Falcon9 Launch Cost Prediction

Xiaoyu Chen

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IBM Developer

SKILLS NETWORK

OUTLINE

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

EXECUTIVE SUMMARY

- Falcon 9 rocket can **re-use the first stage**
  (and hence reduce cost)

- Predict first stage success rate
  - Use historical data
  - ML techniques

INTRODUCTION

- Falcon 9 claims a cost per launch 62 million USD
- Competitors: 165 million USD
- An accurate prediction cost per launch for Falcon9 based on historical data
- What we took into consideration:
  - Launch sites
  - Payload Mass
  - Orbitals
  - Year

Launch-site Info

All launch sites are close to the sea and can be easily reached by road and railway

METHODOLOGY

- Collect data
  - SpaceX API
  - Wikipedia
  - SQL Database
- Exploratory Data Analysis (EDA)
  - Determine what would be the label to train our models
- EDA prediction
  - Visualise relationship between independent variables*
- Train machine learning models
  - Logistic regression
  - Support vector machines
  - KNN
  - Decision tree

RESULTS – Data Wrangling

Launches at each sites:

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

Success Rate:

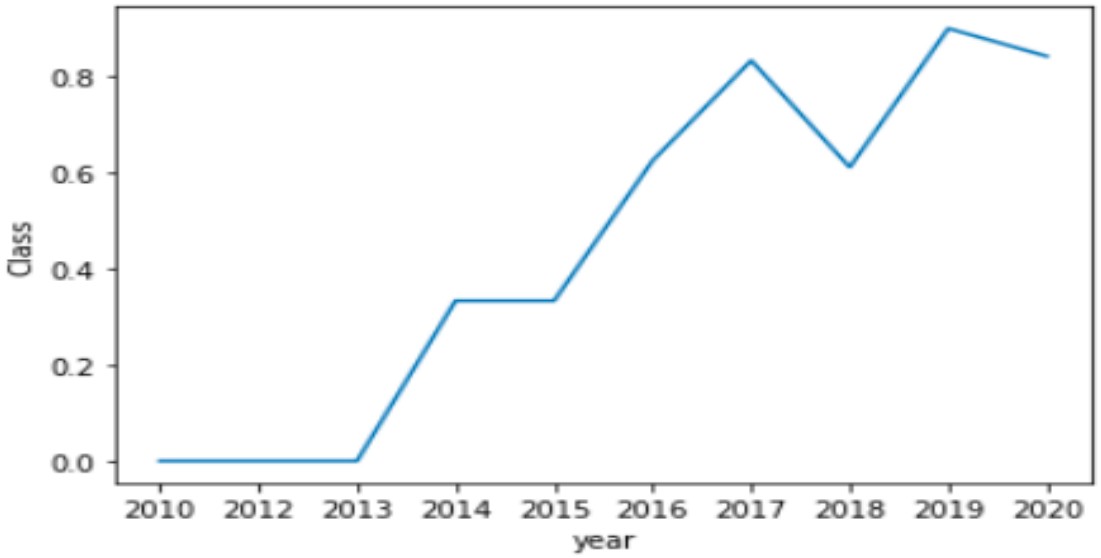
0.67

Launches per Orbital:

