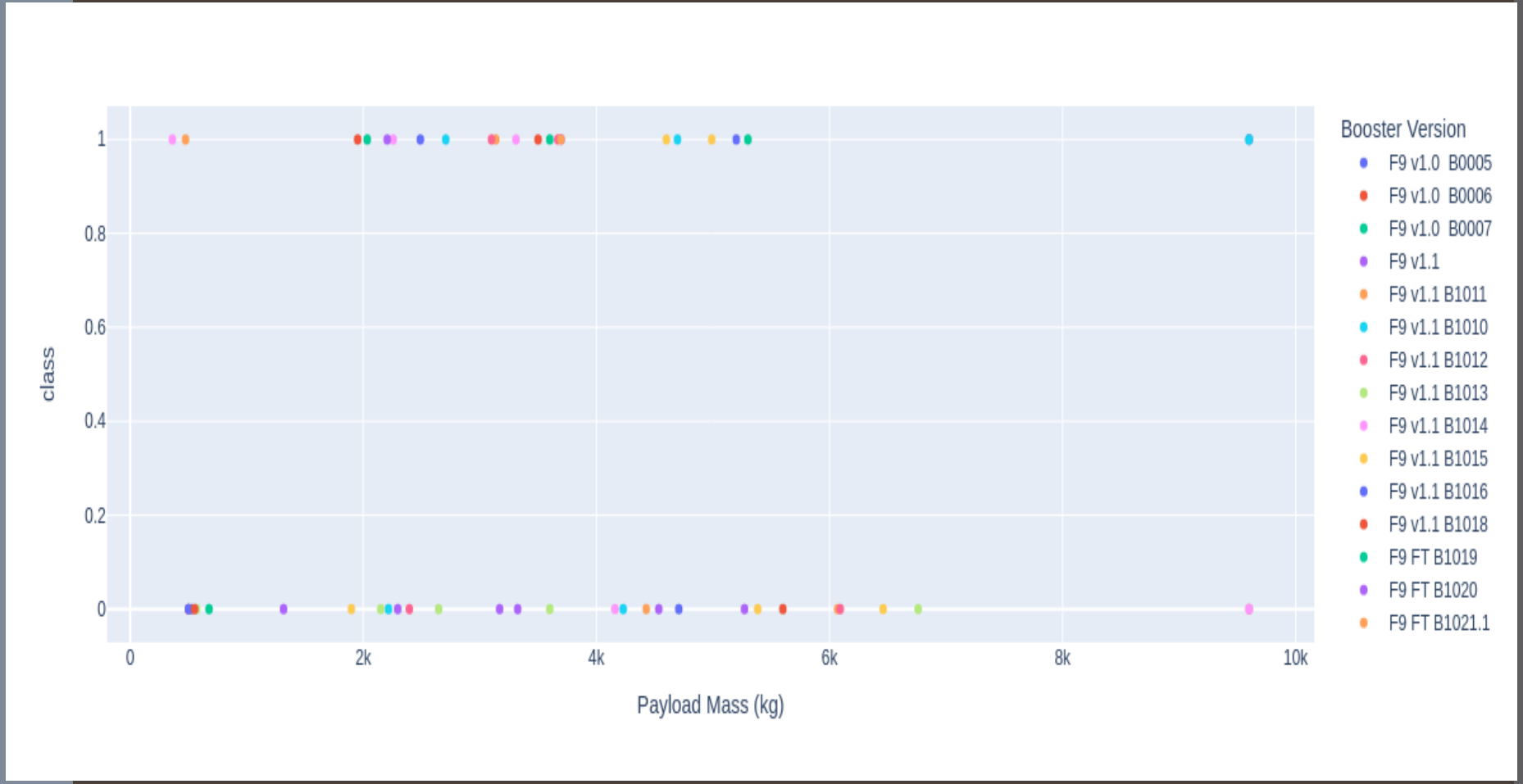
Findings	Implications
Since 2017 Higher % Successes	Something Changed Here
More Fails than Successes Overall	Starting SpaceY Will Probably Start In Failure To Some Extent
Successes are dependent on a number of factors	Factors That Contribute To Success Should Be Optimized and Prioritized

