Data Exploration Assignment

January 18, 2019

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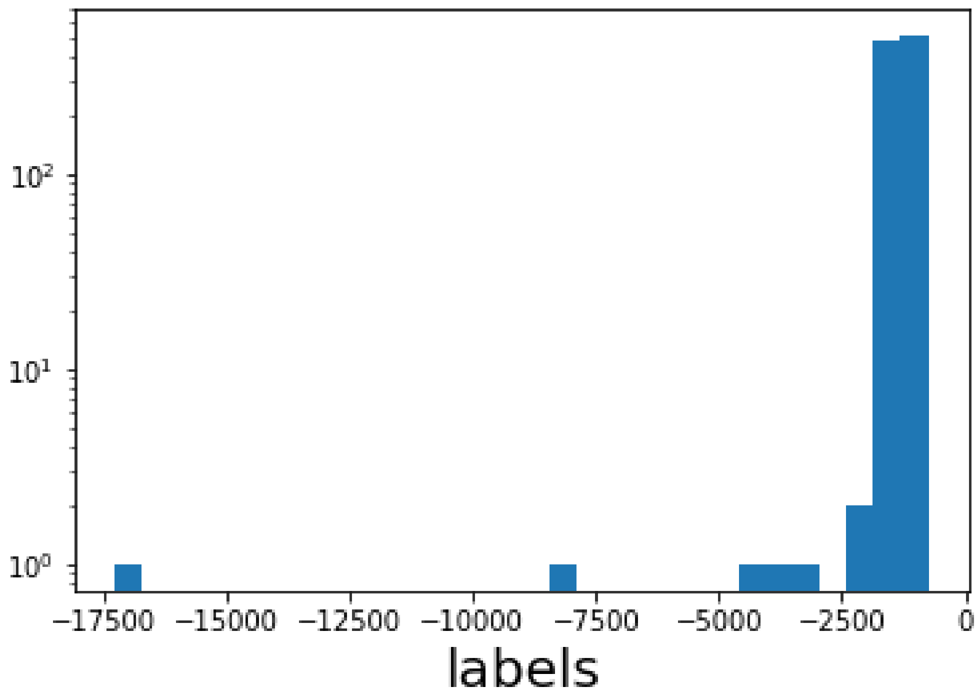
First thing's first, I have done some imports and defined some functions to use for data exploration.

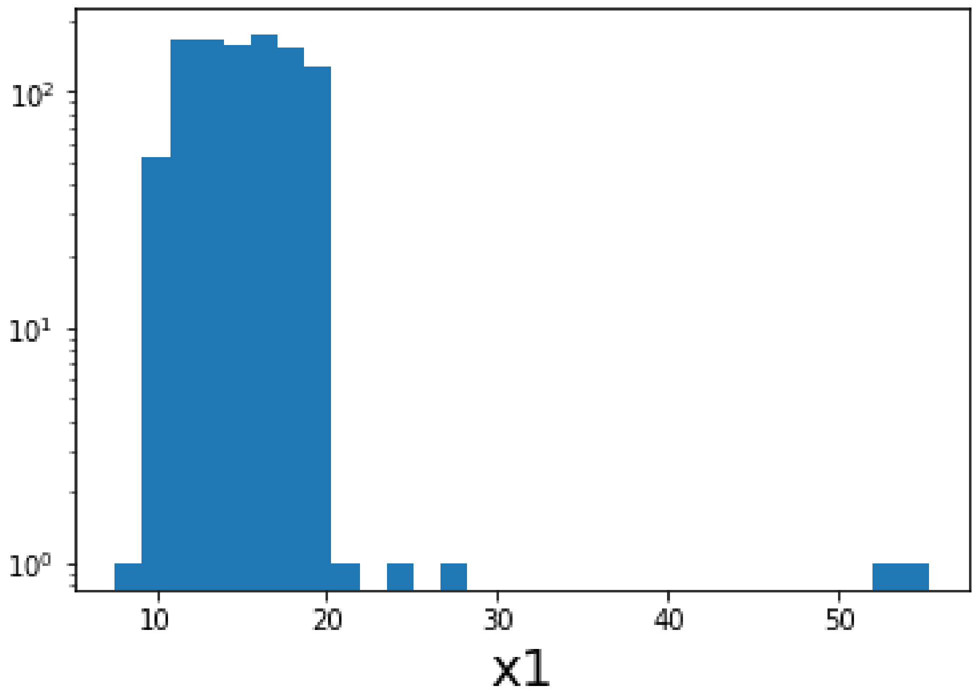
```
In [1]: import pandas as pd
        import matplotlib.pyplot as plt
        import sklearn.model_selection

        def loadData():
            return pd.read_csv("raw-data.csv", index_col=0)
        def saveData(df, fileName):
            df.to_csv(fileName)
        def splitData( df, ratio ):
            dataTrain, dataTest = sklearn.model_selection.train_test_split( df, test_size=ratio,
            return dataTrain, dataTest


        def displayHistogramPlots(df):
            headers = list(df)
            for i in range(len(headers)):
                plt.hist(df[headers[i]],bins=30, log=True, label=headers[i])
                plt.xlabel(headers[i], fontsize=20)
                plt.show()

        def displayScatterPlots(df):
            headers = list(df)
            for i in range(1, len(headers)):
                plt.scatter(df[headers[i]],df['labels'], )
                plt.yscale("symlog")
                plt.ylabel('labels', fontsize=20)
                plt.xlabel(headers[i], fontsize=20)
                plt.show()

        def removeOutliers(df):
            df = df[ df.labels >= -2000 ]
            df = df[ (df.x1 >= 10) & (df.x1 <= 24) ]
```

```
    df = df[ df.x2 <= 35 ]
    df = df[ (df.x3 <= 70) & (df.x3 >= 25)]
    df = df[ (df.x4 <= 80) & (df.x4 >= 15)]
    df = df[ df.x5 >= 40 ]
    df = df[ (df.x6 <= 90) & (df.x6 >= 18)]
    return df

def displayData(df):
    displayHistogramPlots(df)
    displayScatterPlots(df)
```

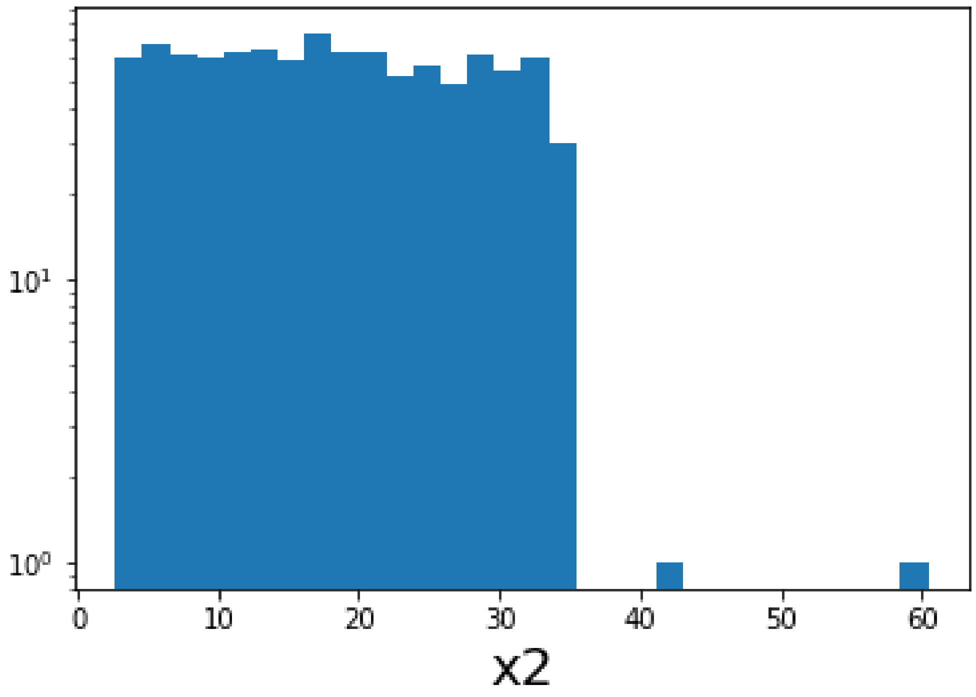
Next I load and display histograms and scatter plots, for the raw (somewhat random) data, that was provided.

```
In [2]: rawData = loadData()
        displayData(rawData)
```

