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SPACE Y

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OUTLINE



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EXECUTIVE SUMMARY

- This project aims to analyze the data from SpaceX Falcon 9 rockets and determine the success rate of their landing attempts. The project uses descriptive and inferential statistics, as well as data visualization techniques, to explore the factors that affect the landing outcomes.
- The key findings of the project are:
 - The overall success rate of Falcon 9 landing attempts is 66%, with 60 successful landings out of 90 attempts.
 - CCAFS SLC 40 Launch Site is the most successful with 33 successful landings, the least successful is the VAFB SLC 4E with 10 successful landings.
 - The success rate varies depending on the landing location, the mission type, the launch year, and the booster version.
 - The most successful landing location is the drone ship, with a 45.56% success rate, followed by the ground pad, with a 15.56% success rate.
 - The most successful Orbit is the GTO, with a 15.56% success rate, followed by the ISS, with a 14.44% success rate.

INTRODUCTION

The goal of this project is to determine the possibility of SPACE Y, a new company entering the industry of space exploration, efficiently launching their rockets and landing the first stage successfully so as to operate economically and effectively.



To do this, we explore the success rate of SPACE X, a leading space exploration company, in landing their first stage successfully. Further, we examine the factors that enhance their success thereby providing the necessary information to enable SPACE Y land their first stage rocket launches successfully.

According to SPACE X, their rocket exploration tours cost \$62 million, which is considerably cheap compared to \$165 million and upwards which is charged by other companies in the industry.

METHODOLOGY

Various data analysis methods were used in pursuit of results.

Exploratory Data Analysis provided the means to understand the relationship between various features in the dataset. Features such as the outcome of the launches and orbit in relation to the launch sites are easily related through the method.

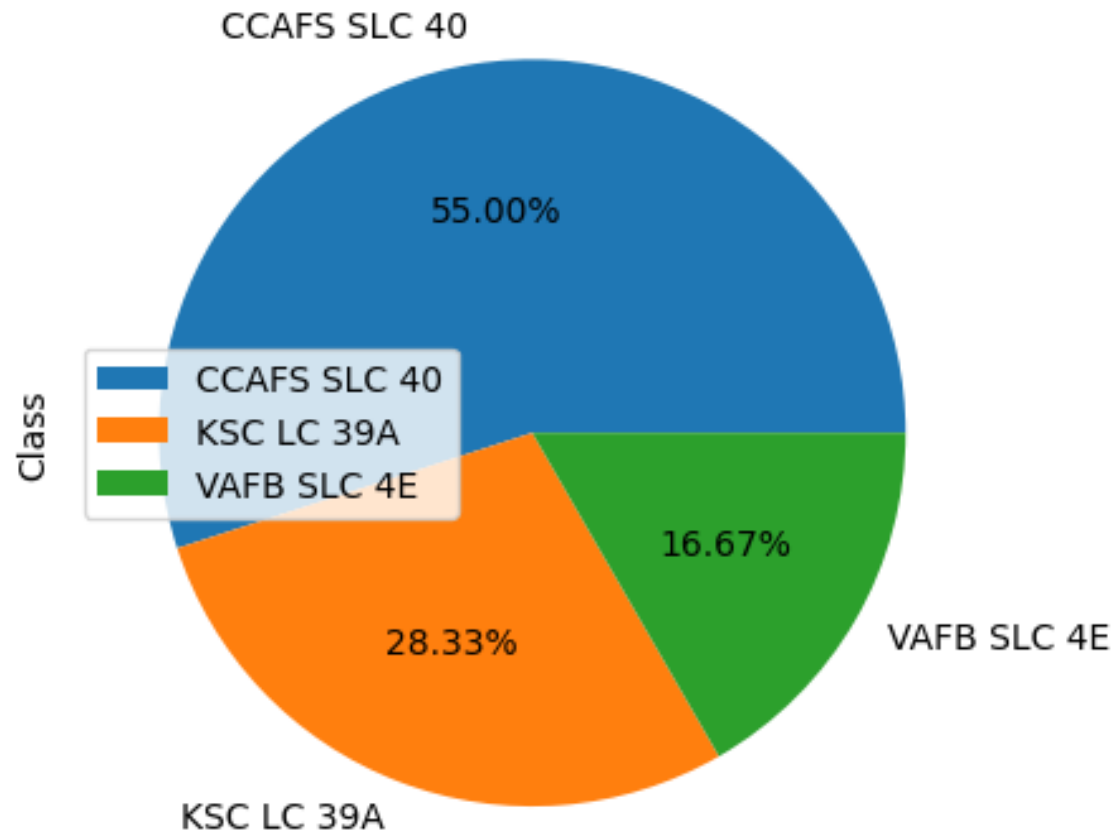
Descriptive Analysis summarized the data through statistics and visualizations such as means, pie charts and histograms which further helped to understand the data.