Best Payload Criteria

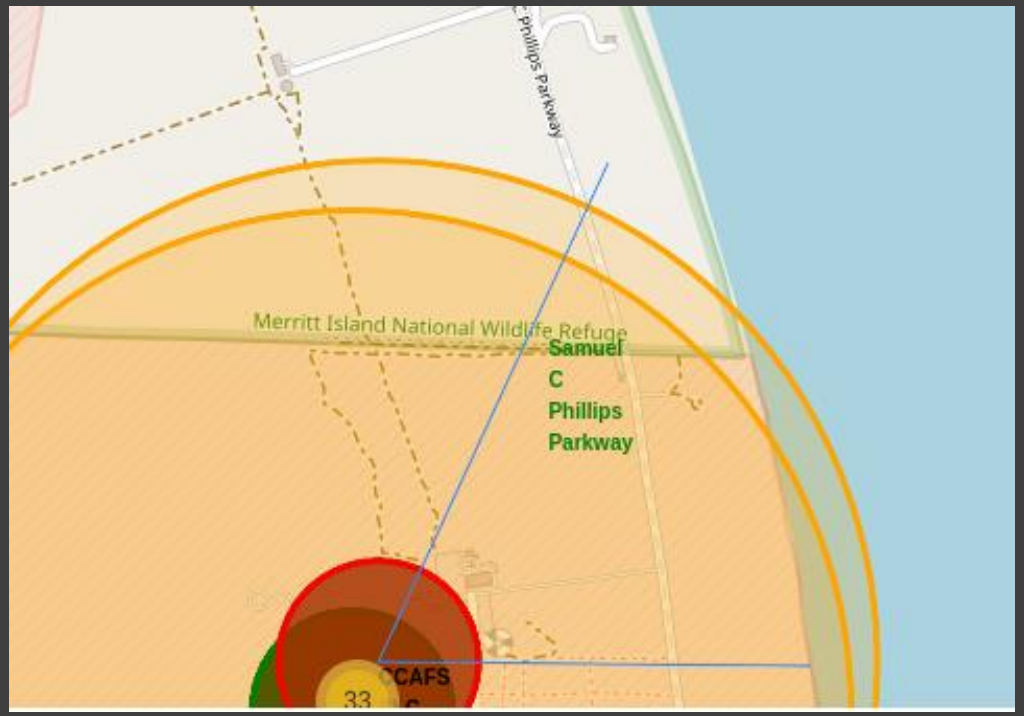


As Discussed Before, different payload weights 'x-axis' are seemingly a strong contributor to success This Graph Shows Only Those Launch Sites From KSC LC-39A as it too has a high success rate.

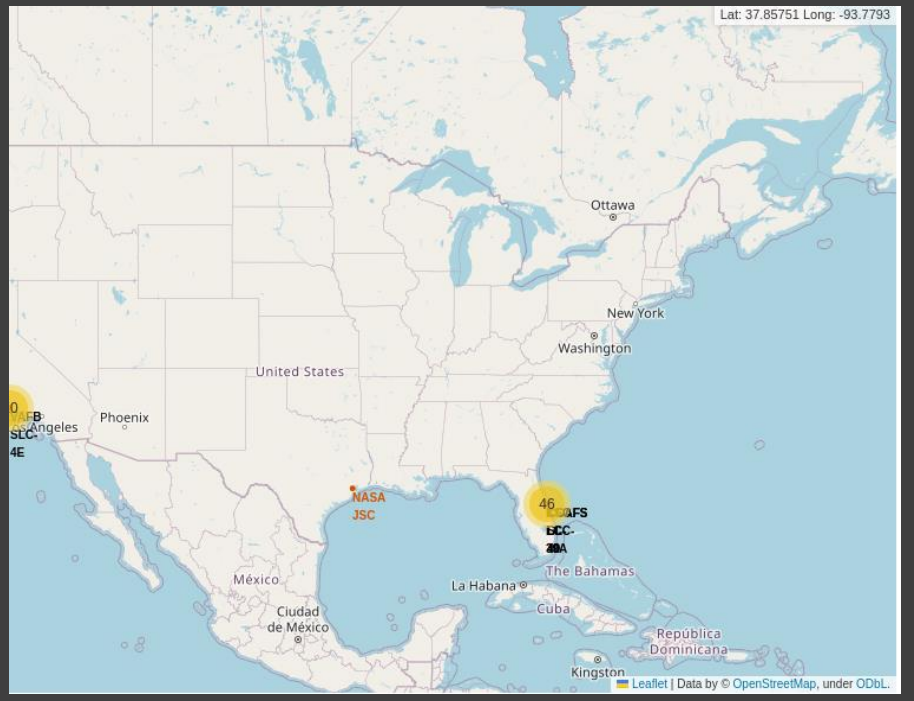
All Weights



In Contrast This Graph Shows All Weights and All Launch Sites. Seemingly Launch Site Is A Stronger Indicator, But The Payload Has A Sweet Spot: Roughly 2000kg -> 6000kg Overall.