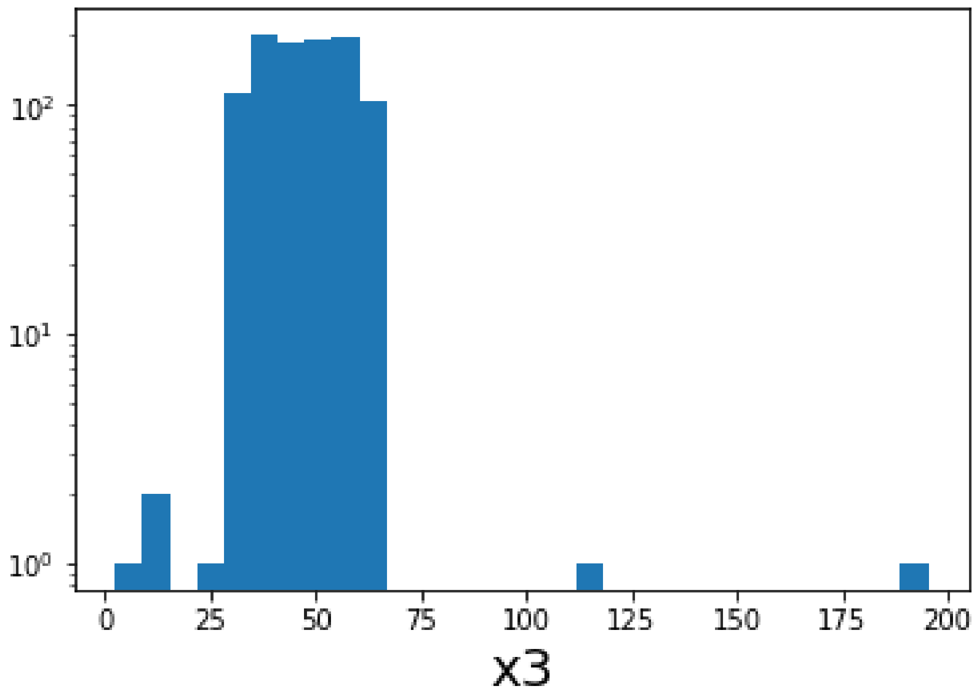




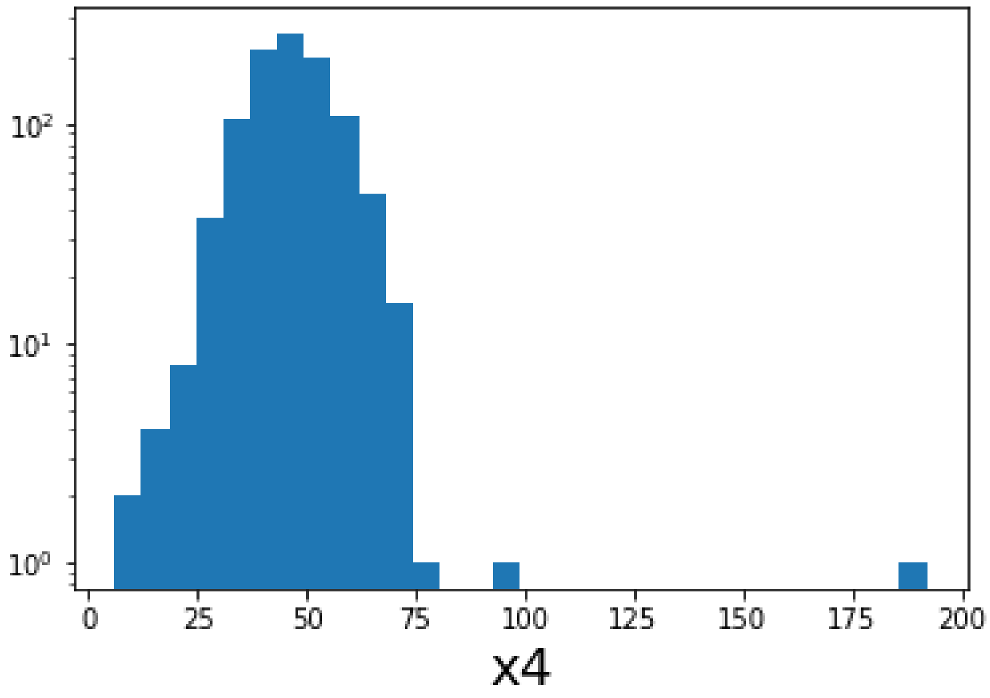
10^2
10^1
10^0
10
20
30
40
50
x1



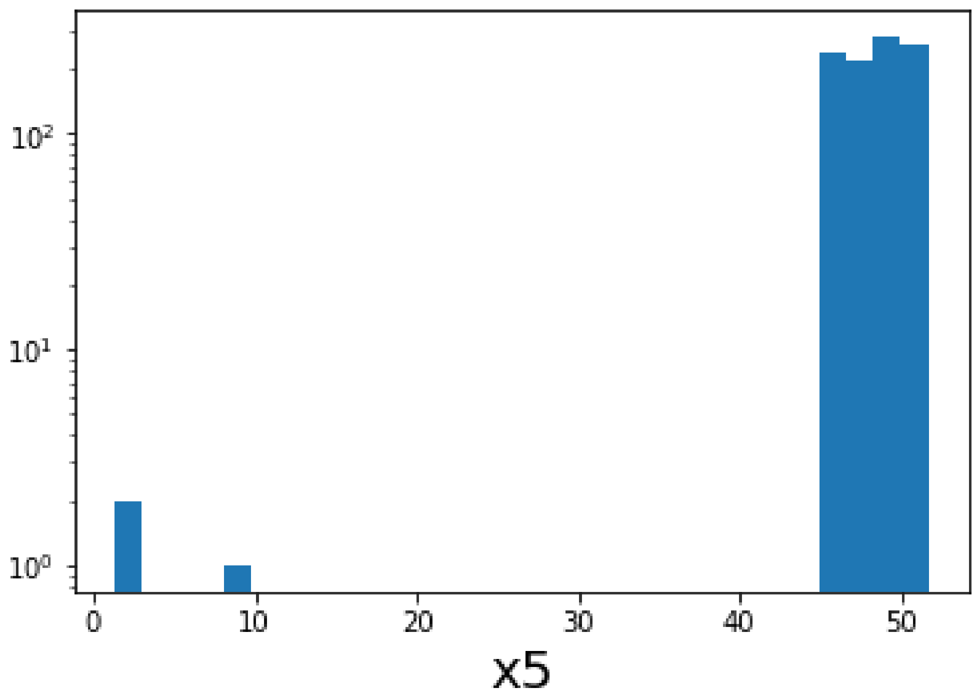
10^1
10^0
0
10
20
30
40
50
60
x2

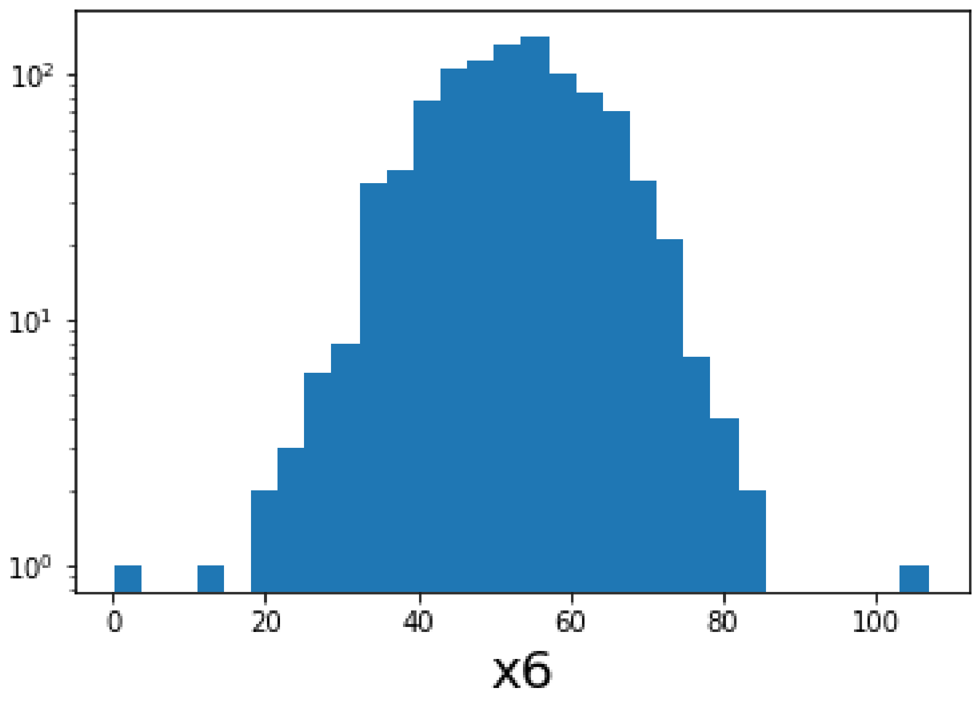


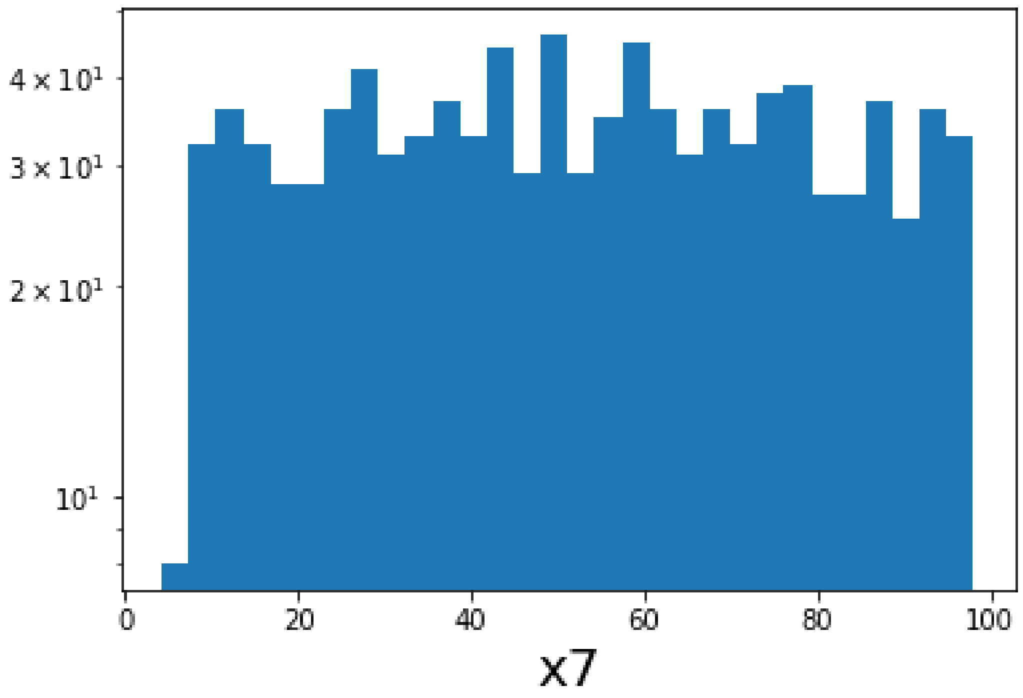
10^2
10^1
10^0
0
25
50
75
100
125
150
175
200
x3

