Outline

- Executive Summary

- Introduction

- Methodology

- Results

- Conclusion

- Appendix

Executive Summary

- Summary of methodologies

- Summary of all results

Introduction

- Project background and context
- Problems you want to find answers

Section 1

Methodology

Methodology

Executive Summary

- Data collection methodology:
  - Describe how data was collected
- Perform data wrangling
  - Describe how data was processed
- Perform exploratory data analysis (EDA) using visualization and SQL
- Perform interactive visual analytics using Folium and Plotly Dash
- Perform predictive analysis using classification models
  - How to build, tune, evaluate classification models

Data Collection

Describe how data sets were collected.

You need to present your data collection process use key phrases and flowcharts

Data Collection – SpaceX API

- Present your data collection with SpaceX REST calls using key phrases and flowcharts

- Add the GitHub URL of the completed SpaceX API calls notebook (must include completed code cell and outcome cell), as an external reference and peer-review purpose

Place your flowchart of SpaceX API calls here

Data Collection - Scraping

- Present your web scraping process using key phrases and flowcharts

- Add the GitHub URL of the completed web scraping notebook, as an external reference and peer-review purpose

Place your flowchart of web scraping here

Data Wrangling

Describe how data were processed
You need to present your data wrangling process using key phrases and flowcharts
Add the GitHub URL of your completed data wrangling related notebooks, as an external reference and peer-review purpose

EDA with Data Visualization

Summarize what charts were plotted and why you used those charts

Add the GitHub URL of your completed EDA with data visualization notebook, as an external reference and peer-review purpose

EDA with SQL

Using bullet point format, summarize the SQL queries you performed

Add the GitHub URL of your completed EDA with SQL notebook, as an external reference and peer-review purpose

Build an Interactive Map with Folium

Summarize what map objects such as markers, circles, lines, etc. you created and added to a folium map

Explain why you added those objects

Add the GitHub URL of your completed interactive map with Folium map, as an external reference and peer-review purpose

Build a Dashboard with Plotly Dash

Summarize what plots/graphs and interactions you have added to a dashboard

Explain why you added those plots and interactions

Add the GitHub URL of your completed Plotly Dash lab, as an external reference and peer-review purpose

Predictive Analysis (Classification)
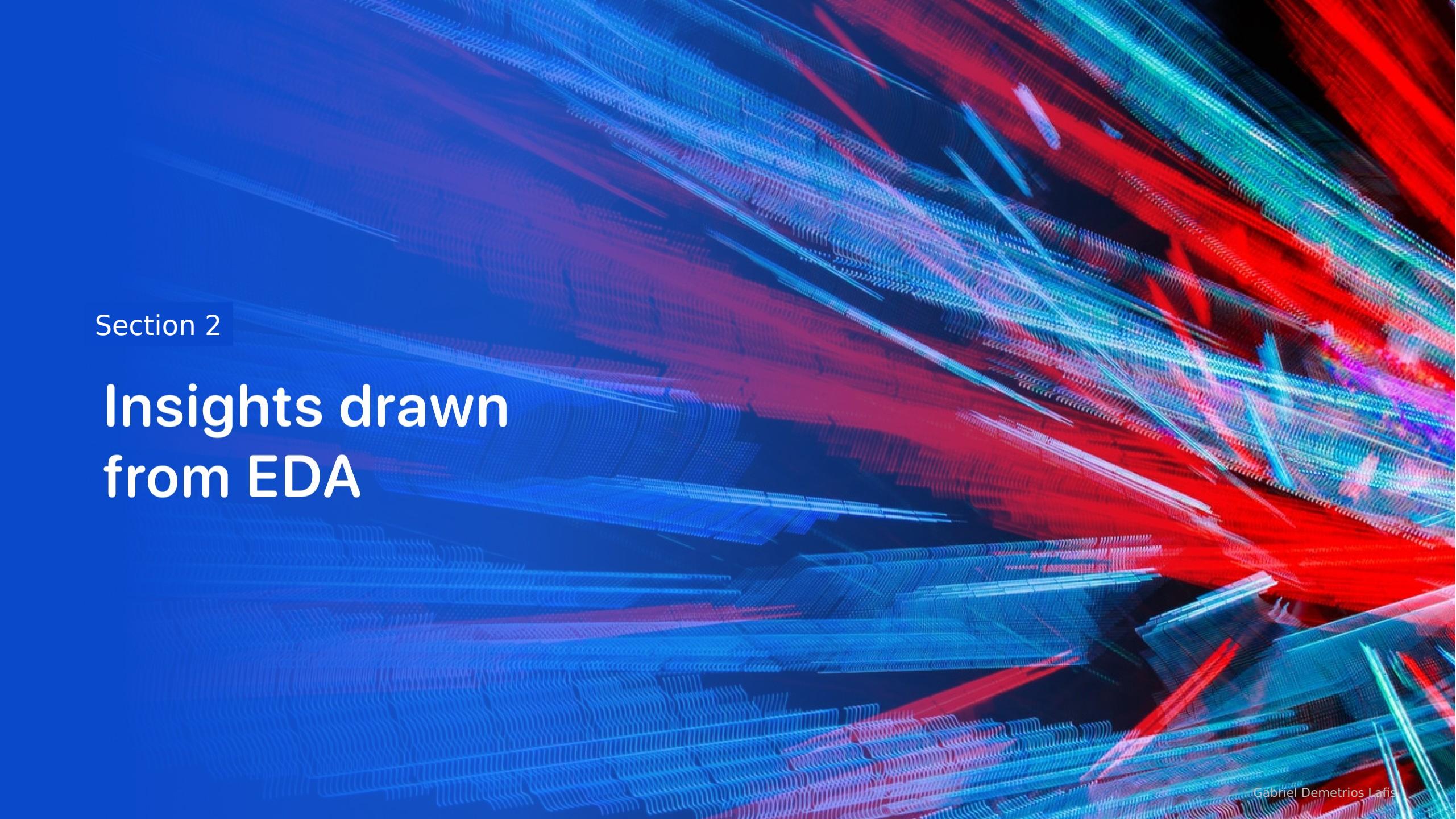
Summarize how you built, evaluated, improved, and found the best performing classification model

