SpaceX Rocket Landing Success Analysis

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SKILLS NETWORK

OUTLINE

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EXECUTIVE SUMMARY

- In this capstone, we will predict if the Falcon 9 first stage will land successfully.
- Price:
  - 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.

INTRODUCTION

- Falcon 9 first stage could be reusable; therefore it is a big factor on saving money.
- This analysis aims to find out which parameters and circumstances are crucial for determining the success of first stage landing/retrieval.
- Booster Version, Payload Mass,
- Orbit, LaunchSite, and other parameters were included in analysis.

METHODOLOGY

- Data Collection:
  - Request to the SpaceX API
  - Clean the requested data
  - Performing web scraping to collect Falcon 9 historical launch records from a Wikipedia
- Data Wrangling by execute SQL queries, perform exploratory data analysis and determine training labels.
- Data Visualisation.
- Model Creation.

RESULTS

- Data Analysis insights
- Data Visualization: plots, dashboard screens, maps
- Modeled Predictions: Logistic Regression, Support Vector Machine, k neighbours, Decission tree.

DATA ANALYSIS INSIGHTS

The number of launches on each site:

CCAFS SLC 40	55
KSC LC 39A	22
VAFB SLC 4E	13

Succefull Landings – 60, other – 30.

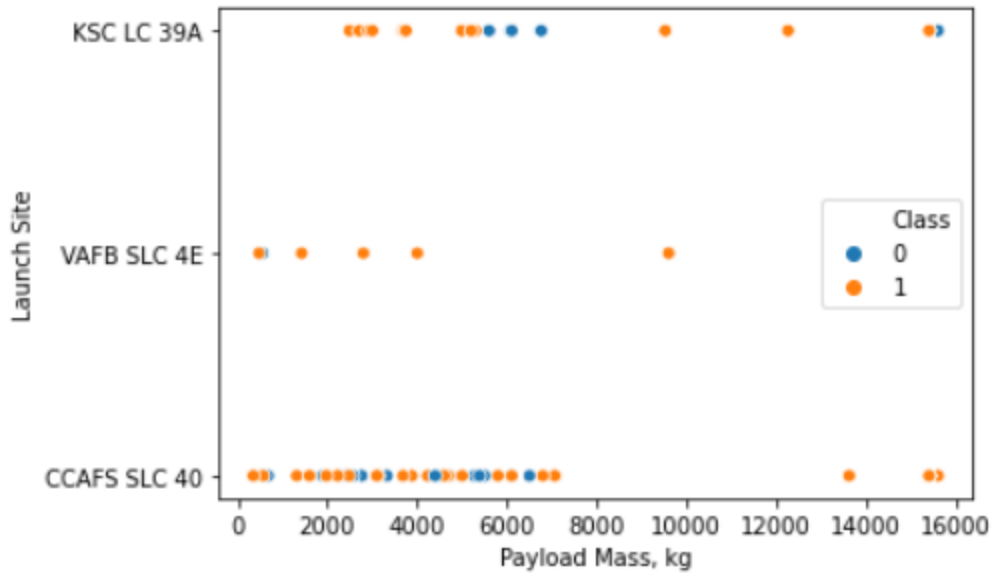
The number and occurrence of each orbit:

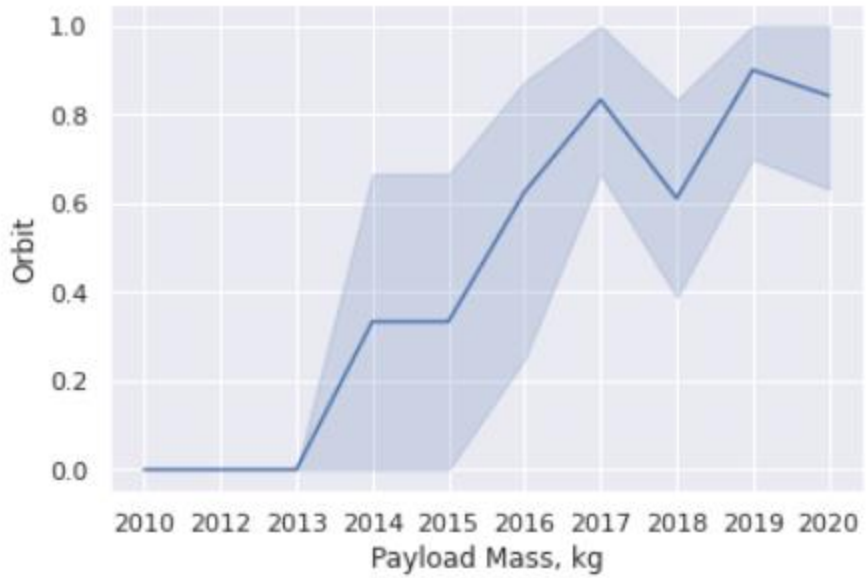
GTO	27
ISS	21
VLEO	14
PO	9
LEO	7
SSO	5
MEO	3
ES-L1	1
HEO	1
SO	1
GEO	1

DATA ANALYSIS SQL RESULTS

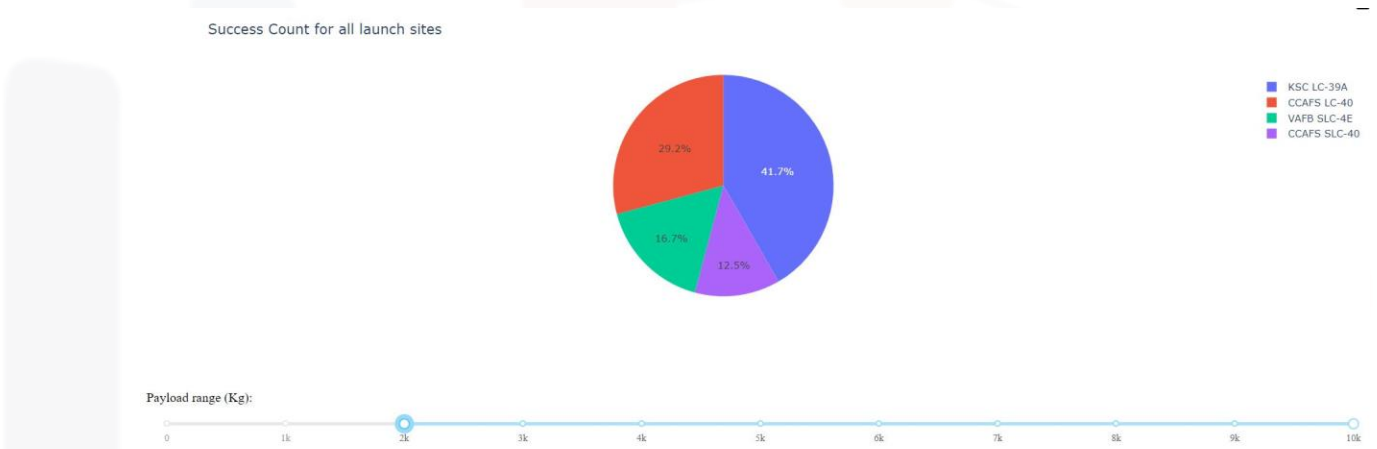
1. %sql select distinct Launch_Site from SPACEXTBL
2. %sql select * from SPACEXTBL where Launch_Site like 'CCA%' limit 20
3. %sql select sum(PAYLOAD_MASS__KG_) from SPACEXTBL
4. %sql select avg(PAYLOAD_MASS__KG_) as avg from SPACEXTBL where booster_version = 'F9 v1.1'
5. %sql select date from SPACEXTBL WHERE "Landing _Outcome" Like '%ground pad%' and "Landing _Outcome" Like 'Success%'
6. %sql select distinct Booster_Version from SPACEXTBL Where PAYLOAD_MASS__KG_ >4000 and PAYLOAD_MASS__KG_ <6000 and "Landing _Outcome" Like '%drone ship%' and "Landing _Outcome" Like 'Success%'
7. %sql select count(mission_outcome) as Counted, mission_outcome from SPACEXTBL group by mission_outcome
8. %sql select booster_version, PAYLOAD_MASS__KG_ from SPACEXTBL where PAYLOAD_MASS__KG_ = (select max(PAYLOAD_MASS__KG_) from SPACEXTBL)
9. %sql select substr(Date, 4, 2) as month, "Landing _Outcome", booster_version, Launch_site from SPACEXTBL where substr(Date, 7, 4) = '2015' and "Landing _Outcome" Like '%Failure (drone ship)%'
10. %sql select "Landing _Outcome", date from SPACEXTBL where DATE BETWEEN '04-06-2010' AND '20-03-2017' order by date desc