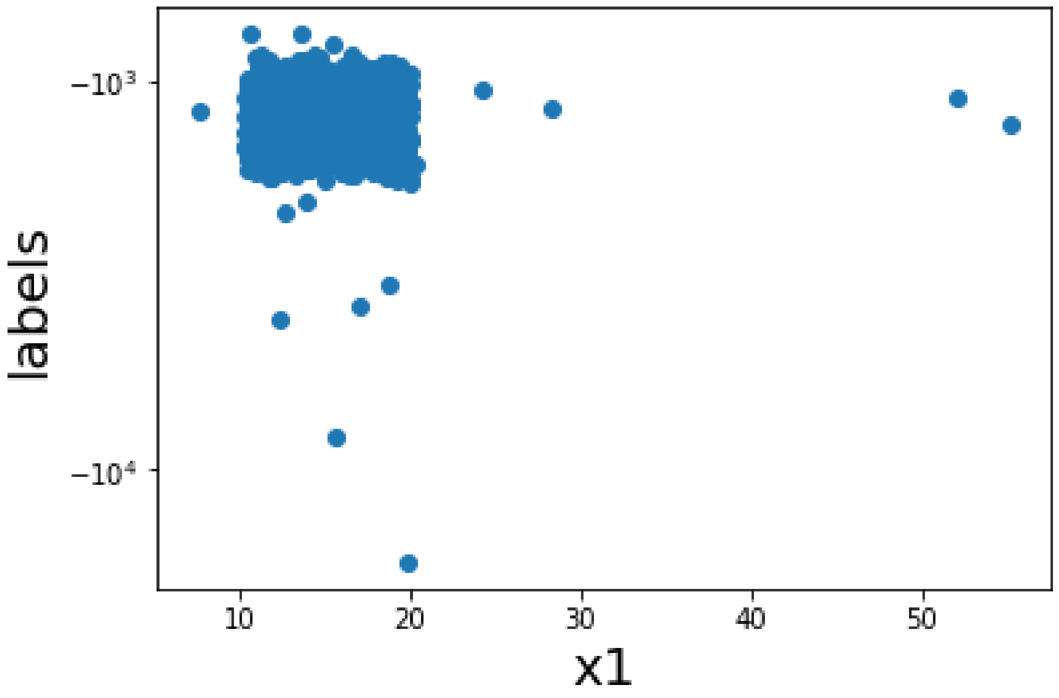


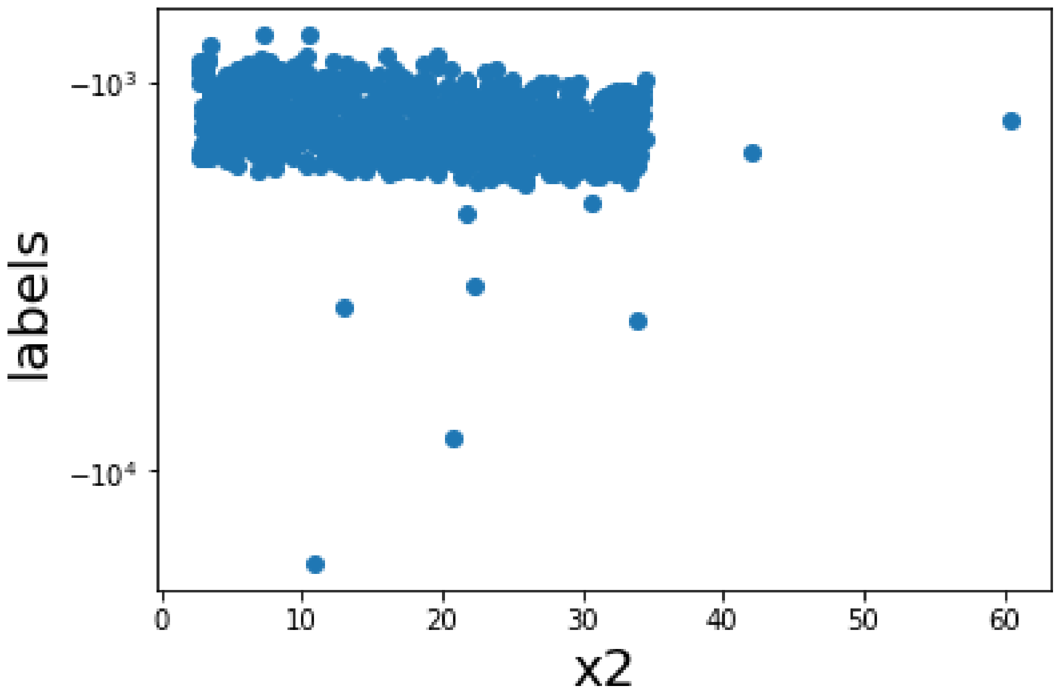
10^2
10^1
10^0
0
25
50
75
100
125
150
175
200
x4