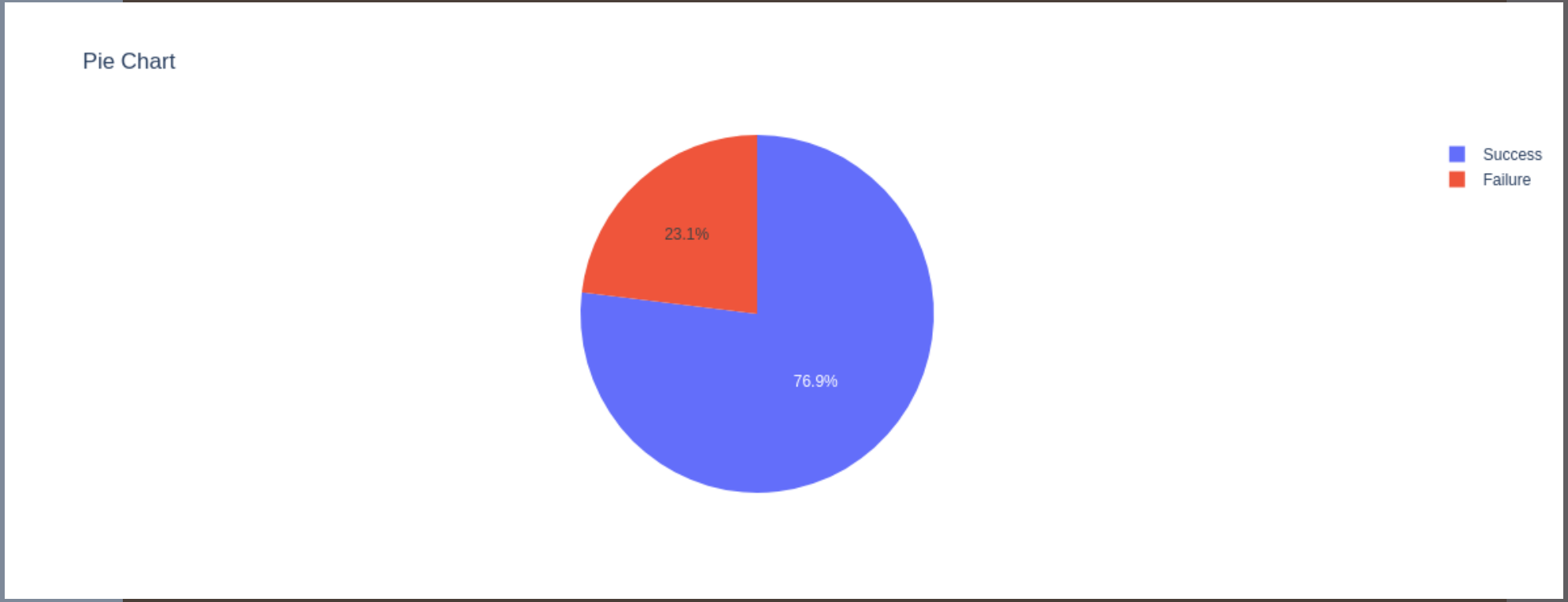
Near a highway



All Launch Sites Near The Ocean

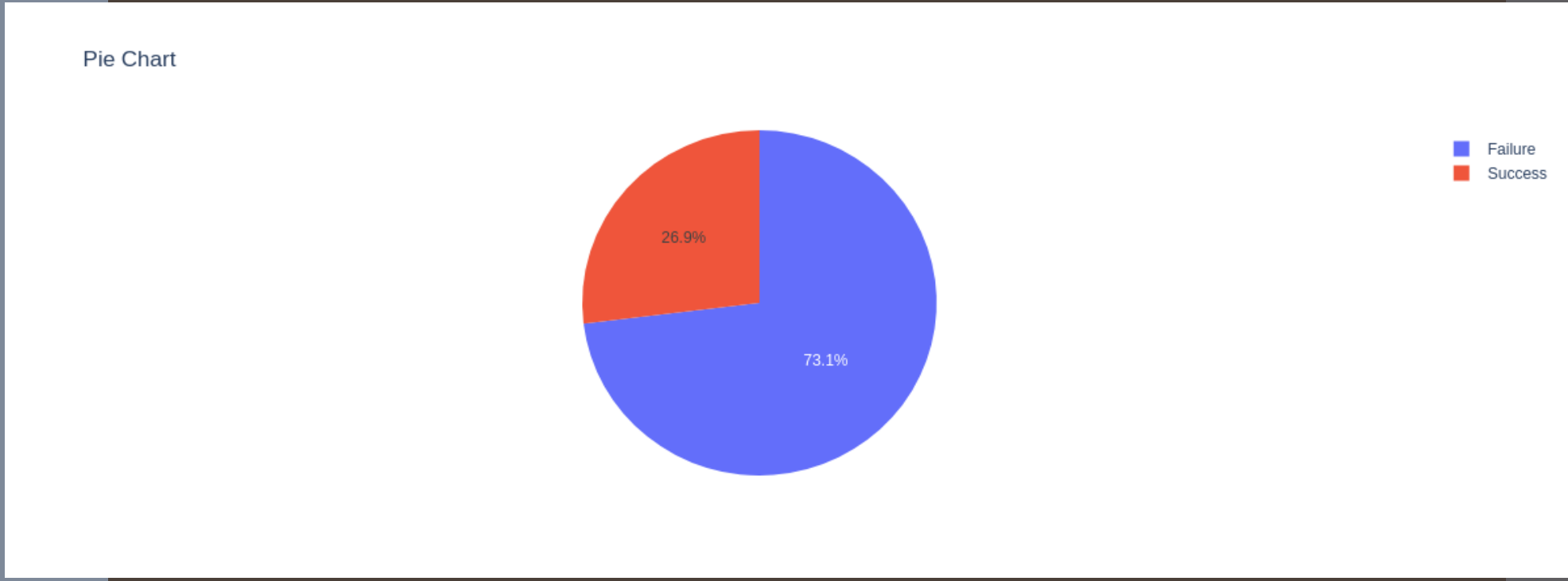
Locations

Launch Site KSC LC-39A Success Rate



Launch Site KSC LC-39A shows a 76.9% chance of success, not accounting for load.

Launch Site KSC CCAFS LC-40 Success Rate



In Contras KSC CCAFS LC-40 shows about the opposite in terms of odds.

Overall Successes By Landing

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

```
%%sql
SELECT COUNT("Landing _Outcome") as success_count, "Landing _Outcome" FROM spacex
WHERE "Date" BETWEEN '04-06-2010' AND '20-03-2017'
AND "Landing _Outcome" LIKE '%Success%'
GROUP BY "Landing _Outcome"
ORDER BY success_count DESC
```

3 rows affected.

	success_count	Landing _Outcome
0	20	Success
1	8	Success (drone ship)
2	6	Success (ground pad)

We Can See Here All The Different Types Of Landings Given And How Many Each Has Provided A Successful Landing.