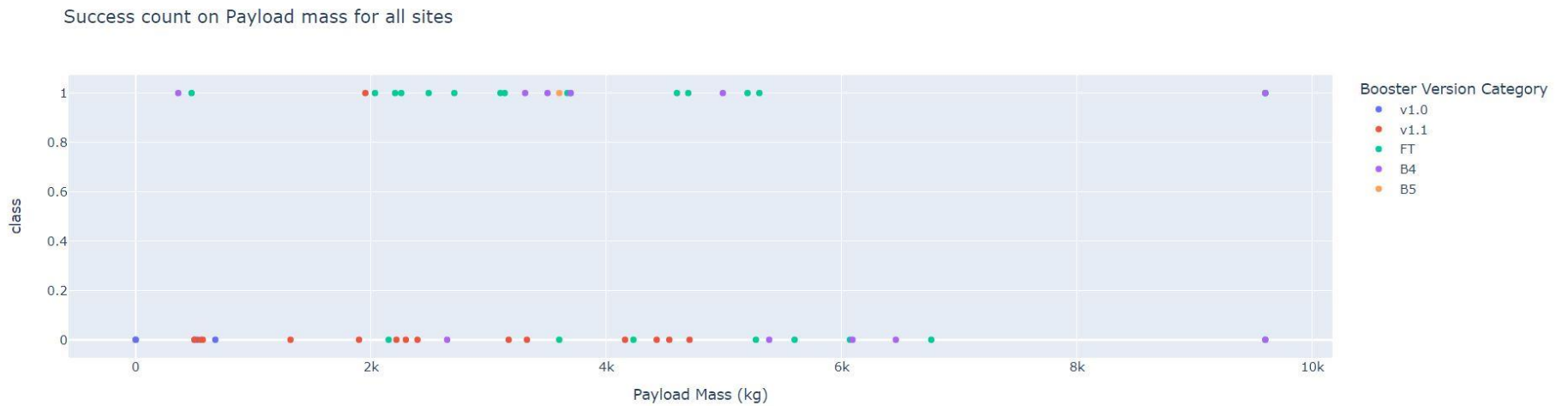
DATA VISUALIZATION: PLOTS



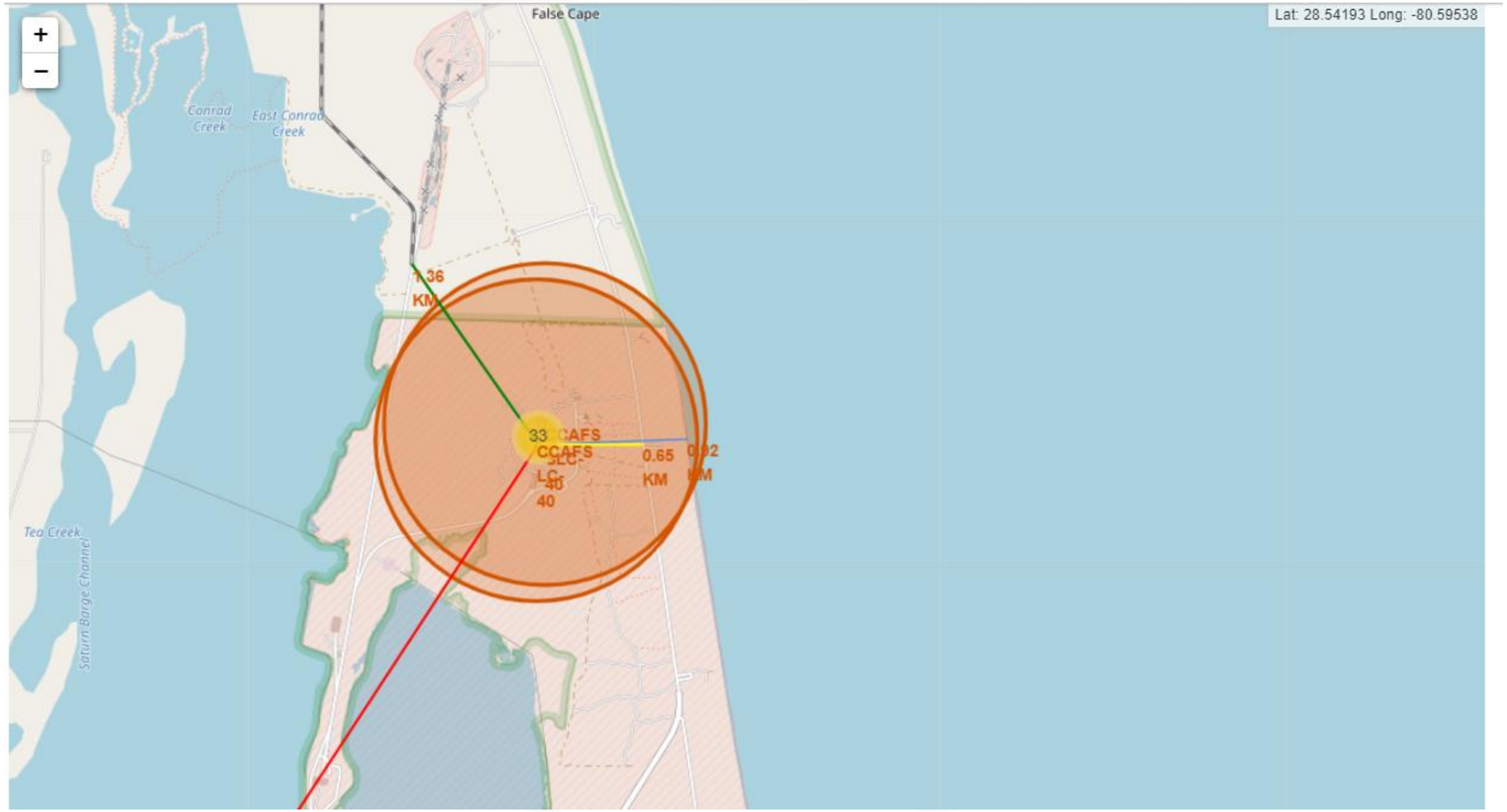


DATA VISUALIZATION: DASHBOARD SCREENS





DATA VISUALIZATION: MAPS



Modeling Results

The Scores of modeling are:

- Logistic Regression = 0.83
- Support Vector Machine = 0.83
- k neighbours = 0.83
- Decission Tree = 0.55

DISCUSSION

Best way to predict the outcome of landing is by using: Logistic Regression, Support Vector Machine, and k neighbours