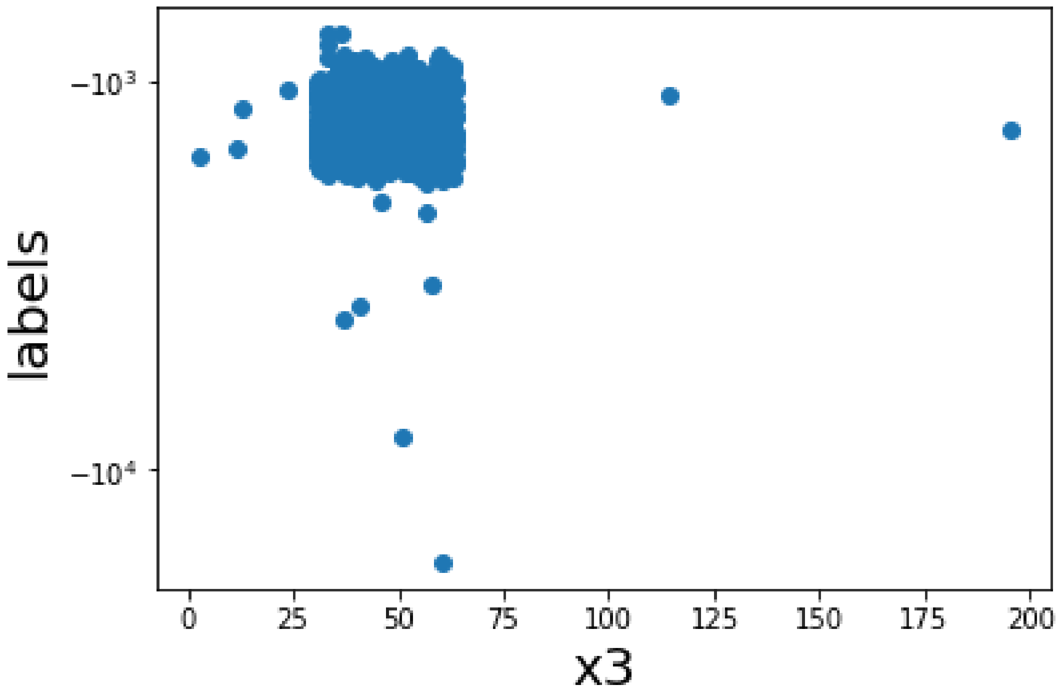

10²
10¹
10⁰
0
10
20
30
40
50
x5

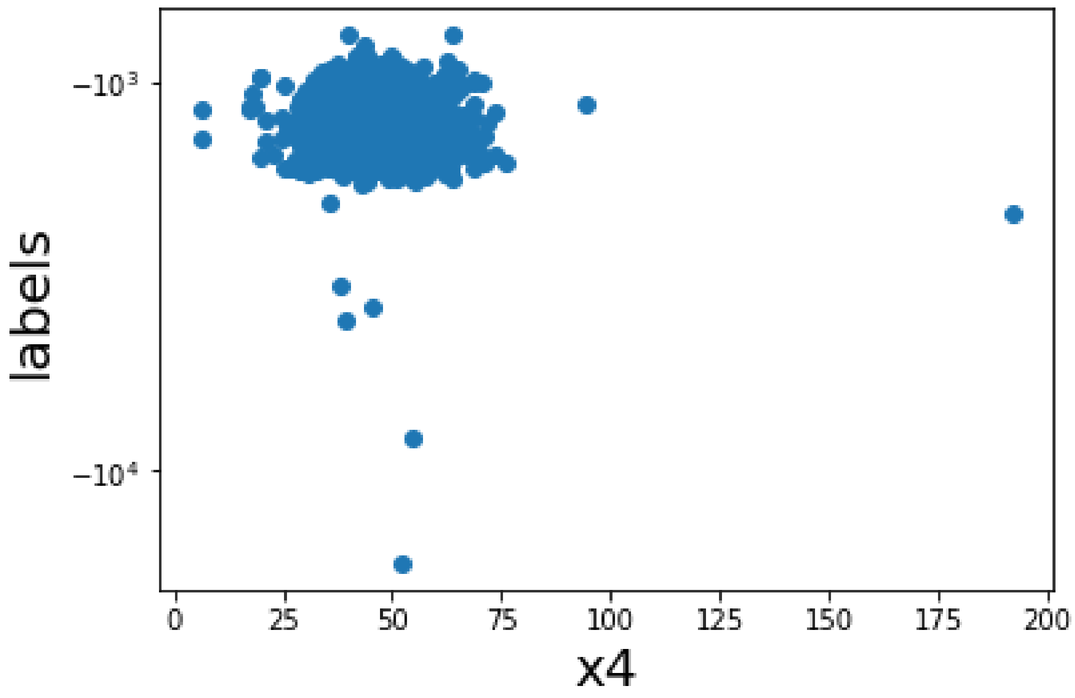

10²
10¹
10⁰
0
20
40
60
80
100
x6


4×10^1
3×10^1
2×10^1
10^1
0
20
40
60
80
100
x7

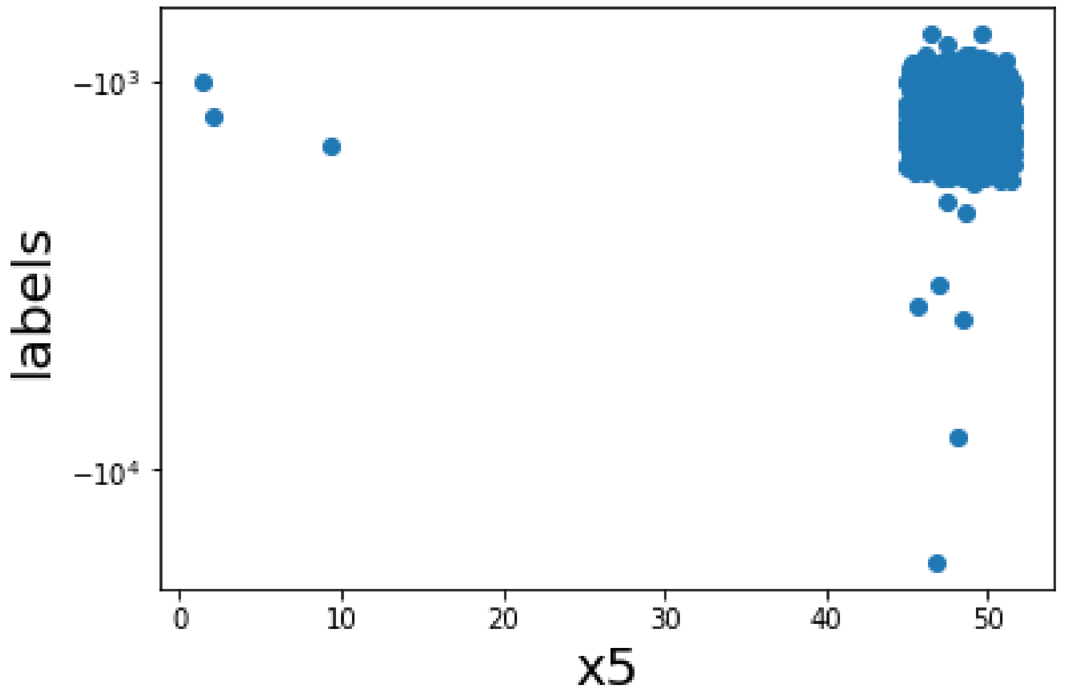

-10^3
-10^4
labels
10
20
30
40
50
x1


−10³
−10⁴
labels
0
10
20
30
40
50
60
x2

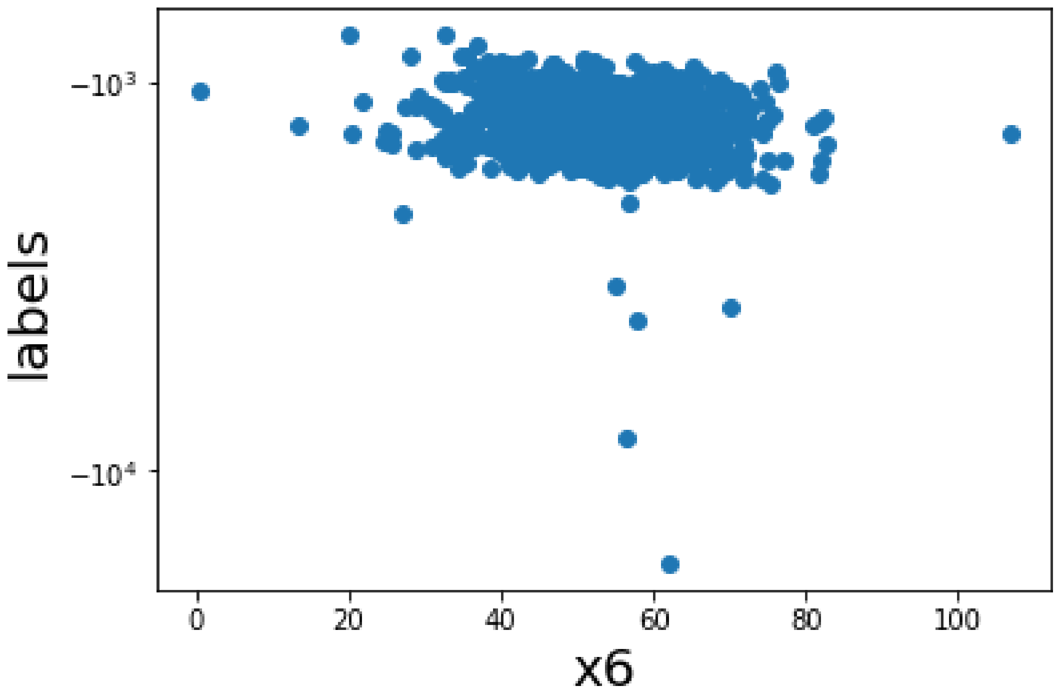

−10³
−10⁴
labels
0
25
50
75
100
125
150
175
200
x3



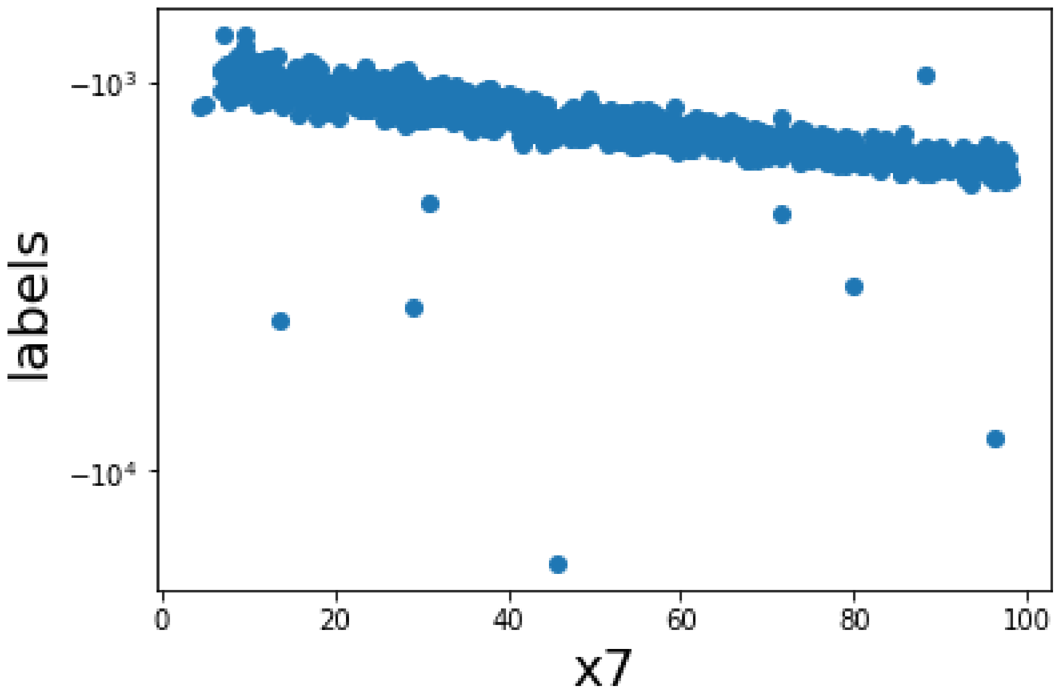
-10^3
-10^4
labels
0
25
50
75
100
125
150
175
200
x4



-10^3
-10^4
labels
0
10
20
30
40
50
x5



-10^3
-10^4
labels
0
20
40
60
80
100
x6



-10^3
-10^4
labels
0
20
40
60
80
100
x7

After examining the raw data, I have defined a function to remove all outliers, for each feature. This had a dramatic impact on the ease of interpreting the data.

As we can see below, the histograms, and scatter plots, show clean distibutions for the labels, and each feature. The correlation, as seen in the scatter plots, between each feature and the labels, are as follows:

- X1

  Mostly uniform, with little to no correlation

- X2

  A slight negative correlation

- X3

  Similar to X1, with little to no correlation

- X4

  Mostly a clustered blob, no correlation

- X5

  Similar to X1 and X3, wwith little to no correlation

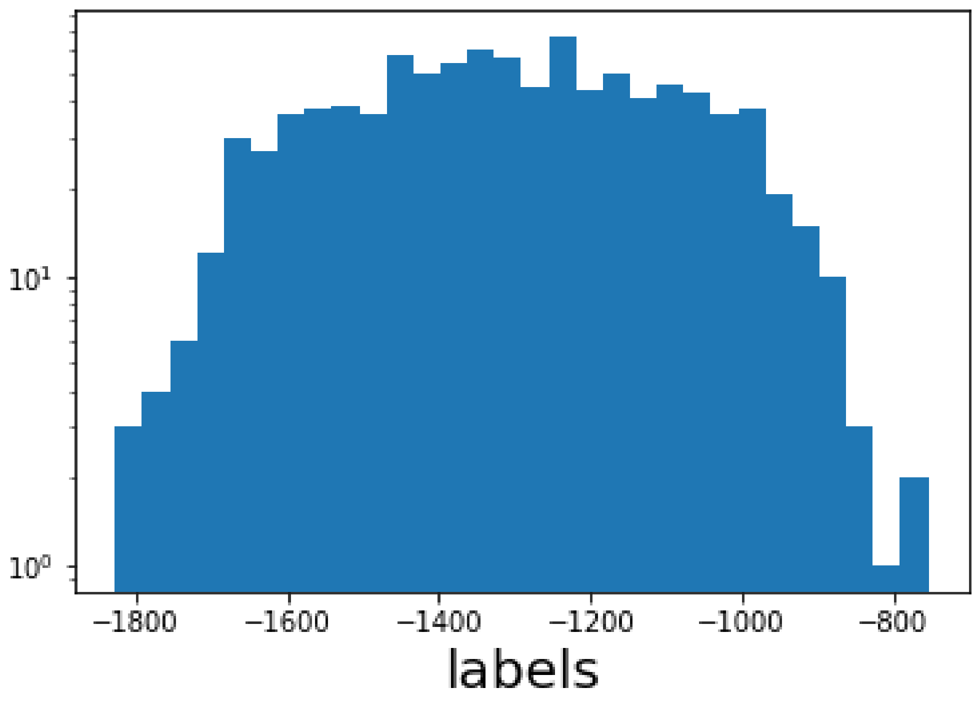
- X6

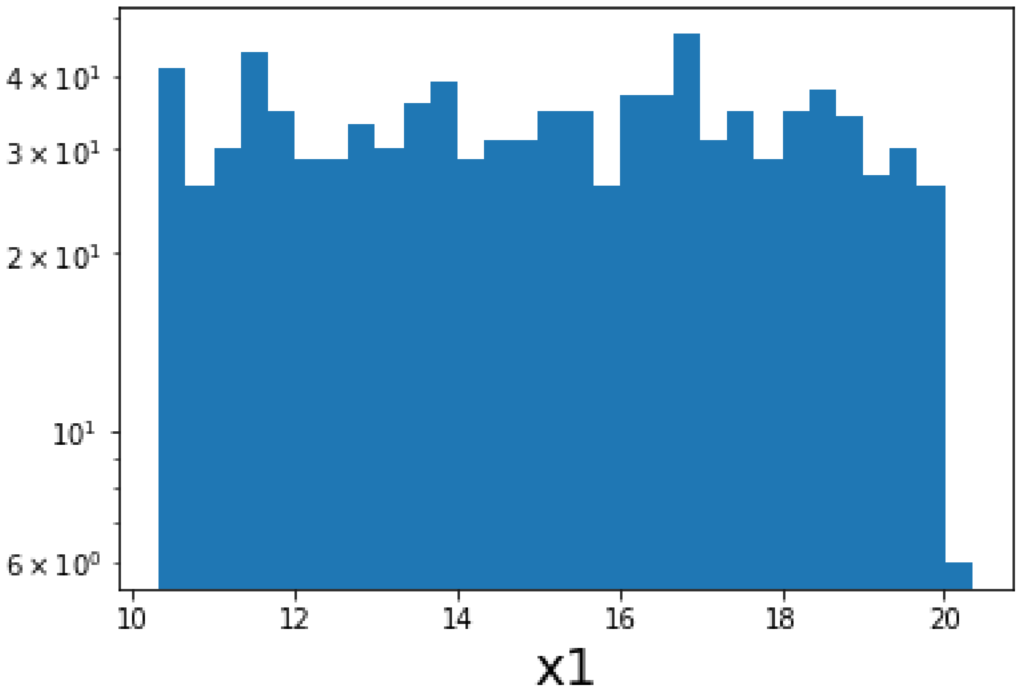
  A blob like cluster with a slight negative correlation

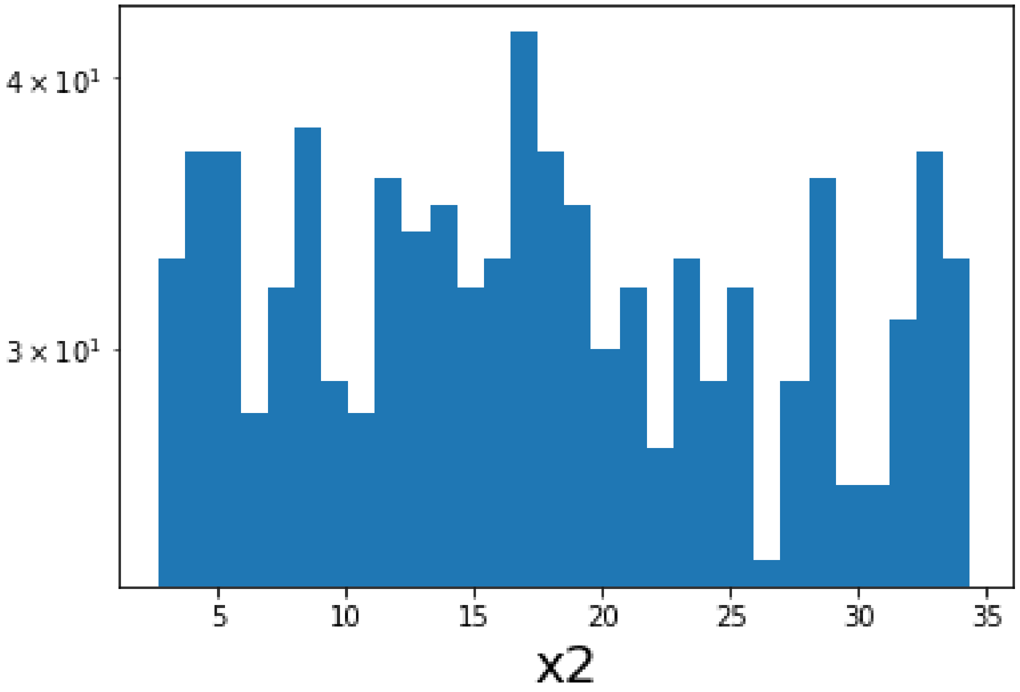
- X7

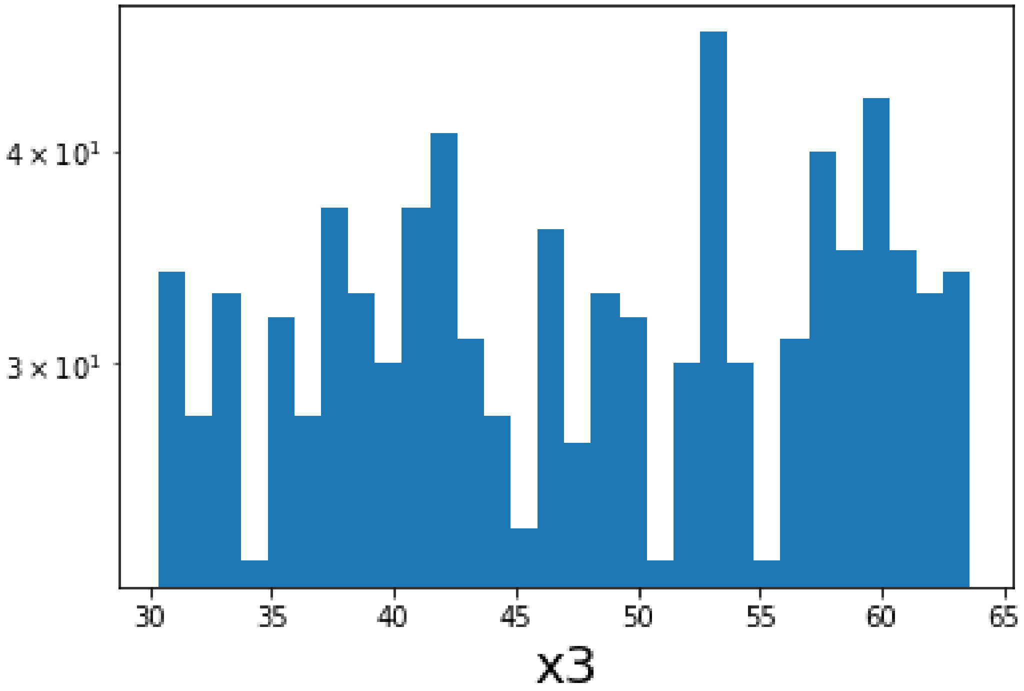
  A negatively correlated line, with noise along line