You need present your model development process using key phrases and flowchart

Add the GitHub URL of your completed predictive analysis lab, as an external reference and peer-review purpose

Results

- Exploratory data analysis results

- Interactive analytics demo in screenshots

- Predictive analysis results

Section 2

Insights drawn from EDA

Flight Number vs. Launch Site

- Show a scatter plot of Flight Number vs. Launch Site

- Show the screenshot of the scatter plot with explanations

Payload vs. Launch Site

- Show a scatter plot of Payload vs. Launch Site

- Show the screenshot of the scatter plot with explanations

Success Rate vs. Orbit Type

- Show a bar chart for the success rate of each orbit type

- Show the screenshot of the scatter plot with explanations

Flight Number vs. Orbit Type

- Show a scatter point of Flight number vs. Orbit type

- Show the screenshot of the scatter plot with explanations

Payload vs. Orbit Type

- Show a scatter point of payload vs. orbit type

- Show the screenshot of the scatter plot with explanations

Launch Success Yearly Trend

- Show a line chart of yearly average success rate

- Show the screenshot of the scatter plot with explanations

All Launch Site Names

Find the names of the unique launch sites

Present your query result with a short explanation here

Launch Site Names Begin with 'CCA'

Find 5 records where launch sites begin with `CCA`

Present your query result with a short explanation here

Total Payload Mass

Calculate the total payload carried by boosters from NASA

Present your query result with a short explanation here

Average Payload Mass by F9 v1.1

Calculate the average payload mass carried by booster version F9 v1.1

Present your query result with a short explanation here

First Successful Ground Landing Date

Find the dates of the first successful landing outcome on ground pad

Present your query result with a short explanation here

Successful Drone Ship Landing with Payload between 4000 and 6000

List the names of boosters which have successfully landed on drone ship and had payload mass greater than 4000 but less than 6000

Present your query result with a short explanation here

Total Number of Successful and Failure Mission Outcomes

Calculate the total number of successful and failure mission outcomes

Present your query result with a short explanation here

Boosters Carried Maximum Payload

List the names of the booster which have carried the maximum payload mass

Present your query result with a short explanation here

2015 Launch Records

List the failed landing_outcomes in drone ship, their booster versions, and launch site names for in year 2015

Present your query result with a short explanation here

Rank Landing Outcomes Between 2010-06-04 and 2017-03-20

Rank the count of landing outcomes (such as Failure (drone ship) or Success (ground pad)) between the date 2010-06-04 and 2017-03-20, in descending order