OVERALL FINDINGS & IMPLICATIONS

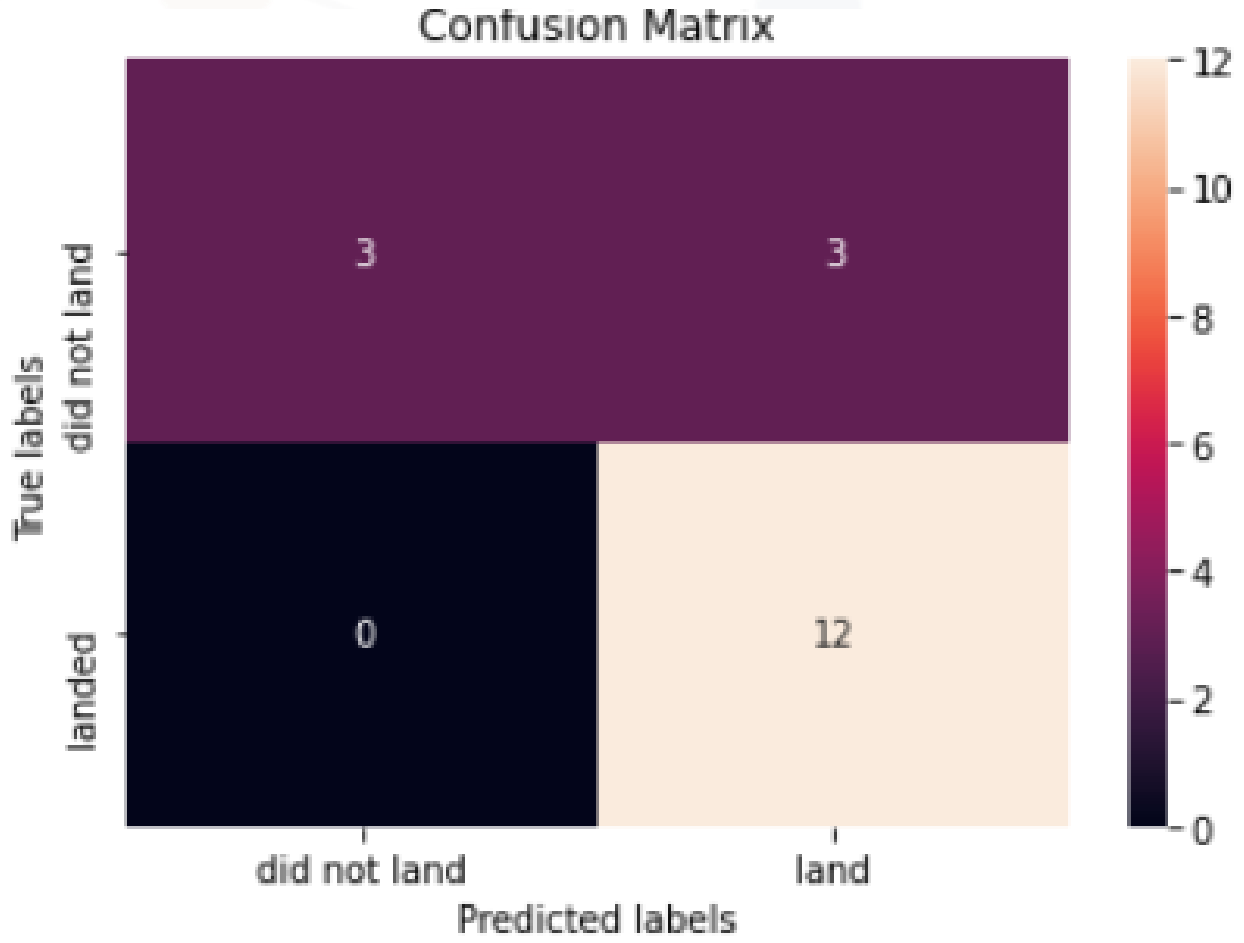
Data visualization reveals that Booster Version, Payload Mass, Orbit, Launch Site correlate with landing outcome.

The mentioned prediction models is sufficiently accurate (Score =0.83)

CONCLUSION

- Use of prediction models worked.
- Parameters for analysis were adequate.
- Further analysis would require more data and additional parameters discovered for model validation.

APPENDIX


Confusion Matrix
True labels
did not land
landed
3
3
0
12
did not land
land
Predicted labels
12
10
8
6
4
2
0