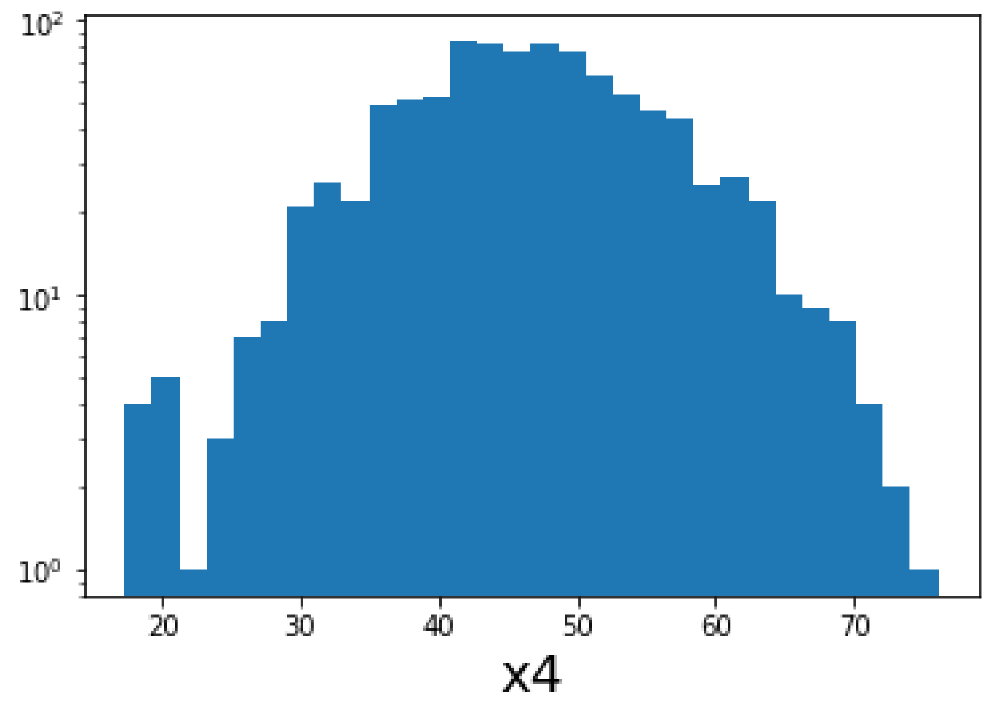
```
In [3]: cleanData = removeOutliers(rawData)
        displayData(cleanData)
```