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

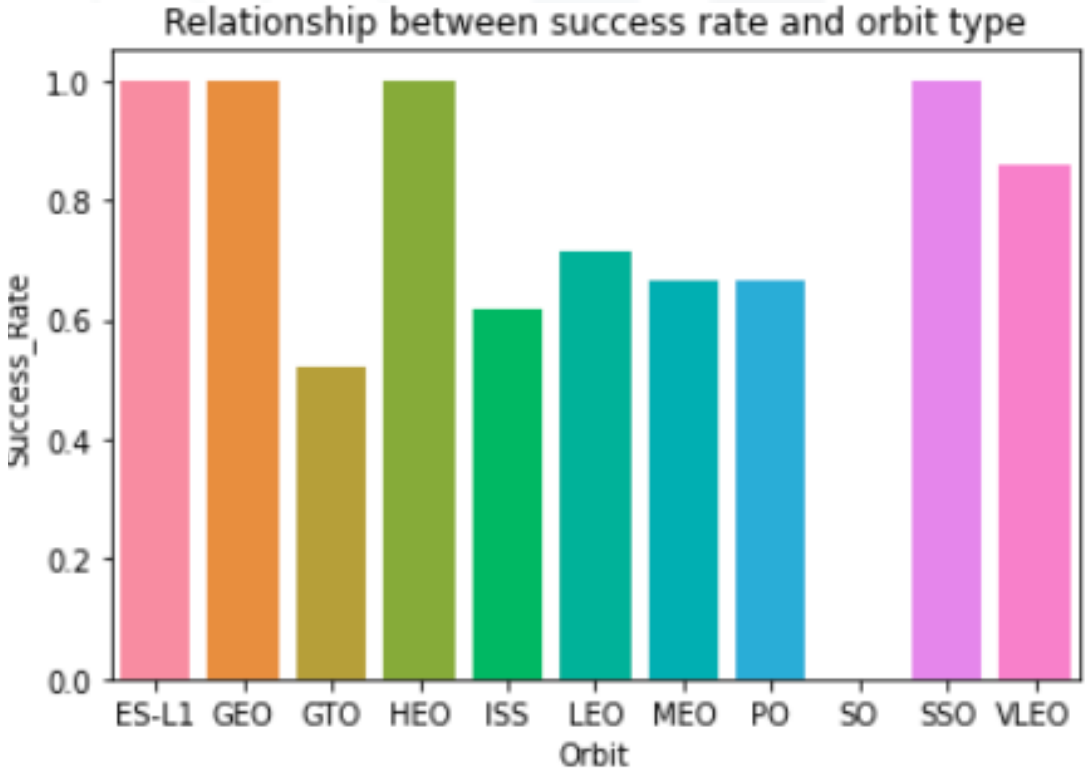
RESULTS – EDA

We see correlation for Launch Site, Payload Mass, Orbital and Year



Success Rate vs.Year

Success Rate per Orbital:



RESULTS – SQL Database

Additional data in a SQL database was also analysed

Mission Success Rate: **97%** (98/101)

Landing Success Rate: **65%** (66/101)

Launch Site info:

CCAFS SLC-40	34
CCAFS LC-40	26
KSC LC-39A	25
VAFB SLC-4E	16

* Launch Site info from API + wikipedia

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

RESULTS – Summary

Launch Site info:

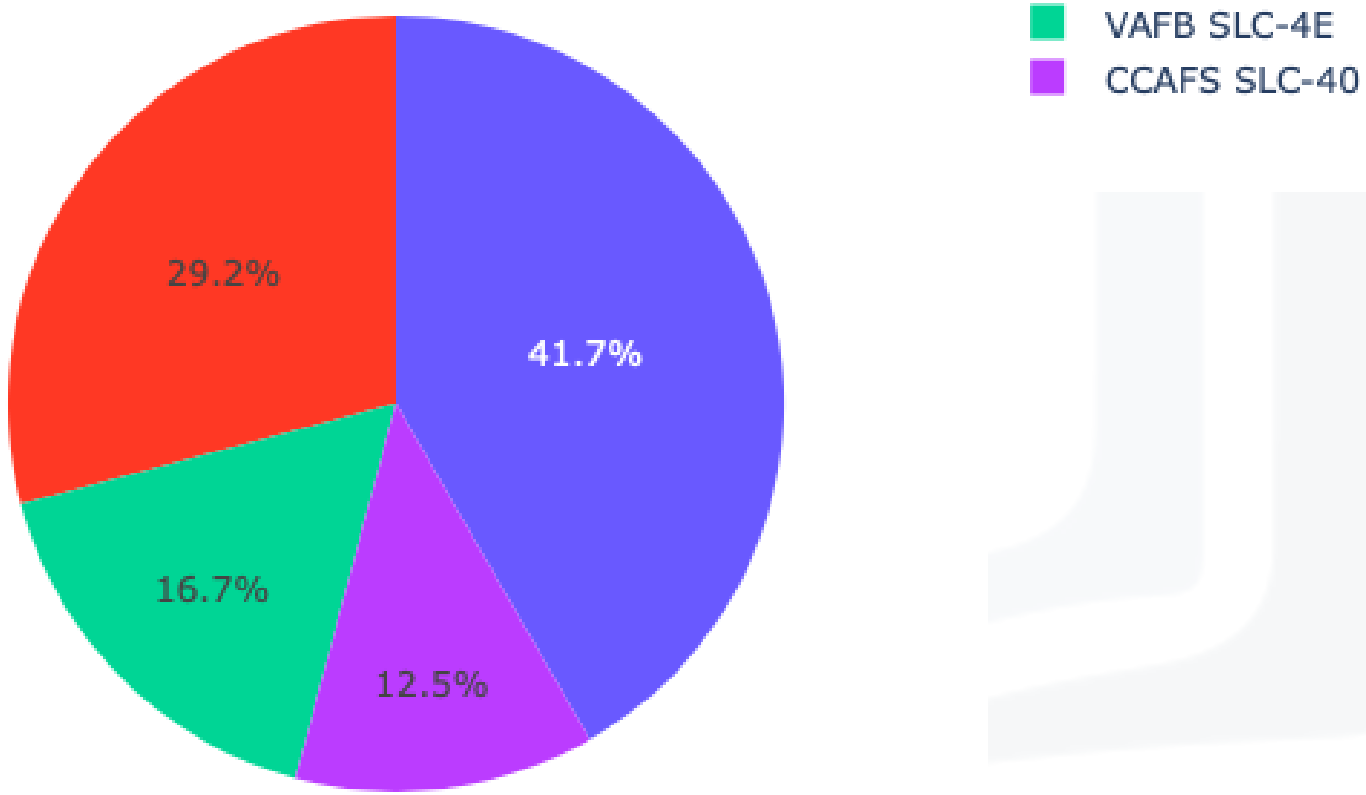
CCAFS	SLC-40	89
CCAFS	LC-40	26
KSC	LC-39A	47
VAFB	SLC-4E	29

Mission Success Rate: **82%** (159/192)

