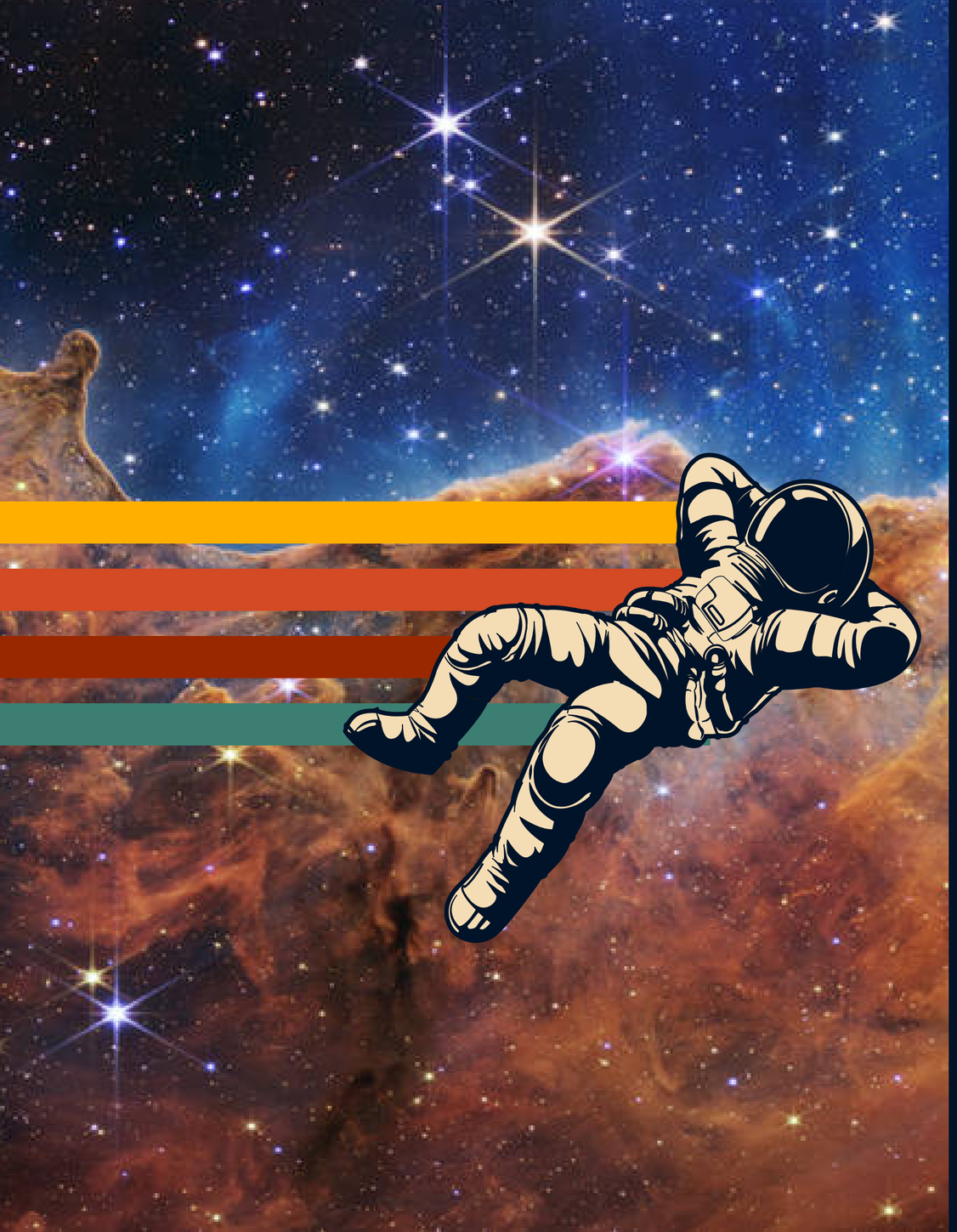

NEOs CLASSIFICATION

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Analyzing dataset

01

Dropped imperial u.m.

Our dataset presented a series of the same features expressed in different units of measurement, so we kept the units of measurement used in Europe.

02

Check NAs

There are no NAs

03

Check duplicates

There are no repeated rows but an analysis of the NEOs id revealed that the same object was detected several times in the search span.