Best Booster Type

Class is a representation of success or failure:
1 = Success
0 = Failure

The Two Best Booster Types
B4 and **FT**:
FT has a Success Rate of 16/24
= 66.66R%
B4 has a Success Rate of 6/11
= 54.54R%

	Booster Version	class
0	F9 B4 B1039.2	0
1	F9 B4 B1040.2	0
2	F9 B4 B1041.2	0
3	F9 B4 B1043.2	0
4	F9 B4 B1039.1	1
5	F9 B4 B1040.1	1
6	F9 B4 B1041.1	1
7	F9 B4 B1042.1	1
8	F9 B4 B1043.1	1
9	F9 B4 B1044	0
10	F9 B4 B1045.1	1
11	F9 B5 B1046.1	1
12	F9 FT B1021.2	1
13	F9 FT B1029.2	1
14	F9 FT B1031.2	1
15	F9 FT B1032.2	0
16	F9 FT B1035.2	1
17	F9 FT B1036.2	0
18	F9 FT B1038.2	0
19	F9 FT B1019	1
20	F9 FT B1020	0
21	F9 FT B1021.1	1
22	F9 FT B1022	1
23	F9 FT B1023.1	1
24	F9 FT B1024	0
25	F9 FT B1025.1	1
26	F9 FT B1026	1
27	F9 FT B1029.1	1
28	F9 FT B1030	0
29	F9 FT B1031.1	1
30	F9 FT B1032.1	1
31	F9 FT B1034	0
32	F9 FT B1035.1	1
33	F9 FT B1036.1	1
34	F9 FT B1037	0

