SpaceX Falcon 9 First Landing Prediction

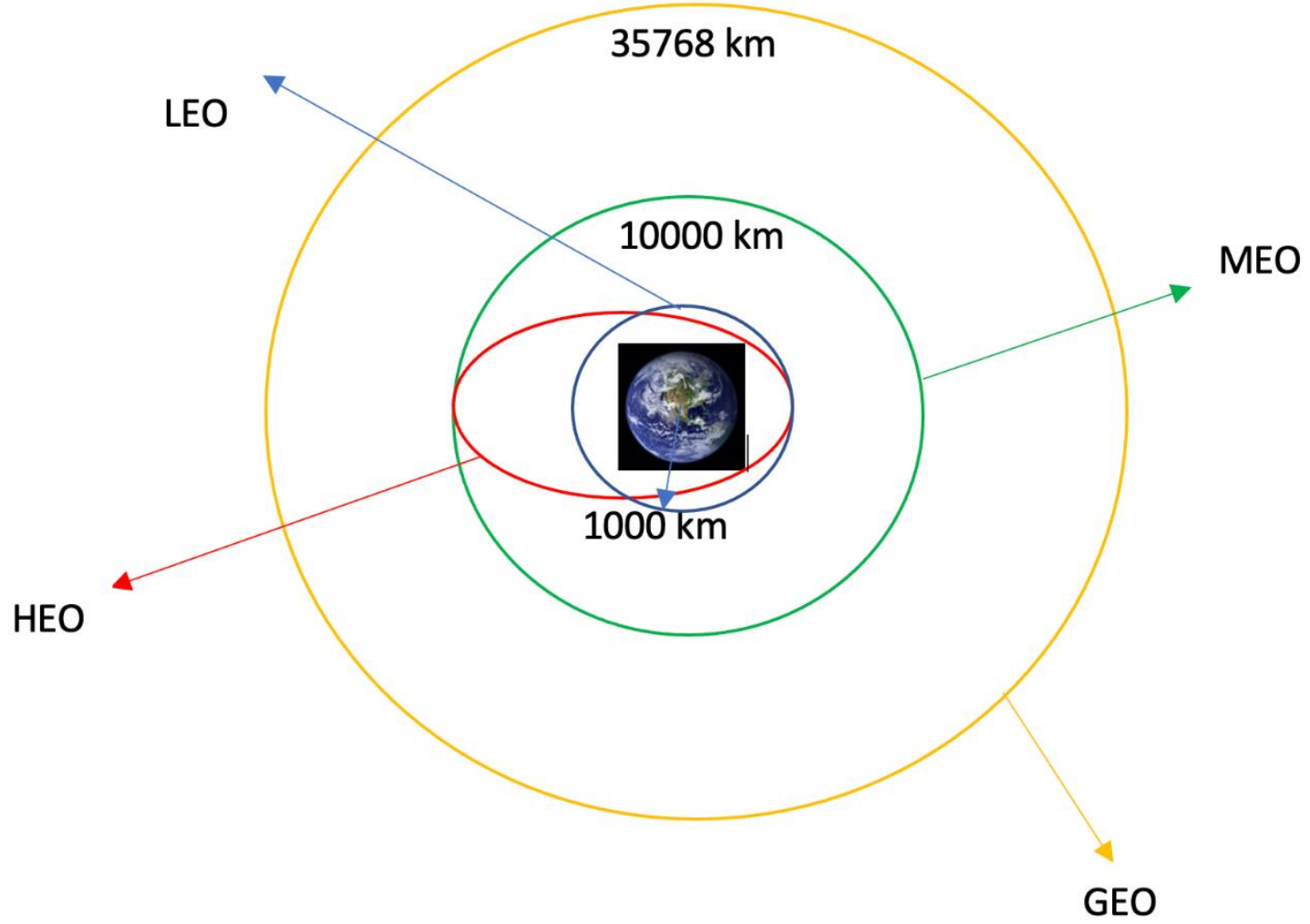
Jan 15, 2024

Executive Summary slide

- Collected data from 200 sites
- There are 55 landings on VAFB SLC 4E, 22 landings on KSC LC 39A, and 13 landings on SLC-4E facilities.
- 67% success rate on the Falcon 9 mission!

Introduction

•**LEO**: Low Earth orbit (LEO)is an Earth-centred orbit with an altitude of 2,000 km (1,200 mi) or less (approximately one-third of the radius of Earth
•**VLEO**: Very Low Earth Orbits (VLEO)
•**GTO** A geosynchronous orbit is a high Earth orbit that allows satellites to match Earth's rotation.
•**SSO (or SO)**: It is a Sun-synchronous orbit also called a heliosynchronous orbit is a nearly polar orbit around a planet, in which the satellite passes over any given point of the planet's surface at the same local mean solar time
•**ES-L1** :At the Lagrange points the gravitational forces of the two large bodies cancel out in such a way that a small object placed in orbit there is in equilibrium relative to the center of mass of the large bodies. L1 is one such point between the sun and the earth.