04

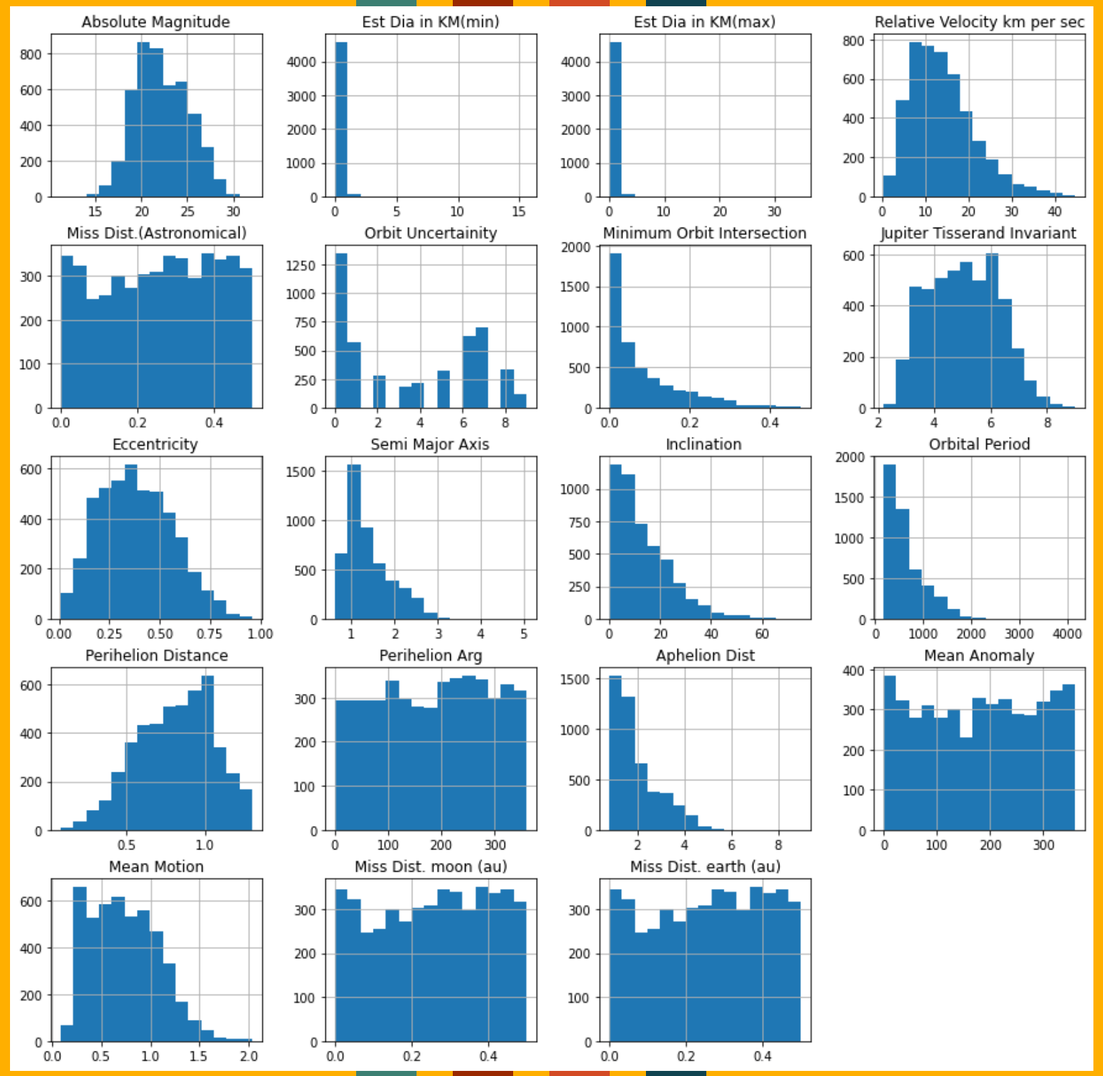
Converting variables

In this section we have converted all the features that refer to a distance into 'astronomical units' (the distance between the earth and the sun) in order to have the same scale.