Present your query result with a short explanation here

Section 3

Launch Sites
Proximities Analysis

Gabriel Demetrios Lafis

\<Folium Map Screenshot 1\>

Replace \<Folium map screenshot 1\> title with an appropriate title

Explore the generated folium map and make a proper screenshot to include all launch sites' location markers on a global map

Explain the important elements and findings on the screenshot

<Folium Map Screenshot 2>

Replace <Folium map screenshot 2> title with an appropriate title

Explore the folium map and make a proper screenshot to show the color-labeled launch outcomes on the map
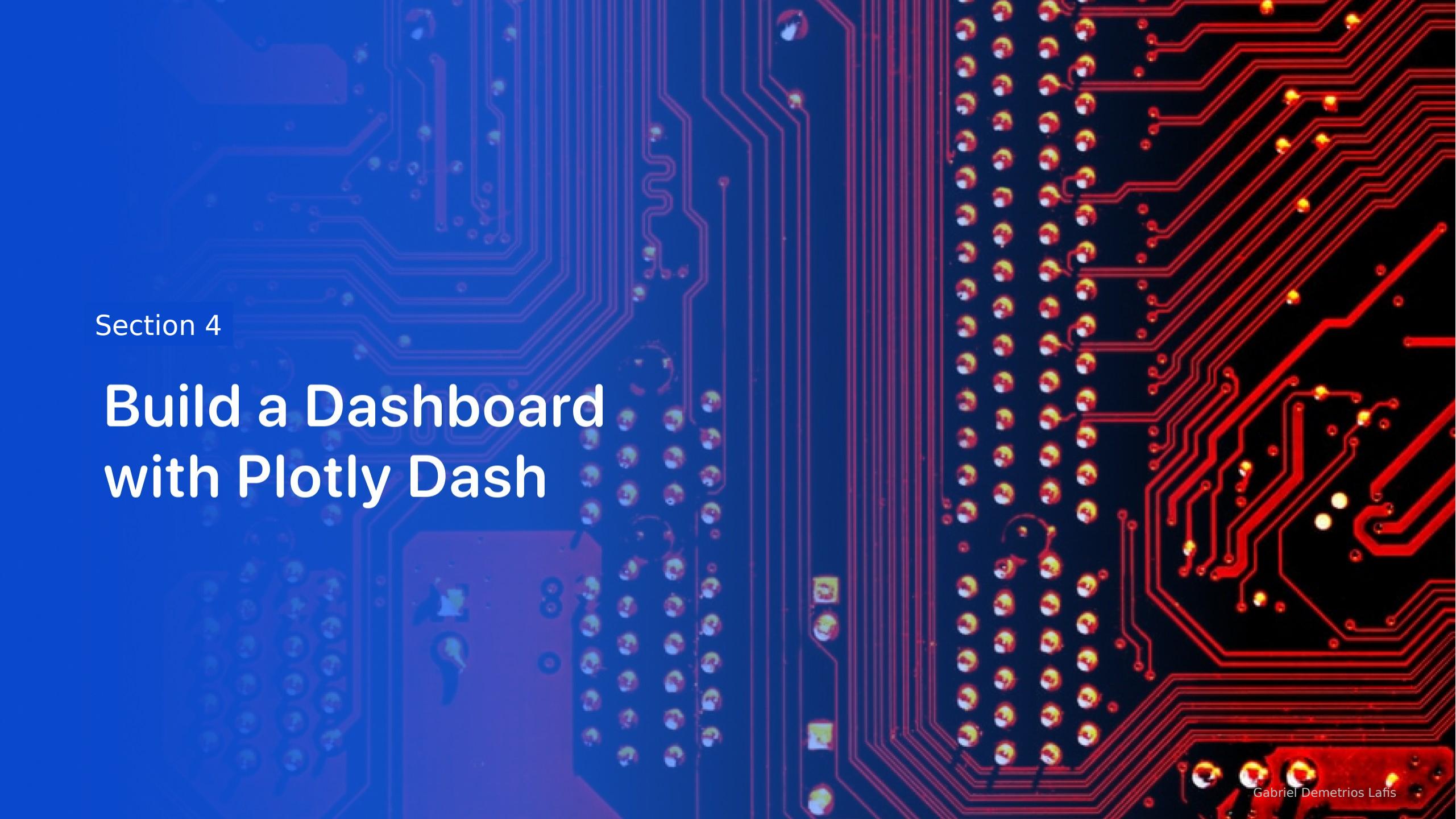
Explain the important elements and findings on the screenshot

