**Capstone Project: SpaceX Falcon 9 Launch Success Prediction**

🎯 Objective:

The goal of this project is to build a machine learning model that predicts whether a SpaceX Falcon 9 launch will be successful or not based on various mission parameters like launch site, booster version, payload mass, and customer.

📥 1. Data Collection:

Data was scraped from Wikipedia, covering historical Falcon 9 and Heavy launches. BeautifulSoup was used to extract relevant tables.

🧹 2. Data Cleaning & Preprocessing:

* Extracted relevant columns such as Flight No., Date, Booster Version, Launch Site, Payload Mass, Orbit, Customer, Launch Outcome.
* Converted "Date" to datetime and extracted the launch year.
* Handled missing values using SimpleImputer (mean for numeric, most frequent for categorical).
* Applied OneHotEncoding and Standard Scaling using ColumnTransformer.

📊 3. Exploratory Data Analysis:

* Visualized number of launches per year.
* Analyzed launch success rate over time.
* Explored trends by payload mass, orbit type, and customer.

🧠 4. Modeling:

* Model Used: Logistic Regression (Pipeline with preprocessing).
* Train-Test Split: 80-20
* Accuracy Achieved: 100% on test data

Confusion Matrix:

[[21 0]

[ 0 20]]

Model showed all features were well learned and data was properly cleaned.

📈 5. Feature Importance:

* Top features influencing launch success included:
* Launch Site
* Booster Version
* Orbit
* Year
* Customer
* Visualized with a horizontal bar chart using model coefficients.

📝 6. Conclusion:

The project successfully demonstrates how machine learning, combined with clean historical launch data, can accurately predict the success of Falcon 9 launches. This methodology could help aerospace companies assess mission risk and optimize planning.