EXPLORATORY DATA ANALYSIS

Distributions

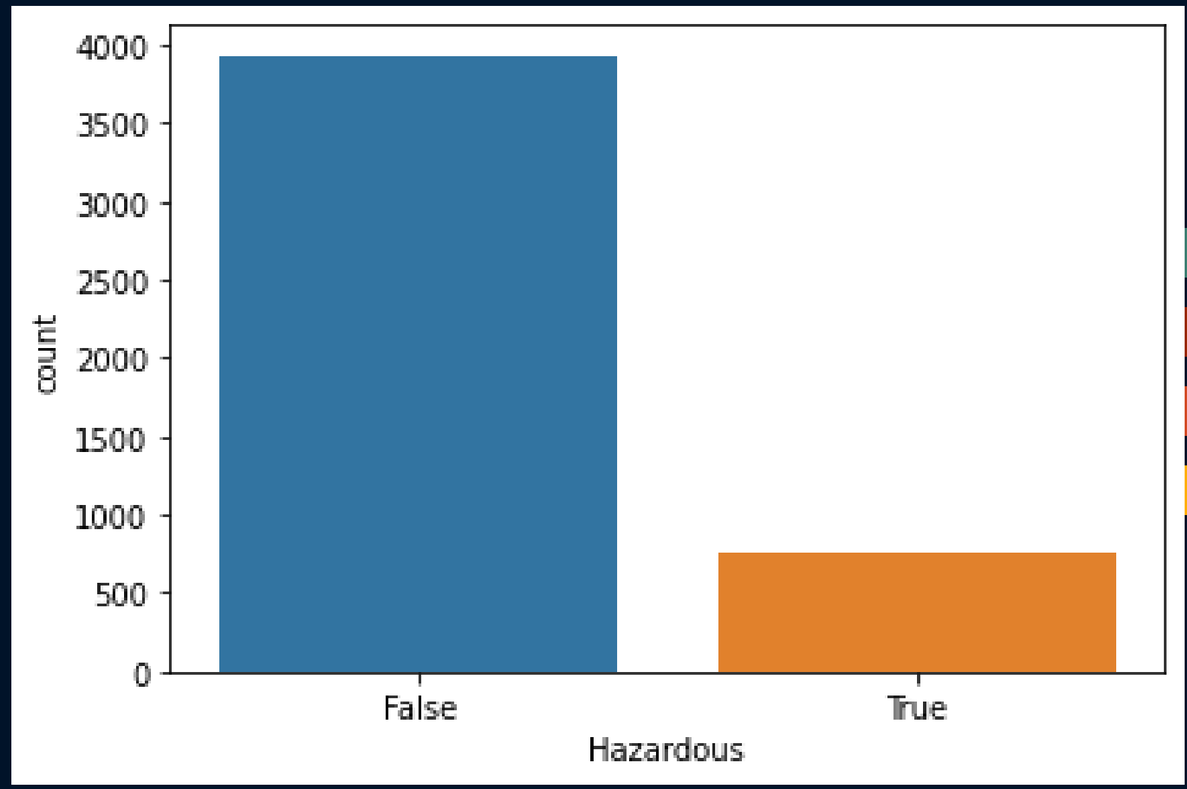
As can be seen, the **distributions** of the variables are not very usable for some models due to the lack of Gaussianity.



BALANCE

False-Positive ratio

Out of 4687 observations **755** are classified as **potentially dangerous**, representing 16.11% of the total observations



