Assignment 1

1. Data Dimensionality

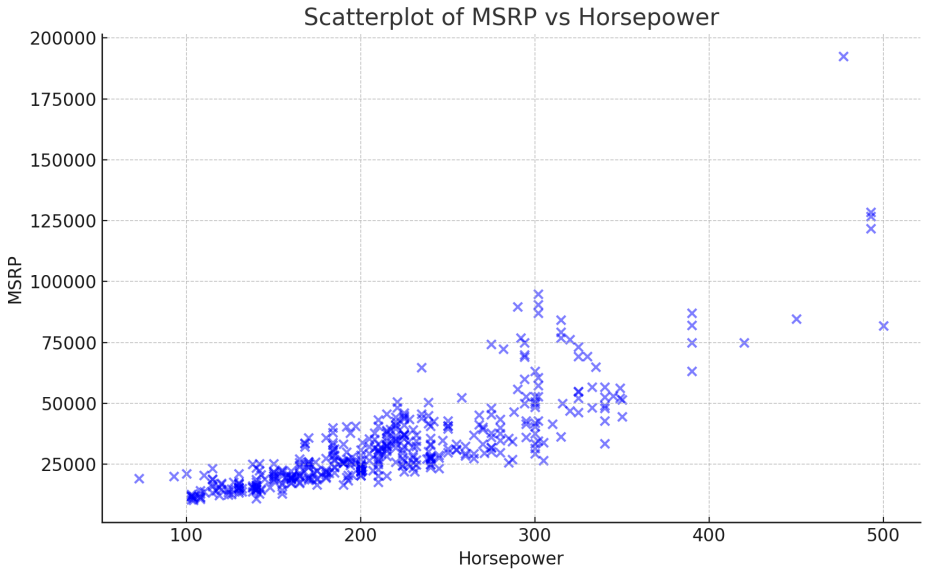
Below is a summary of the data dimensionality of the automotive dataset.

Metric	Value	
Total number of vehicles	428	
Number of attributes	12	
Missing Values	Make	0
	Model	0
	Type	0
	Origin	0
	DriveTrain	0
	MSRP	0
	EngineSize	0
	Cylinders	2
	Horsepower	0
	MPG_Highway	0
	Weight	0
	Length	0
Data Types	Make	object
	Model	object
	Type	object
	Origin	object
	DriveTrain	object
	MSRP	int64
	EngineSize	float64
	Cylinders	float64
	Horsepower	int64
	MPG_Highway	int64
	Weight	int64
	Length	int64

2. Data Visualization

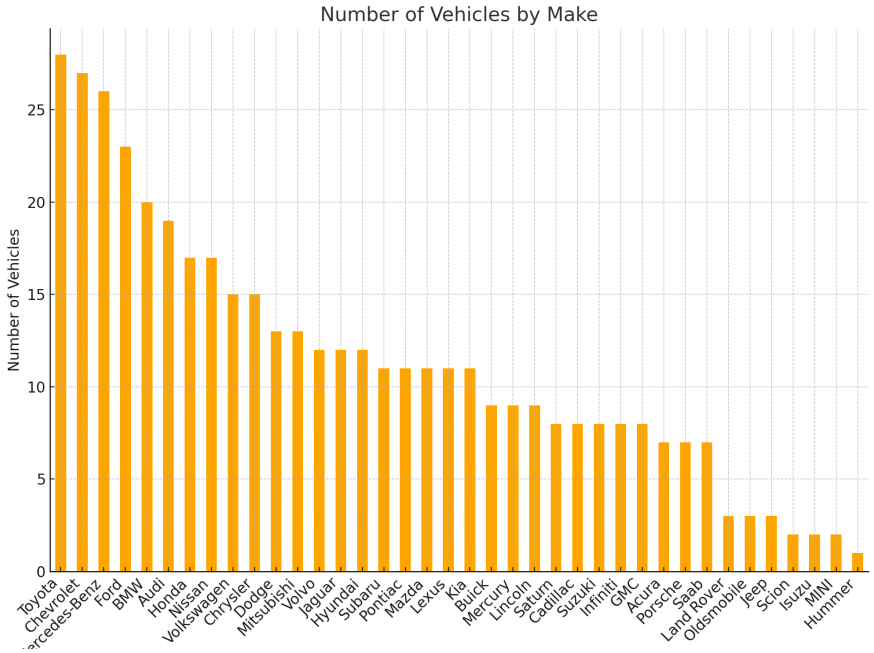
Scatterplot of MSRP vs Horsepower

The scatterplot below shows the relationship between MSRP and Horsepower.



Bar plot of Number of Vehicles by Make

The bar plot below shows the number of vehicles by each make.



Make with the Greatest Number of Vehicles

The company with the greatest number of vehicles is Toyota, which has a total of 28 vehicles.

3. Normalization and Standardization of Horsepower

The table below shows the original, normalized, and standardized values of the Horsepower variable:

Index	Original Horsepower	Normalized Horsepower	Standardized Horsepower
0	265	0.4496	0.6845
1	200	0.2974	-0.2214
2	200	0.2974	-0.2214
3	270	0.4614	0.7542
4	225	0.3560	0.1270

Statistical Summary

Here is the statistical summary of the transformed data:

Index	Original Horsepower	Normalized Horsepower	Standardized Horsepower
count	428.000000	428.000000	4.280000e+02
mean	215.885514	0.334626	-7.470660e-17
std	71.836032	0.168234	1.001170e+00
min	73.000000	0.000000	-1.991379e+00
25%	165.000000	0.215457	-7.091854e-01
50%	210.000000	0.320843	-8.202571e-02
75%	255.000000	0.426230	5.451340e-01
max	500.000000	1.000000	3.959670e+00

4. Discussion

Differences between Normalization and Standardization

Normalization rescales the data to a fixed range, typically between 0 and 1. This is useful when features have different scales and you want to ensure that they contribute equally to a model, particularly in algorithms like k-nearest neighbors (KNN) or neural networks, where the magnitude of data values can influence the result. Standardization, however, centers the data by subtracting the mean and scales it by the standard deviation, leading to a mean of 0 and a standard deviation of 1. This transformation is more suitable for algorithms like SVM or PCA, which assume that the data is normally distributed or when features have different

variances. In this dataset, normalization compressed the horsepower values into a small range, whereas standardization adjusted the spread of the data around the mean, making it easier to identify outliers and compare across features.

Preferred Transformation Method

In this context, I prefer standardization because it maintains the original distribution of the data while ensuring that features are on the same scale. This is particularly important when analyzing datasets where the relationships between features are more significant than their individual scales. Standardization allows for better comparison between different attributes, especially when the data follows a normal distribution, and it is essential in statistical modeling techniques where the variance of data influences the results.