<Folium Map Screenshot 3>

Replace <Folium map screenshot 3> title with an appropriate title

Explore the generated folium map and show the screenshot of a selected launch site to its proximities such as railway, highway, coastline, with distance calculated and displayed

Explain the important elements and findings on the screenshot

Section 4

Build a Dashboard with Plotly Dash

<Dashboard Screenshot 1>

Replace <Dashboard screenshot 1> title with an appropriate title

Show the screenshot of launch success count for all sites, in a piechart

Explain the important elements and findings on the screenshot

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<Dashboard Screenshot 2>

Replace <Dashboard screenshot 2> title with an appropriate title

Show the screenshot of the piechart for the launch site with highest launch success ratio

Explain the important elements and findings on the screenshot

<Dashboard Screenshot 3>

Replace <Dashboard screenshot 3> title with an appropriate title

Show screenshots of Payload vs. Launch Outcome scatter plot for all sites, with different payload selected in the range slider

Explain the important elements and findings on the screenshot, such as which payload range or booster version have the largest success rate, etc.

Section 5

Predictive Analysis (Classification)

Classification Accuracy

- Visualize the built model accuracy for all built classification models, in a bar chart

- Find which model has the highest classification accuracy

Confusion Matrix

- Show the confusion matrix of the best performing model with an explanation

Conclusions

Point 1

Point 2

Point 3

Point 4

...

Appendix

Include any relevant assets like Python code snippets, SQL queries, charts, Notebook outputs, or data sets that you may have created during this project

Thank you!

Gabriel Demetrios Lafis

Outline

- Executive Summary
- Introduction to SpaceX & Falcon Family
- Falcon 9 Evolution (v1.0 to Block 5)
- Launch Statistics & Success Rate
- Reusability: Landings & Reflights
- Falcon Heavy Overview
- Notable Missions & Payloads
- Conclusion
- Appendix
- References

Executive Summary

- SpaceX's Falcon 9 has become a dominant force in the global launch market.

- Boasting a high success rate (over 99% overall, ~99.8% for Block 5).

- Revolutionary first-stage reusability significantly reduces launch costs.

- Boosters have landed successfully over 430 times, with some flying over 25 missions.

- Falcon 9 Block 5 is the current workhorse, optimized for rapid reuse.

- Key missions include Starlink deployment, ISS resupply, and diverse satellite launches.

Introduction to SpaceX & Falcon Family
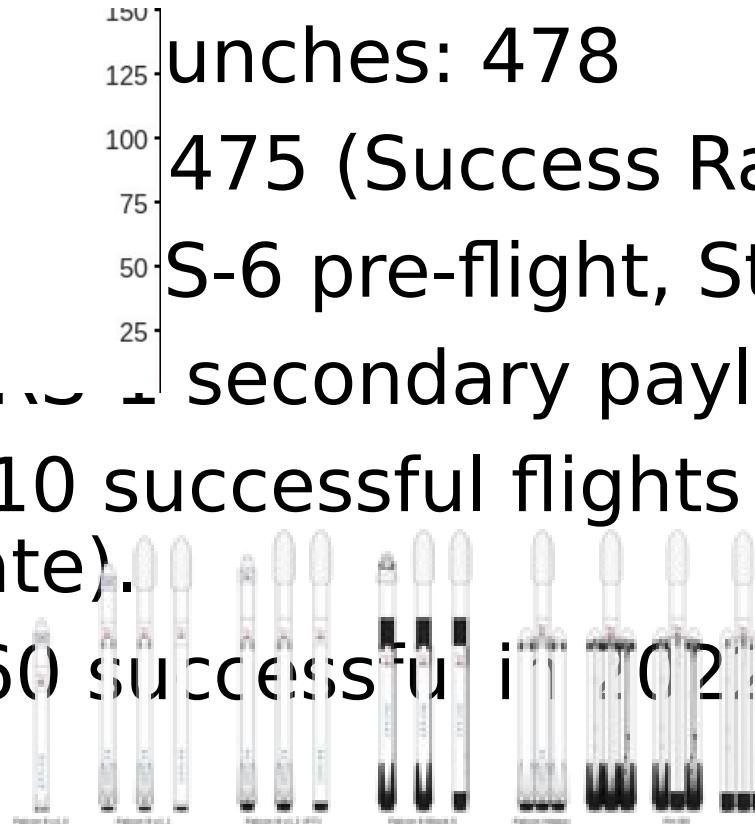
- SpaceX, founded in 2002, aims to revolutionize space technology.