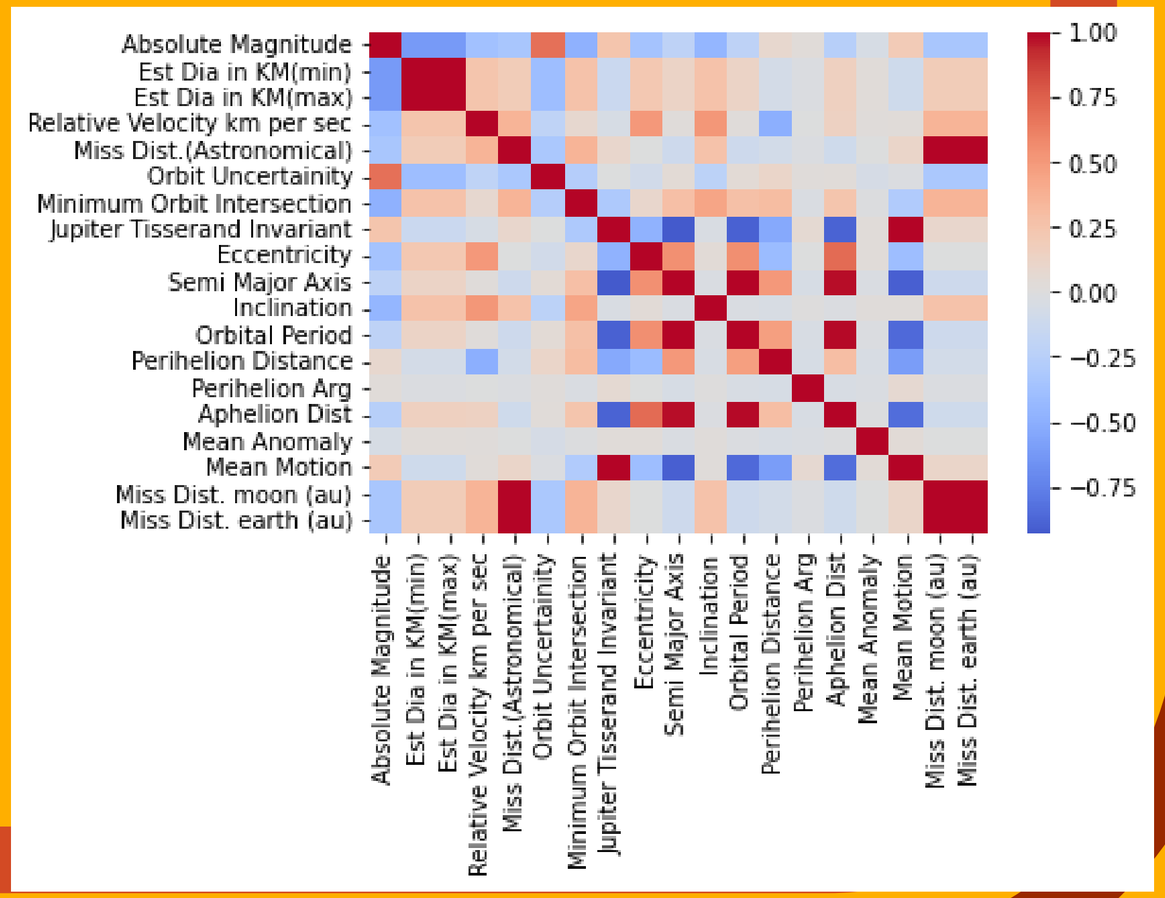
CORRELATIONS

Heatmap

This heatmap provides a visual representation of all the relationships present in the dataset.