OVERALL FINDINGS & IMPLICATIONS

Findings

At Site KSC LC-39A With **2500kg** > Payload < **5500kg** Has Never Failed.

KSC LC-39A & **CCAFS LC-40** both have a high absolute number of successes. (**10**) and (**7**) respectively

Implications

Specifics reasons should be learned to determine how to take advantage of these variables.

These Locations and subsequent landings should be considered for future prospects

CONCLUSION

Emulate Launch Sites

Emulate Payloads

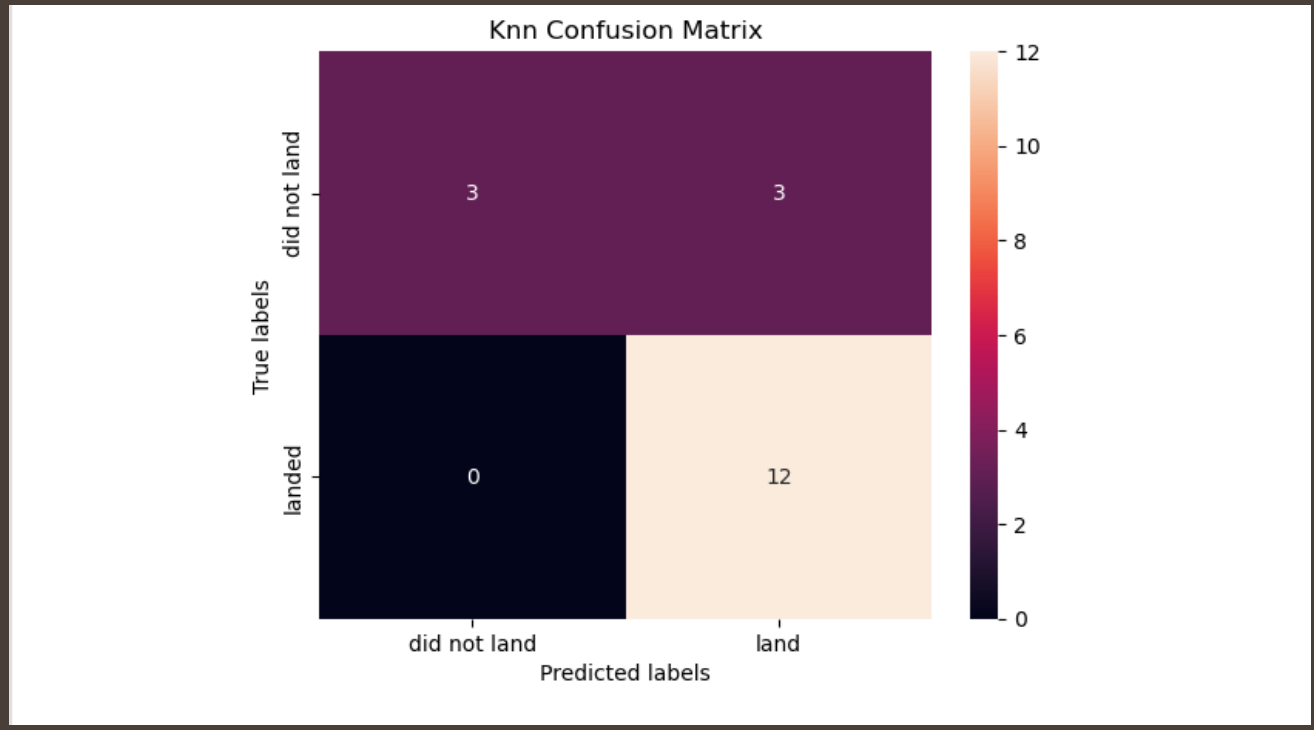
Emulate Booster Types

Final Statements:

Research is needed to learn exactly why certain launch sites lend themselves to better results.