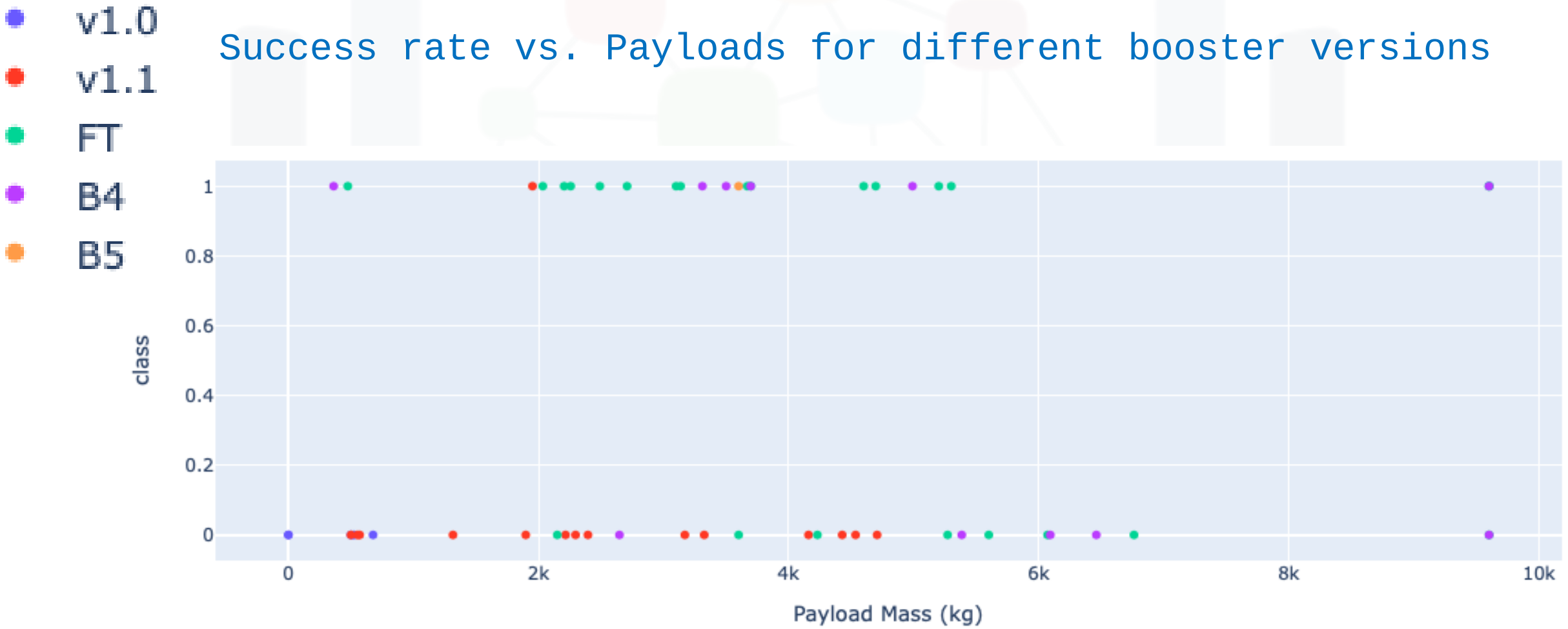
Independent Variables used for model training:
Launch Site, PayloadMass, Orbital, Year

DASHBOARD

Success Rate vs. Launch sites

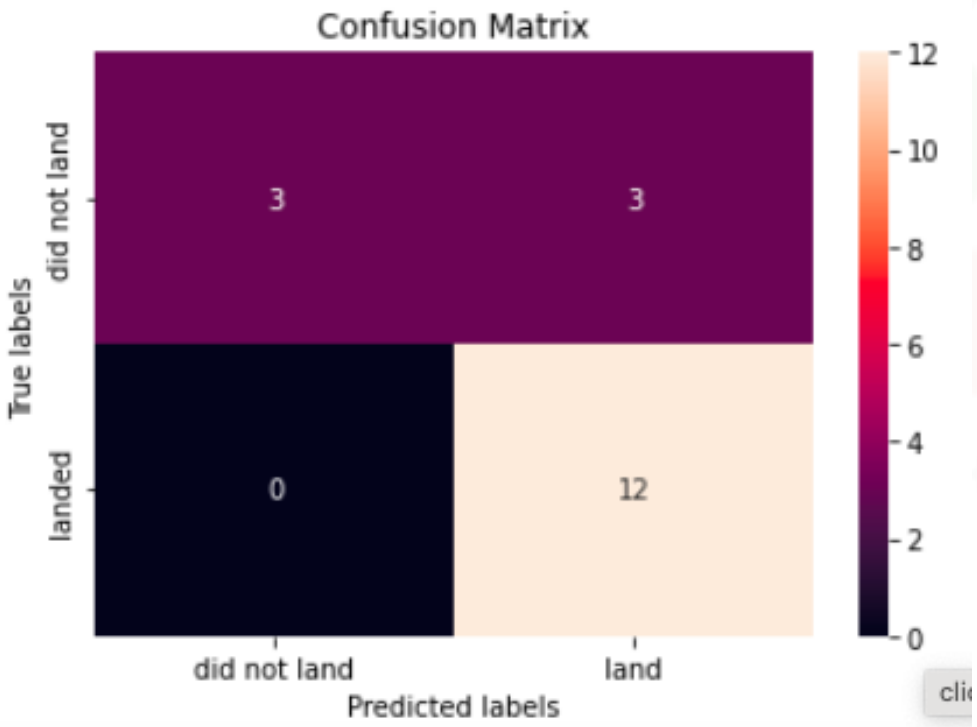


DASHBOARD


v1.0
v1.1
FT
B4
B5
Success rate vs. Payloads for different booster versions
class
1
0.8
0.6
0.4
0.2
0
0
2k
4k
6k
8k
10k
Payload Mass (kg)