Considerations

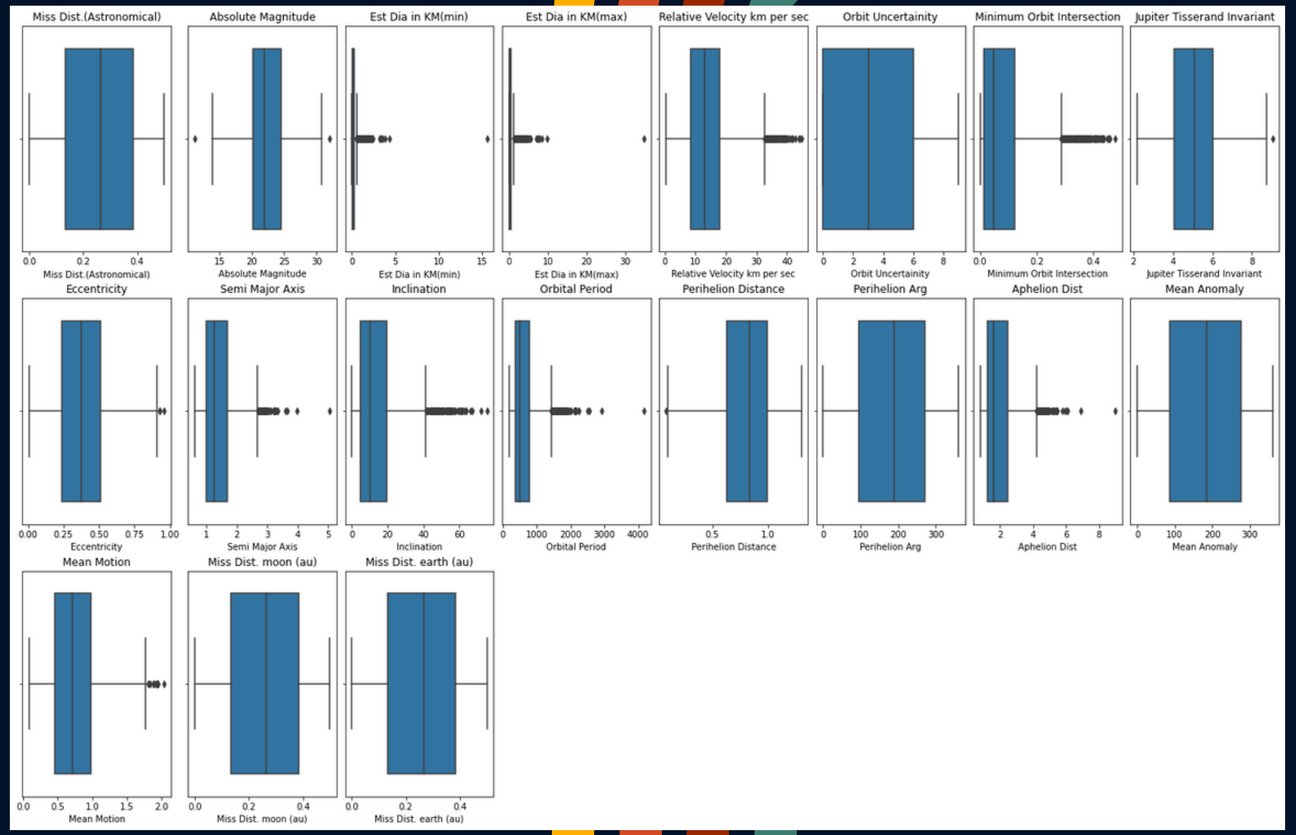
- All attributes involving distances exhibit a **strong correlation**.
- A **negative relationship** is observed between 'Jupiter Tisserand invariant' and 'Orbital period.'



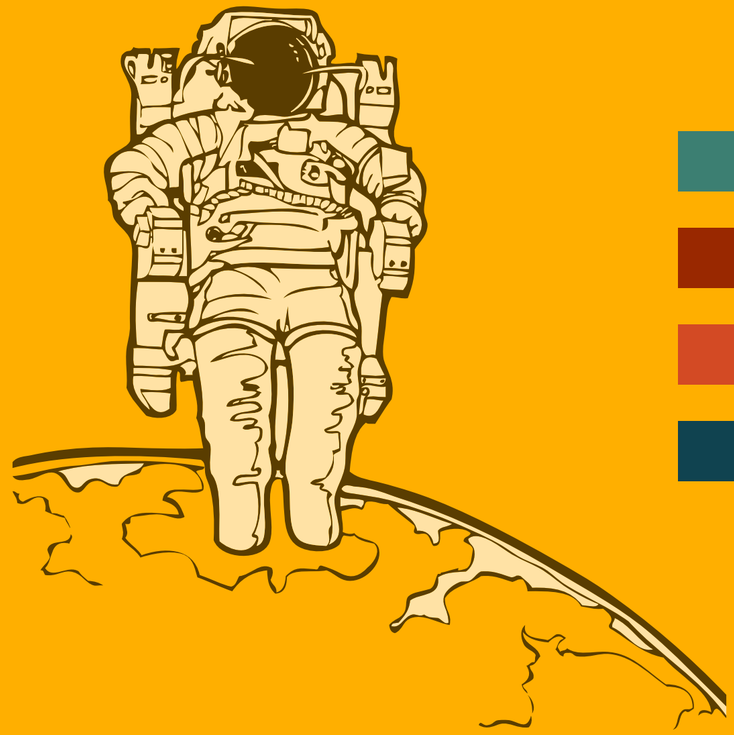
OUTLIERS

Boxplots

Some variables contain various **outliers**; however, these do not pose an issue for our analysis, as they are the observations that require **the most attention**. Consequently, our task can be viewed as analogous to an anomaly detection challenge.