The end goal should be to create a niche for SpaceY using the information herein and after the above mentioned recommendation, thus becoming competitive at a substantially lesser startup cost.

CONCLUSION Continued



Graphs all point in one direction: rockets lifting off from Florida within the payload range of 2000 -> 6000 are most feasible

Through queries it can be understood that drone landings are done with the FT Booster Versions and ground landings are done with both the FT and B4 booster version

The dashboard corroborates the above.

In order to make a better model, more data is necessary to remove so many false positives.

APPENDIX

SVM Did Equally Well in Prediction

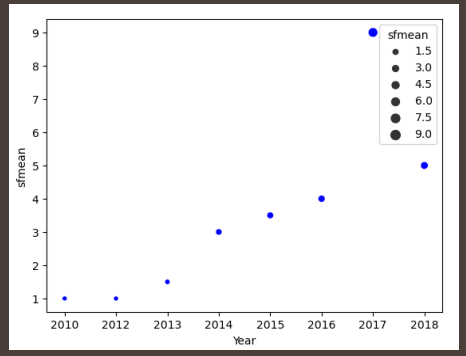
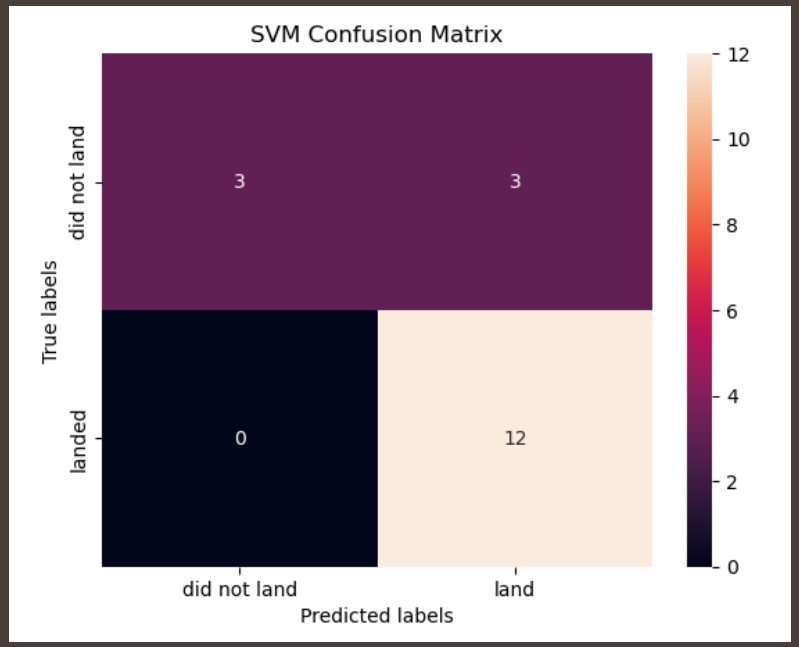
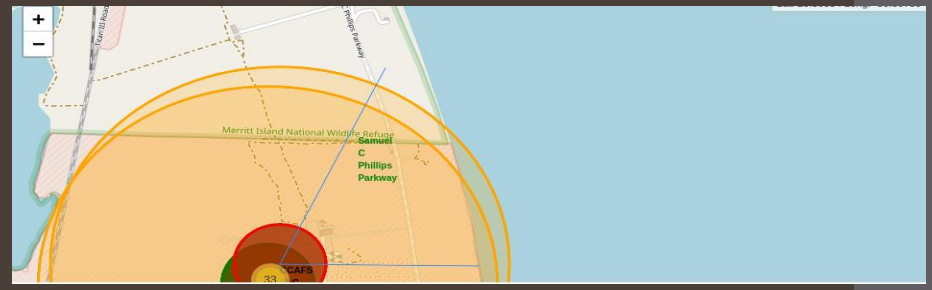


Chart of Squared Mean of (Success – Failure) of the charts shown earlier.





As Described, here is an example of a Launch Site Near the Ocean, Near a Highway as well as a railroad in top right corner. There are No Cities nearby, so a bit remote.

SVM Model Also Shows Good Results, It was redundant and so left here for those who might be curious about it.

Thanks To IBM For Providing And Mostly Curing This Data :)