Through Predictive Analysis, model development was possible which enhanced the results of the dataset and it's ability to predict future successes or failures of rocket launches.

RESULTS

- The overall success rate of Falcon 9 landing attempts is 66%, with 60 successful landings out of 90 attempts.
- CCAFS SLC 40 Launch Site is the most successful with 33 successful landings, the least successful is the VAFB SLC 4E with 10 successful landings.
- The success rate varies depending on the landing location, the mission type, the launch year, and the booster version.
- The most successful landing location is the drone ship, with a 45.56% success rate, followed by the ground pad, with a 15.56% success rate.
- The most successful Orbit is the GTO, with a 15.56% success rate, followed by the ISS, with a 14.44% success rate. SO was the least successful Orbit, while HEO, GEO, ES-L1 had considerably low ranking success in the landing of their first stages.
- The success of the Launch Sites increased with the increase in the Flight Numbers. Notably, Flight Numbers that exceeded 80 for all the Launch Sites landed successfully.
- Similarly, Payload Masses that exceeded 8000 kgs had a higher success rate across the Launch Sites.

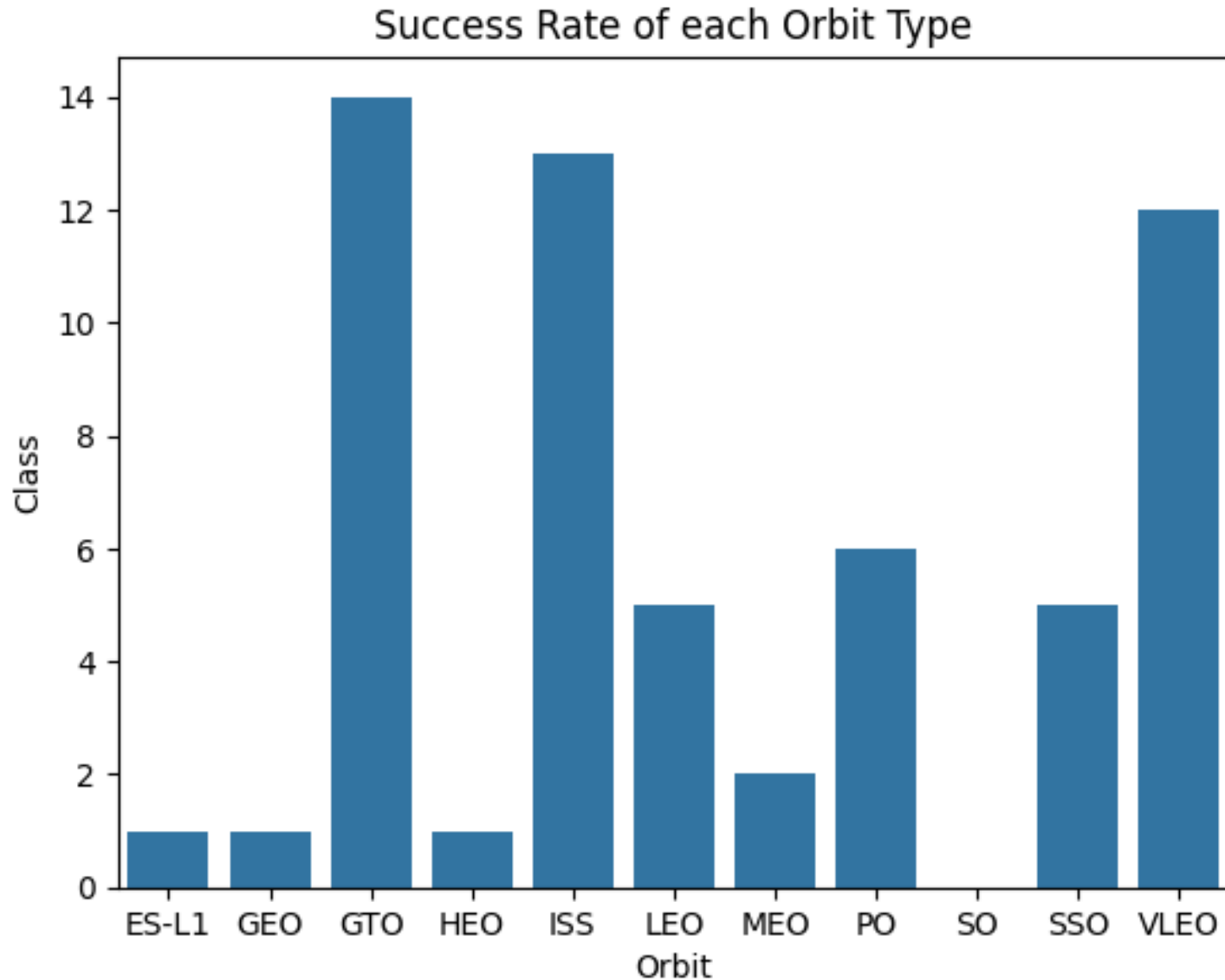
Successful Landings per LaunchSite



LAUNCH SITE SUCCESS RATES

CCAFS SLC 40 Launch Site is the most successful with 33 successful landings, the least successful is the VAFB SLC 4E with 10 successful landings.