Introduction

- **HEO** A highly elliptical orbit, is an elliptic orbit with high eccentricity, usually referring to one around Earth
- **ISS** A modular space station (habitable artificial satellite) in low Earth orbit. It is a multinational collaborative project between five participating space agencies: NASA (United States), Roscosmos (Russia), JAXA (Japan), ESA (Europe), and CSA (Canada)
- **MEO** Geocentric orbits ranging in altitude from 2,000 km (1,200 mi) to just below geosynchronous orbit at 35,786 kilometers (22,236 mi). Also known as an intermediate circular orbit. These are "most commonly at 20,200 kilometers (12,600 mi), or 20,650 kilometers (12,830 mi), with an orbital period of 12 hours
- **HEO** Geocentric orbits above the altitude of geosynchronous orbit (35,786 km or 22,236 mi)
- **GEO** It is a circular geosynchronous orbit 35,786 kilometres (22,236 miles) above Earth's equator and following the direction of Earth's rotation
- **PO** It is one type of satellites in which a satellite passes above or nearly above both poles of the body being orbited (usually a planet such as the Earth

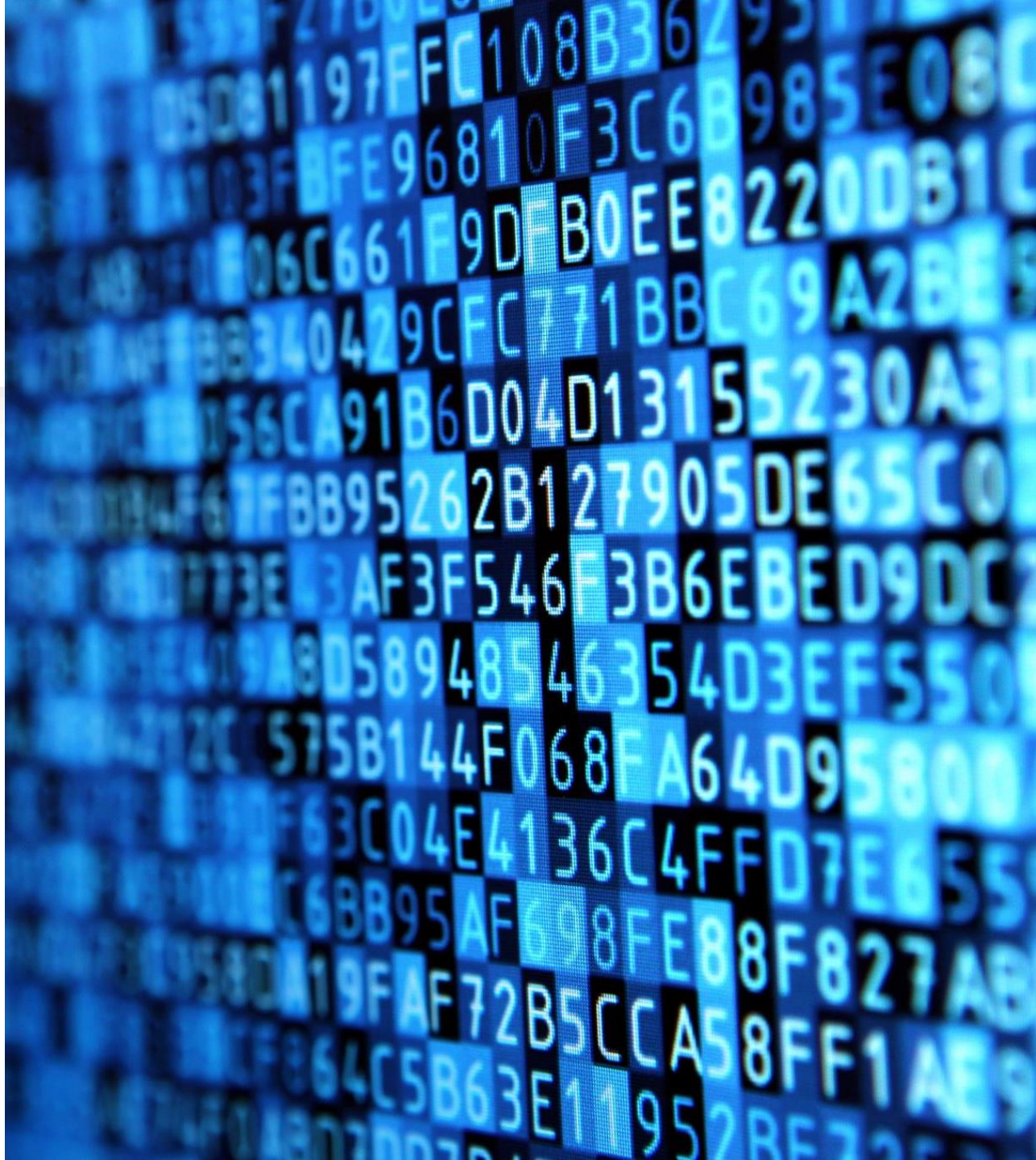
Data collection

- url='https://api.spacexdata.com/v4/launches/past'

  response = requests.get(spacex_url)

  print(response.content)

- data = pd.json_normalize(response.json())