- The Falcon launch vehicle family is central to this vision.

- Includes retired versions: Falcon 9 v1.0, v1.1, v1.2 "Full Thrust".

- Current active version: Falcon 9 Block 5.

- Falcon Heavy: Heavy-lift derivative using three Falcon 9 cores.

Falcon 9 Evolution

- v1.0 (2010-2013): 5 launches, initial flights.
- v1.1 (2013-2016): 15 launches, increased performance.
- v1.2 "Full Thrust" (2015-2018): 36 launches, significant upgrades, first landing attempts.
- Block 5 (May 2018-Pre for rapid reusability (1 refurbishment), enhar NASA/USSF requireme
- Each iteration brough vertical landing capabilities.

Launch Statistics (as of April 2025)

- Total Falcon 9 Family Launches: 478
- Full Mission Success: 475 (Success Rate: 99.37%)
- Failures: 3 (CRS-7, AMOS-6 pre-flight, Starlink G9-3)
- Partial Failure: 1 (CRS-1 secondary payload)
- Falcon 9 Block 5: 410 successful flights in 411 attempts (99.76% success rate).
- Record Launches: 60 successful in 2022, 133 successful in 2024.

Reusability: Landings & Reflights

- Falcon 9: First orbital-class rocket with propulsive vertical landing (Dec 2015).
- Boosters land on drone ships (ASDS) or landing zones (LZ).
- Successful Booster Landings: 438 out of 451 attempts (97.1% overall).
- Block 5 Landing Success: 413 out of 419 attempts (98.6%).
- Booster Reuse Record: 27 flights by a single booster.
- Fairing Reuse: Over 300 successful re-flights, some reused 20+ times.

Falcon Heavy Overview

- Heavy-lift launch vehicle derived from Falcon 9.
- Combines a strengthened Falcon 9 center core with two Falcon 9 first stages as side boosters.
- Side boosters typically land back at LZ-1/LZ-2 or on drone ships; center core lands on a drone ship further downrange.
- Capable of lifting significantly heavier payloads to LEO, GTO, and beyond.

Notable Missions & Payloads

- Starlink Constellation: Majority of launches since 2020.
- ISS Resupply: Dragon cargo and crew missions.
- Commercial Satellites: Communications (GTO), Earth observation (LEO/Polar).
- National Security Space Launch (NSSL): Missions for the U.S. Space Force.
- Interplanetary & Deep Space: DSCOVR (L1), TESS (Lunar Flyby), Tesla Roadster (Heliocentric), DART/Hera (Asteroid), Euclid (L2), Psyche (Asteroid), Europa Clipper (Jupiter Moon).

Conclusion

- Falcon 9 has reshaped the launch industry through performance, reliability, and cost-effectiveness driven by reusability.

- Block 5 continues to be the workhorse, enabling frequent launches for Starlink and diverse customer missions.

- Falcon Heavy provides essential heavy-lift capability.

- SpaceX's focus on reusability continues to push the boundaries of spaceflight economics.

Appendix

Additional charts and data related to Falcon 9 and Falcon Heavy launches.

References

- Wikipedia contributors. (2025, May 2). List of Falcon 9 and Falcon Heavy launches. In Wikipedia, The Free Encyclopedia. Retrieved May 2, 2025, from https://en.wikipedia.org/wiki/List_of_Falcon_9_and_Falcon_Heavy_launches
- SpaceX. (n.d.). Falcon 9. Retrieved May 2, 2025, from https://www.spacex.com/vehicles/falcon-9/
- (Additional sources as needed)

Appendix: Rocket Configurations Over Time

Evolution of Falcon 9 versions and Falcon Heavy launches by year. Source: Wikipedia

Appendix: Launch Sites Usage

Number of launches per site (Cape Canaveral SLC-40, Kennedy LC-39A, Vandenberg SLC-4E) by year. Source: Wikipedia

Appendix: Launch Outcomes Breakdown

Launch outcomes (Success, Failure, Planned) by year. Source: Wikipedia

Appendix: Booster Landing Attempts

Number of successful booster landings versus attempts by year. Source: Wikipedia