KSC LC 39A had 17 successful landings

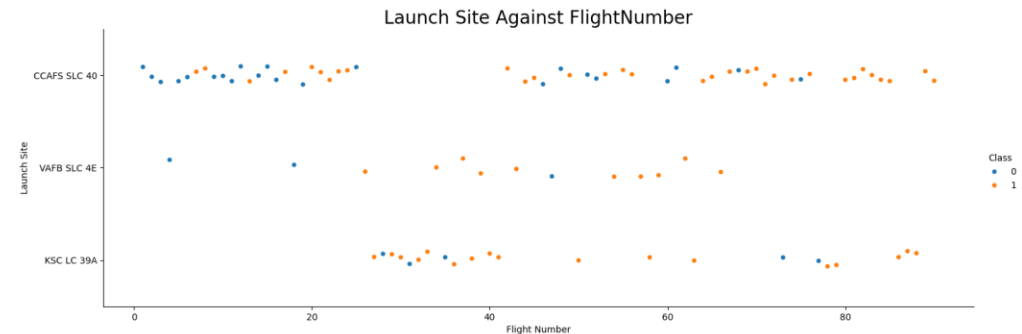


SUCCESS RATE OF EACH ORBIT TYPE

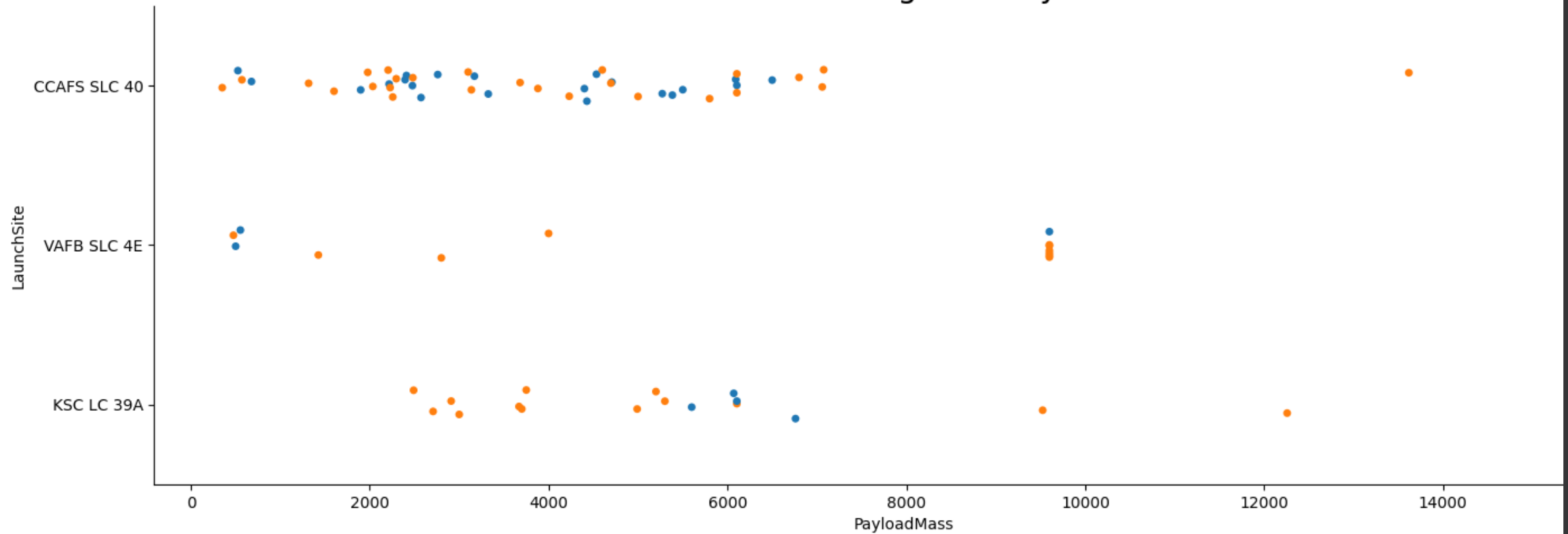
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Launch Sites Compared to Flight Numbers

- The success of each launch site increased with the flight numbers.
- CCAFS SLC 40 and KSC LC 39A performed better compared to VAFB SLC 4E on higher flight numbers.
- VAFB SLC 4E produced better yield sooner as the flight numbers increased.



