Project Report - SpaceX Falcon 9 Launches

Executive Summary

This project analyzes SpaceX Falcon 9 launches to predict the success of the rocket's first stage landings. Methodologies used included data collection using APIs, web scraping, exploratory data analysis (EDA), and predictive analysis using classification models.

Introduction

The primary goal of this project is to predict whether SpaceX's Falcon 9 first stage will land successfully. SpaceX is noted in the aerospace industry for its ability to reuse the rocket's first stage, which reduces launch costs. This analysis focuses on understanding the factors that influence landing success.

Methodology

Data Collection: Launch data was obtained from the SpaceX API and historical records on Wikipedia.

Data Cleaning and Exploratory Analysis: Data was cleaned and analyzed using SQL and statistical visualizations.

Interactive Maps: Folium was used to create maps that visualize optimal locations for launch sites.

Dashboards: An interactive dashboard was developed in Plotly Dash to observe correlations between mission success and payload type.

Predictive Analysis

Several classification models were implemented to predict landing success. SVM, KNN, and Logistic Regression models achieved an accuracy of 83.3%. The SVM model performed the best in terms of Area Under the Curve (AUC), with a value of 0.958.

Results and Conclusions

Rockets with lighter payloads tend to have higher landing success rates.

Launch success rates have increased over time, plateauing since 2019.

The KSC LC-39A launch site recorded the highest number of successful launches.

The GEO, HEO, SSO, and ES L1 orbits showed the highest success rates.

In conclusion, this analysis suggests that SpaceX will continue to improve its success rates, with increasing performance at the evaluated orbits and launch sites.