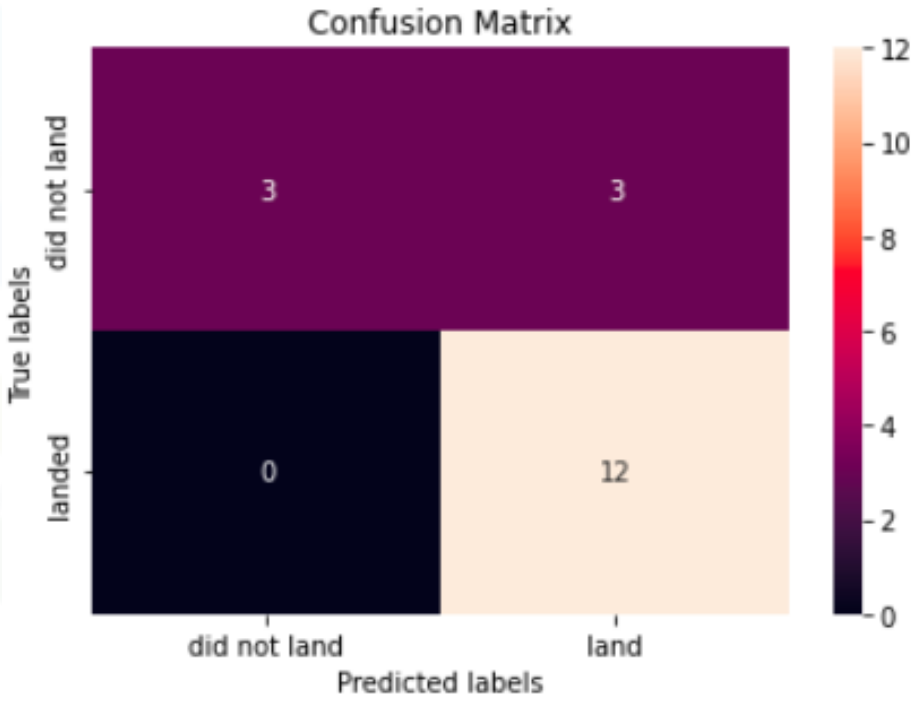
Machine Learning Models

Logistic Regression:



Accurancy Socre: 0.83

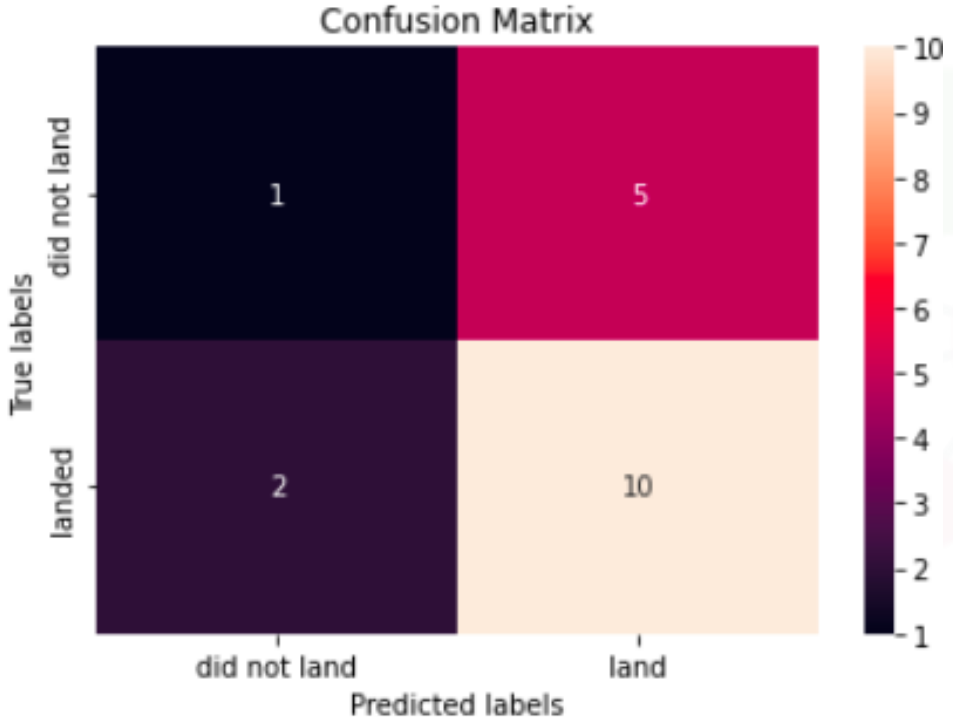
Support Vector Machine:



Accurancy Socre: 0.83

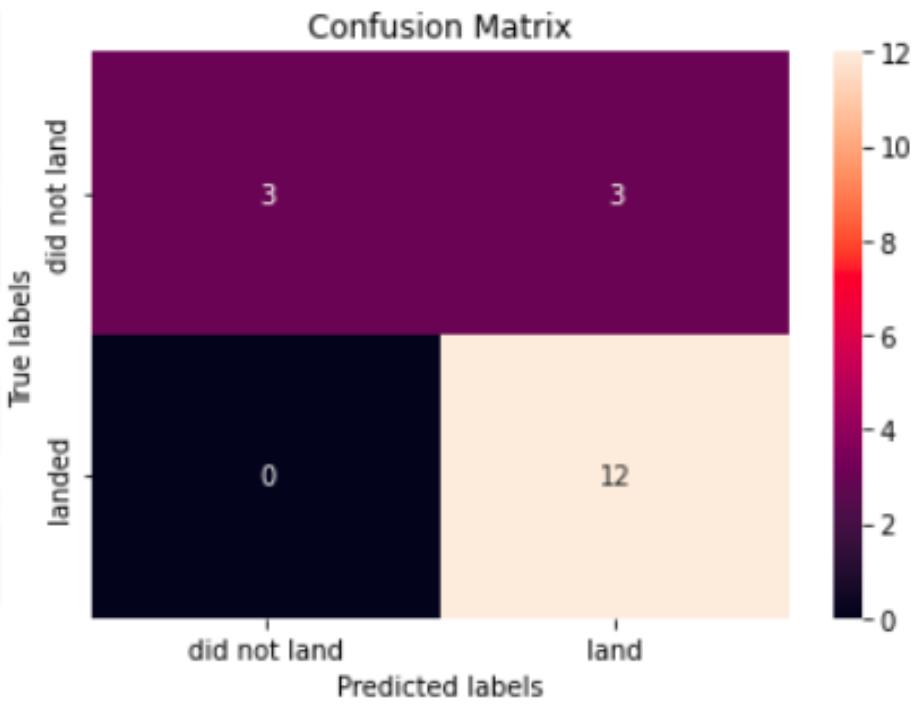
Machine Learning Models

Decision Tree:



Accurancy Socre: 0.61

KNN:



Accurancy Socre: 0.83

CONCLUSION

- Success Rate at **82%** based on historical Data
- Model training reveils that Logistic Regression, Support Vector Machine and KNN all have the same level of accuracy

Analysation & Further Work

- Launch Sites, PayLoadMass,Orbitals and Year all have impacts on success rate. Detailed analysation on Launch Site is required as the other factors can’t be easily modified.
- See if it’s the facilities at one Launch Site improved success rate, or if it’s because it only launches easier missions.
- Train the models again by using different selection of training and testing data to see if we obtain the same results.