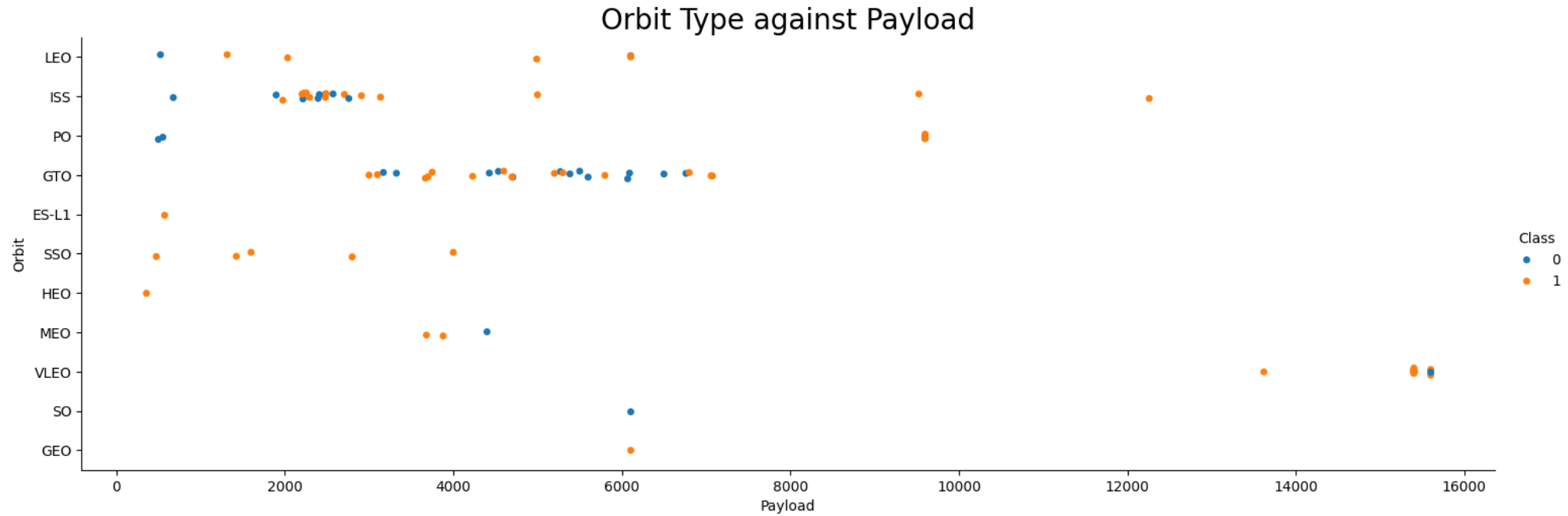
Launch Site Against Payload



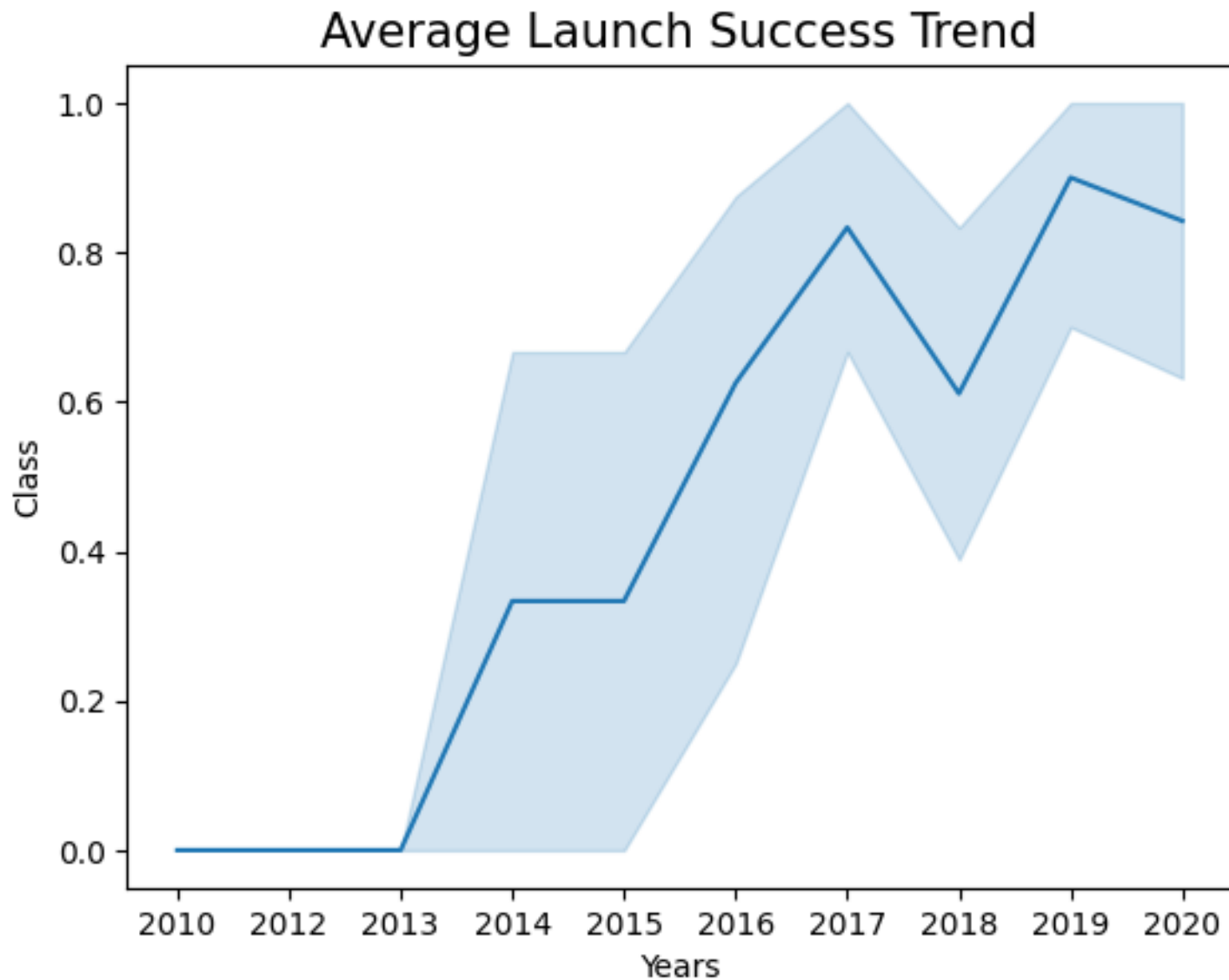
Launch Site Against Payload Mass

As the Payload Mass increases the success rate for landing the first stage increases. This is noticeable in the CCAFS SLC 40 and KSC LC 39A launch sites.

VAFB SLC 4E performs exceptionally well in landing the first stage on lower Payload Masses.



Comparing the Orbit type against Payload, it is evident that higher payload masses yielded successful landing of the first stage. ES-L1, SSO, LEO, HEO had exceptional success in landing whereas GTO can be observed to have mixed outcomes indicating that the Payload Mass did not bear any correlation to landing the first stage of the rockets.



Success Trend Yearly

It can be observed that there was a steep increase in the average success rate of landing the first stage from the year 2013 to 2017. There was a slight drop between 2017 and 2018 before the trend picked up forward to 2020.

DISCUSSION

Based on the findings from the analysis it is evident that SPACE X falcon 9 rockets have an above average success rate of landing their first stage at 66%. This enables them reuse their rockets which is the main reason for their cheap pricing.

CCAFS SLC 40 Launch Site is the most successful with 33 successful landings, the least successful is the VAFB SLC 4E with 10 successful landings. There is no clear reason indicating the cause of the difference in the success of the launch sites.

It is notable to indicate that generally the success of landing the first stage increased with an increase in the number of flights across all launch sites. The success rate of all the sites with the increase in the Flight Number is consistent with the general success rate of the launches.

GTO is the most successful Orbit Type followed by ISS and VLEO, on the contrary, SO,HEO, and ES-L1 yielded the least number of successful landings.

Interestingly, the Payload Mass had a positive impact on both the Launch Site's and Orbit Type's success rate. As the mass increased, the success of the features equally increased.

There has been a steady rise in the successes of the landings from the year 2013 onwards. However, this has not been without occasional dips in the trend as can be observed in the year 2017 –2018.

CONCLUSION

In conclusion, the strategy by SpaceX to reuse their first stage is working and can be attributed to being responsible for the relatively cheap launching cost. Various launch sites for the company have varying success rates with CCAFS SLC 40 taking the lead. It is recommended to consider more factors that can influence the success rate of landing the first stage from these sites.

Also, further analysis and research should be done to enhance the understanding of the relationship between the payload mass and the success in landing the first stage. Consequently, it can be derived from this research that it is indeed possible to reuse the first stage of a launch hence provide launching services at affordable and competitive prices to SpaceX.