LOGISTIC REGRESSION



UNDERSAMPLING

Index	Type	Size	
0	DataFrame	(3, 18)	Column names: Absolute Magnitude, Relative Velocity km per sec, Miss D ...
1	DataFrame	(6, 18)	Column names: Absolute Magnitude, Relative Velocity km per sec, Miss D ...
2	DataFrame	(36, 18)	Column names: Absolute Magnitude, Relative Velocity km per sec, Miss D ...
3	DataFrame	(3, 18)	Column names: Absolute Magnitude, Relative Velocity km per sec, Miss D ...
4	DataFrame	(3, 18)	Column names: Absolute Magnitude, Relative Velocity km per sec, Miss D ...
5	DataFrame	(4, 18)	Column names: Absolute Magnitude, Relative Velocity km per sec, Miss D ...
6	DataFrame	(4, 18)	Column names: Absolute Magnitude, Relative Velocity km per sec, Miss D ...
7	DataFrame	(3, 18)	Column names: Absolute Magnitude, Relative Velocity km per sec, Miss D ...
8	DataFrame	(3, 18)	Column names: Absolute Magnitude, Relative Velocity km per sec, Miss D ...
9	DataFrame	(3, 18)	Column names: Absolute Magnitude, Relative Velocity km per sec, Miss D ...
10	DataFrame	(23, 18)	Column names: Absolute Magnitude, Relative Velocity km per sec, Miss D ...
11	DataFrame	(22, 18)	Column names: Absolute Magnitude, Relative Velocity km per sec, Miss D ...
12	DataFrame	(7, 18)	Column names: Absolute Magnitude, Relative Velocity km per sec, Miss D ...
13	DataFrame	(5, 18)	Column names: Absolute Magnitude, Relative Velocity km per sec, Miss D ...
14	DataFrame	(6, 18)	Column names: Absolute Magnitude, Relative Velocity km per sec, Miss D ...
15	DataFrame	(7, 18)	Column names: Absolute Magnitude, Relative Velocity km per sec, Miss D ...
16	DataFrame	(8, 18)	Column names: Absolute Magnitude, Relative Velocity km per sec, Miss D ...
17	DataFrame	(7, 18)	Column names: Absolute Magnitude, Relative Velocity km per sec, Miss D ...
18	DataFrame	(3, 18)	Column names: Absolute Magnitude, Relative Velocity km per sec, Miss D ...
19	DataFrame	(6, 18)	Column names: Absolute Magnitude, Relative Velocity km per sec, Miss D ...
20	DataFrame	(6, 18)	Column names: Absolute Magnitude, Relative Velocity km per sec, Miss D ...
21	DataFrame	(3, 18)	Column names: Absolute Magnitude, Relative Velocity km per sec, Miss D ...
22	DataFrame	(3, 18)	Column names: Absolute Magnitude, Relative Velocity km per sec, Miss D ...

Why:

Since logistic regression requires a balanced dataset, we chose to implement **undersampling**.

Index	lute Magni	Velocity km	ist.(Astronc	it Uncertai	n Orbit Inte	Tisserand I	Eccentricity	mi Major A	Inclination	rbital Perio	helion Dista	erih
29	23.8	11.9306	0.0975441	0	0.052677	7.48	0.386459	0.762974	20.8338	243.424	0.468116	351
33	23.8	11.9306	0.0975438	0	0.0515902	7.48	0.386445	0.762954	20.8334	243.414	0.468114	351
316	23.8	11.917	0.0884576	0	0.052677	7.48	0.386459	0.762974	20.8338	243.424	0.468116	351
322	23.8	11.917	0.0884573	0	0.0515902	7.48	0.386445	0.762954	20.8334	243.414	0.468114	351
4195	23.8	12.0762	0.0562219	0	0.052677	7.48	0.386459	0.762974	20.8338	243.424	0.468116	351
4204	23.8	12.0762	0.0562218	0	0.0515902	7.48	0.386445	0.762954	20.8334	243.414	0.468114	351

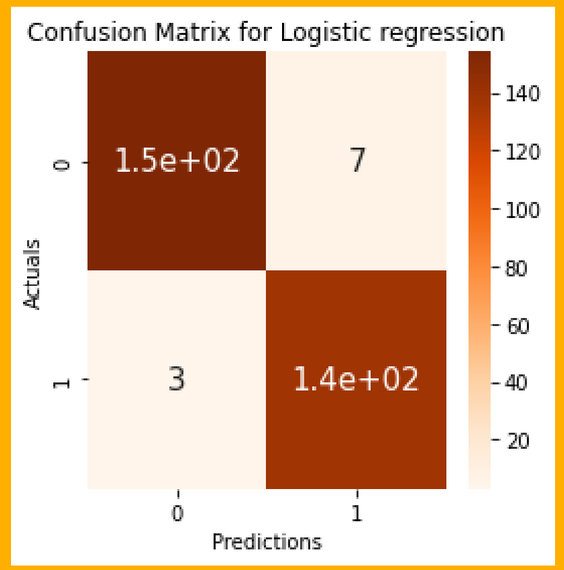
How:

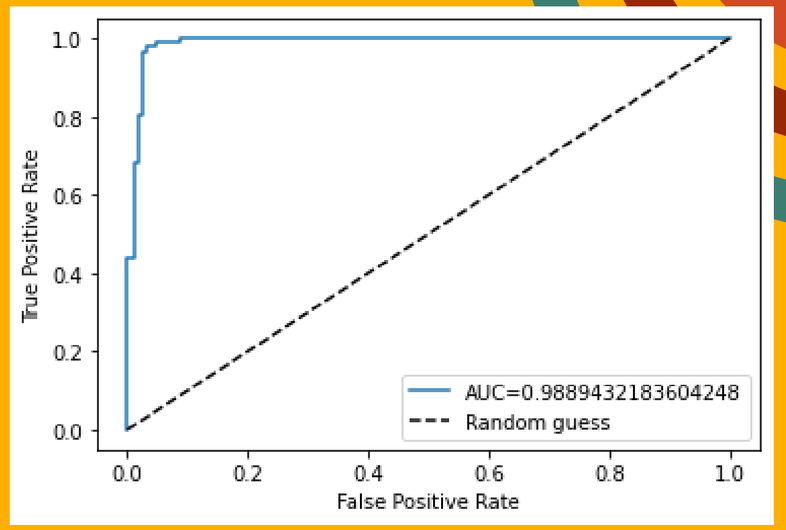
We performed **DBSCAN clustering**, and then collected observations from each cluster, resulting in 1510 perfectly balanced observations.

MODEL METRICS

Confusion Matrix

Logistic regression **precision**: 0.9517241379310345
Logistic regression **accuracy**: 0.9668874172185431
Logistic regression **recall**: 0.9787234042553191
Logistic regression **F-1 score**: 0.965034965034965
Logistic regression **specificity**: 0.9565217391304348





ROC curve

The ROC curve is almost perfect
with an **AUC** of: 0.989

PARAMETERS

Interpretation:

Clearly, not all of the parameters are relevant for the model.

	2.5%	97.5%	Odds Ratio	pvalues	significant?
x1	3.155310e-04	5.825838e-03	1.355814e-03	6.845492e-19	significant
x2	1.804305e+00	1.051243e+01	4.355185e+00	1.065462e-03	significant
x3	0.000000e+00	inf	1.770546e-37	9.999808e-01	not significant
x4	3.350756e-01	1.084910e+00	6.029318e-01	9.140011e-02	not significant
x5	1.782153e-03	2.396448e-02	6.535164e-03	3.247812e-14	significant
x6	8.121680e+02	3.591726e+16	5.401004e+09	5.177060e-03	significant
x7	1.930467e-01	9.055550e+00	1.322174e+00	7.760404e-01	not significant
x8	0.000000e+00	inf	2.015626e+01	9.999998e-01	not significant
x9	4.942356e-01	2.684544e+00	1.151867e+00	7.432891e-01	not significant
x10	2.754636e-12	1.792121e+09	7.026124e-02	8.280472e-01	not significant
x11	0.000000e+00	inf	1.201890e+00	9.999999e-01	not significant
x12	6.950560e-01	1.541571e+00	1.035122e+00	8.651103e-01	not significant
x13	0.000000e+00	inf	2.412068e+01	9.999998e-01	not significant
x14	1.051653e+00	2.426355e+00	1.597399e+00	2.808427e-02	significant
x15	4.391807e-14	4.087983e-04	4.237173e-09	9.934457e-04	significant
x16	0.000000e+00	inf	1.323124e+16	9.999928e-01	not significant
x17	0.000000e+00	inf	3.341519e+20	9.999895e-01	not significant
x18	5.692982e-01	7.304492e+00	2.039224e+00	2.736961e-01	not significant

THANK YOU