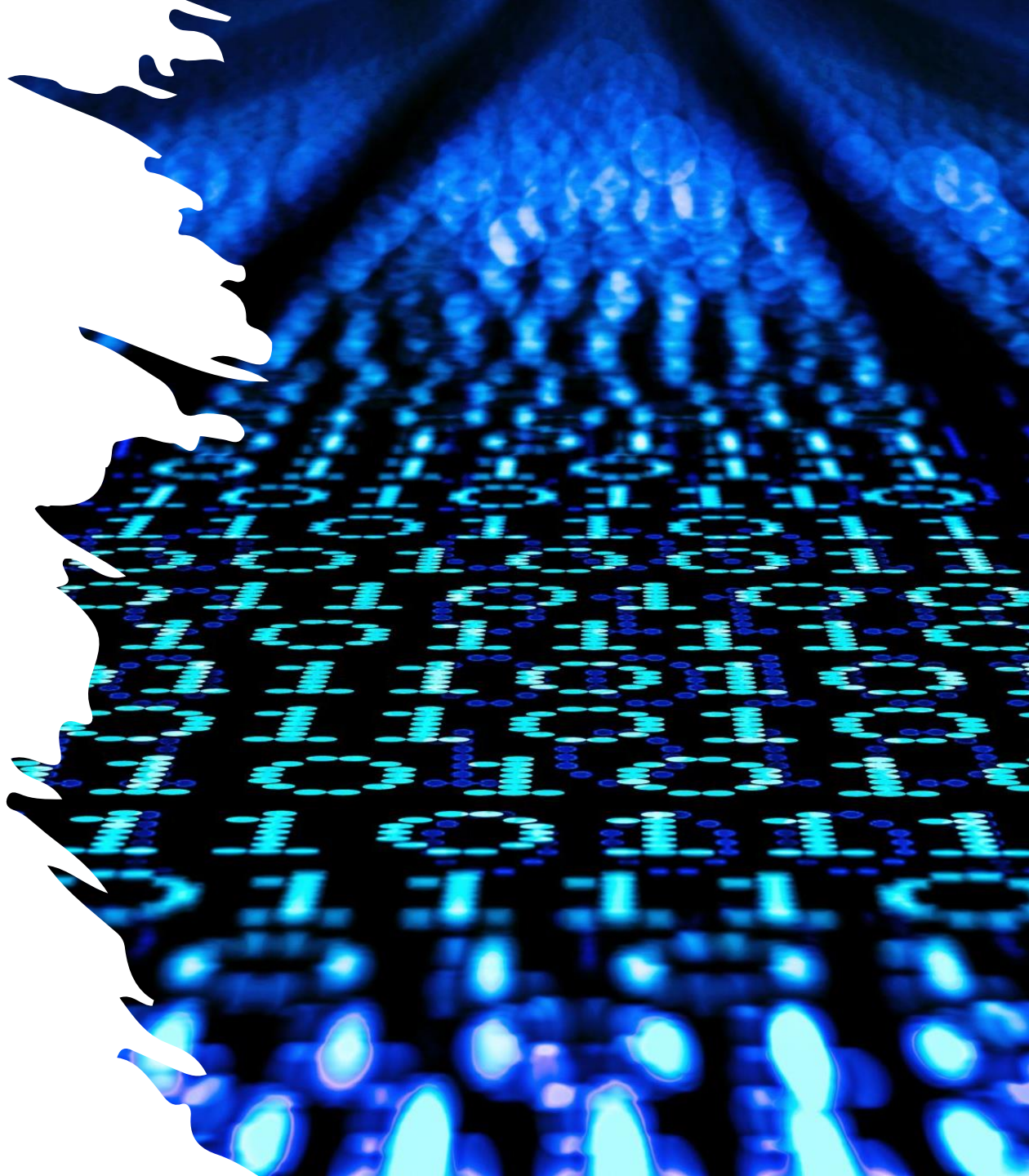


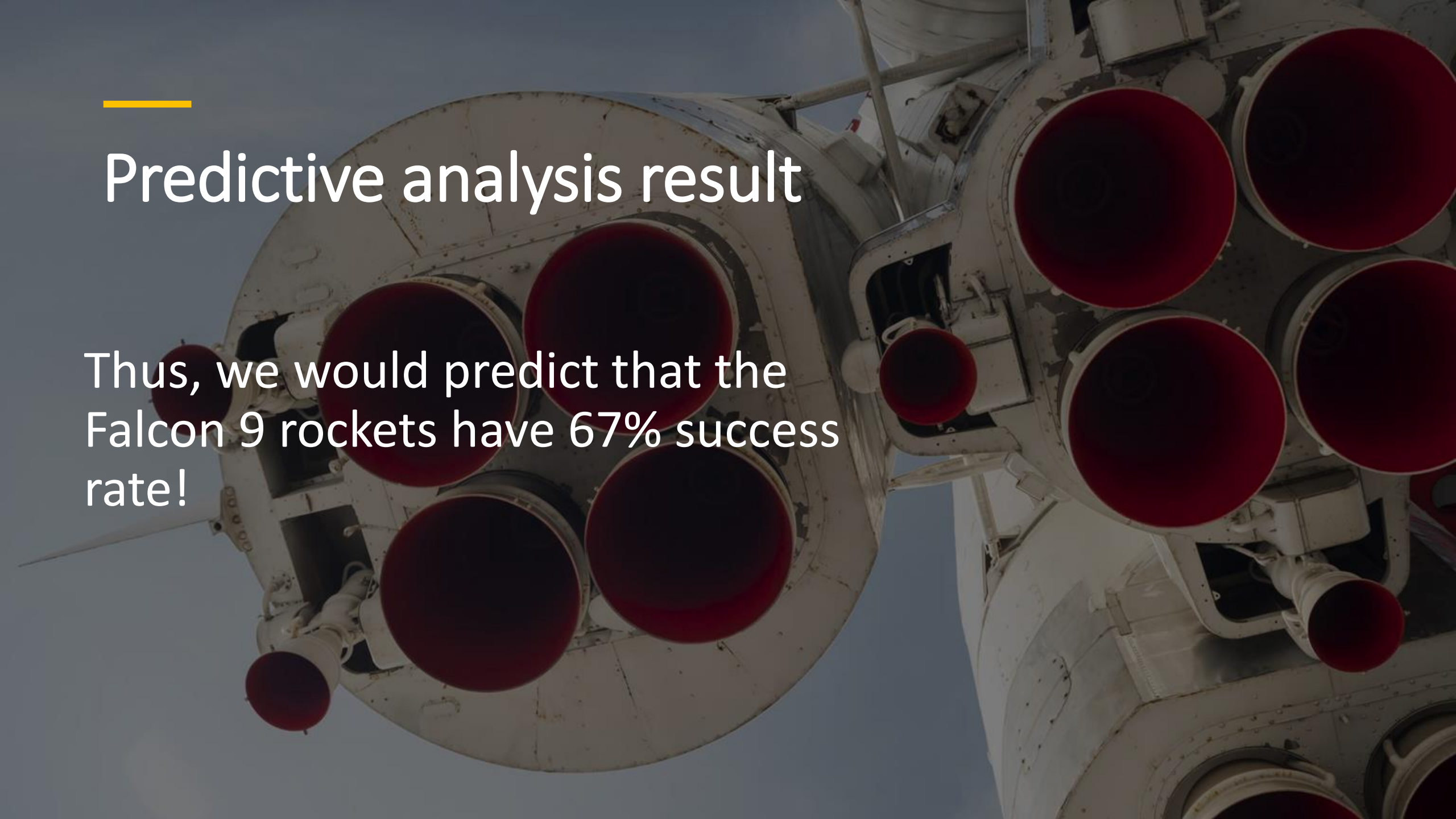
Data Wranglings

- # Calculate the mean value of PayloadMass column
payload_mass_mean = data_falcon9['PayloadMass'].mean()

- # Replace the np.nan values with its mean value
data_falcon9['PayloadMass'] = data_falcon9['PayloadMass'].replace(np.nan, payload_mass_mean)

- data_falcon9.isnull().sum()





Predictive analysis result

Thus, we would predict that the Falcon 9 rockets have 67% success rate!

Conclusion

The falcon 9 missions have 67% success rate in total, which is higher than falcon 1 missions.