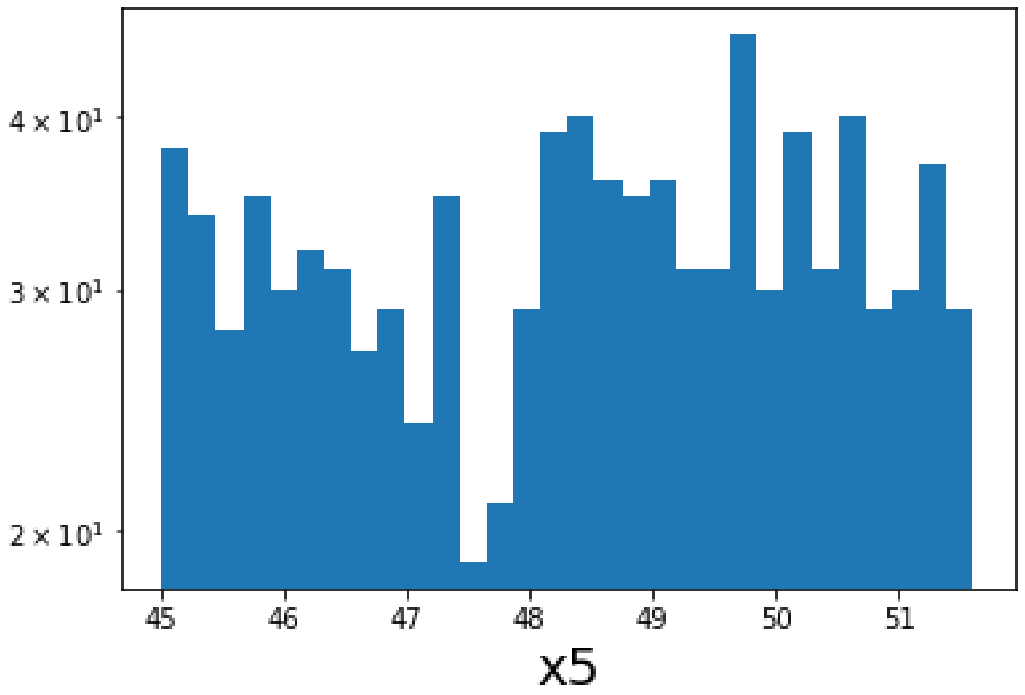

10^1
10^0
−1800
−1600
−1400
−1200
−1000
−800
labels

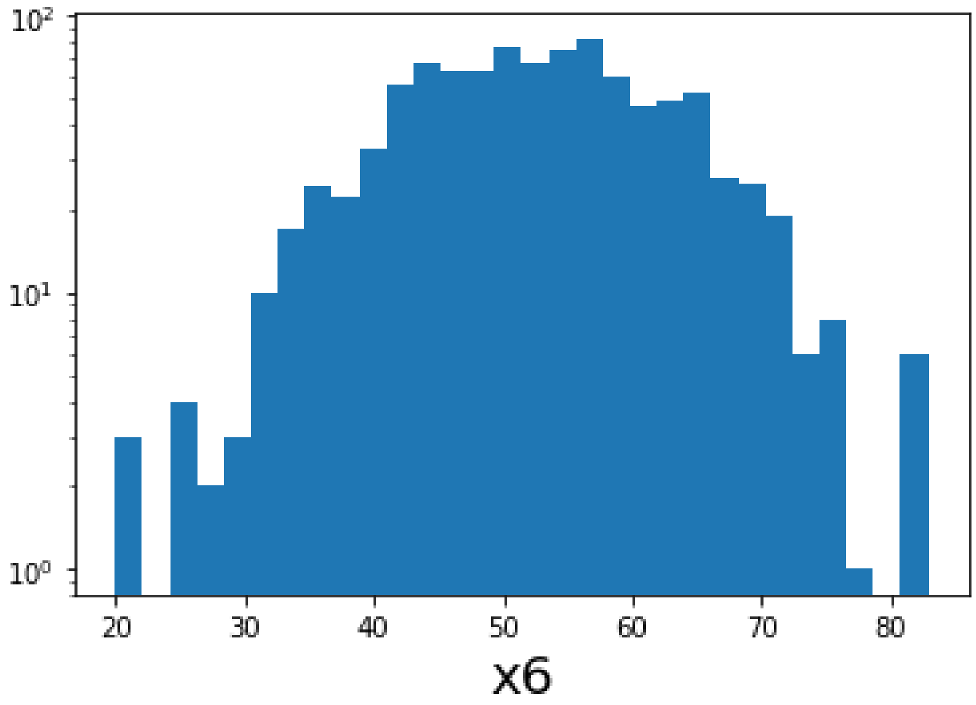

4 × 10^1
3 × 10^1
2 × 10^1
10^1
6 × 10^0
10
12
14
16
18
20
x1


4×10^1
3×10^1
5
10
15
20
25
30
35
x2

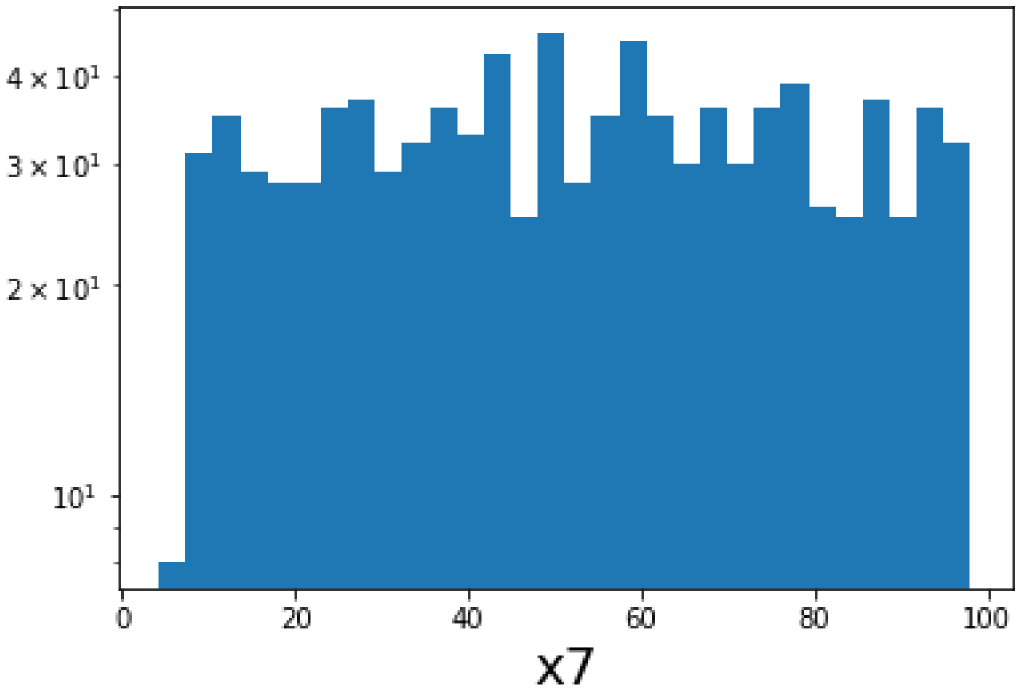

4×10^1
3×10^1
30
35
40
45
50
55
60
65
x3


10^2
10^1
10^0
20
30
40
50
60
70
x4

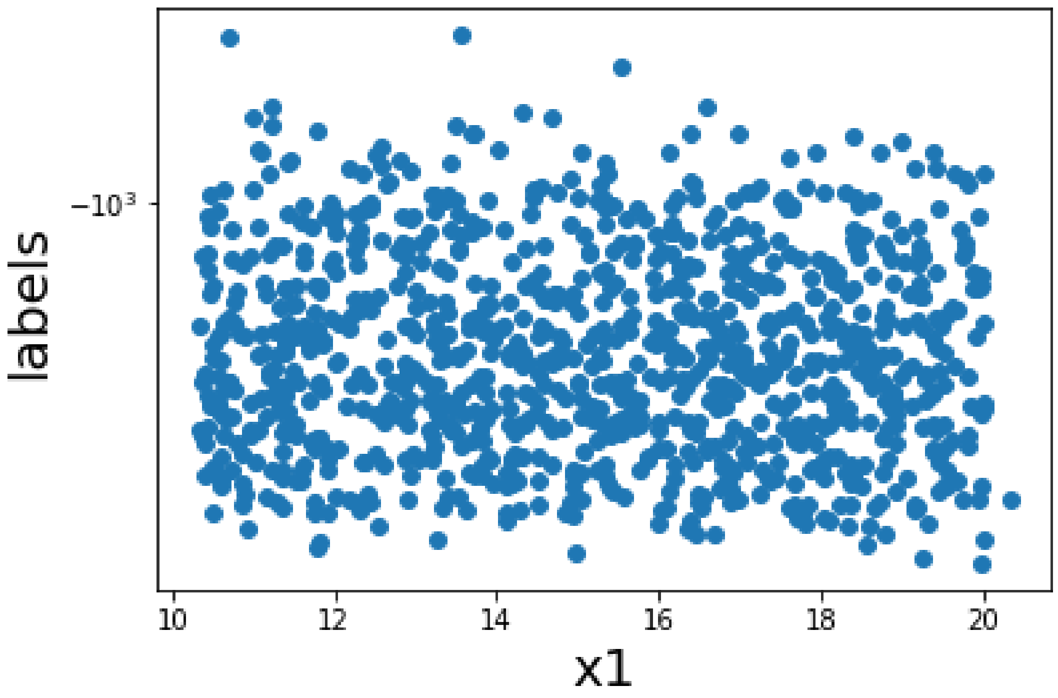

4×10^1
3×10^1
2×10^1
45
46
47
48
49
50
51
x5



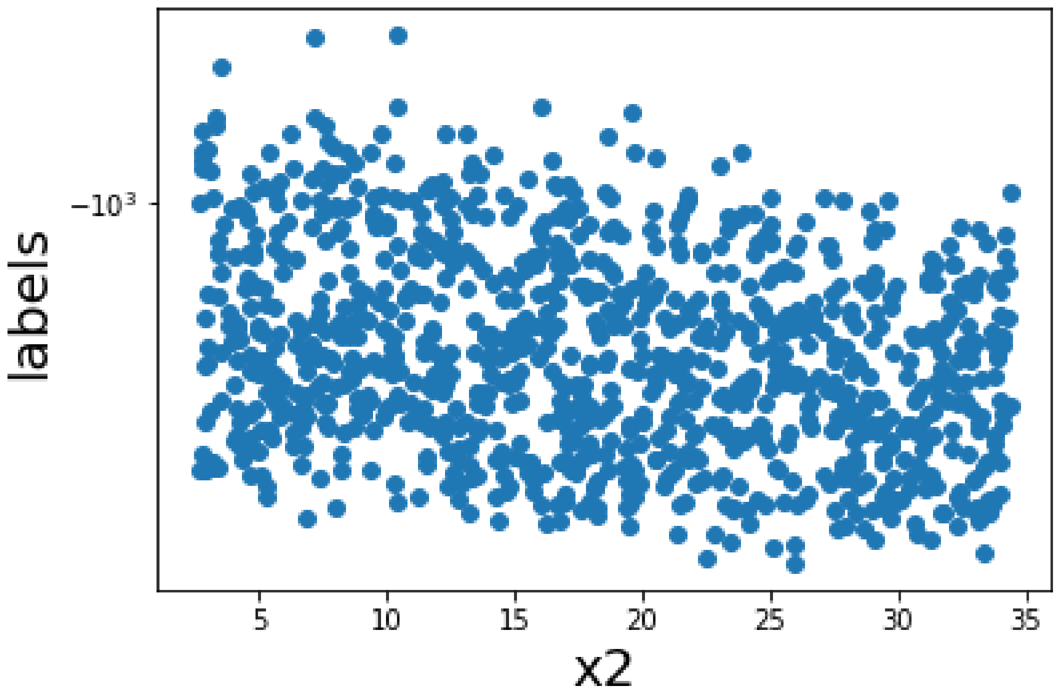
10^2
10^1
10^0
20
30
40
50
60
70
80
x6



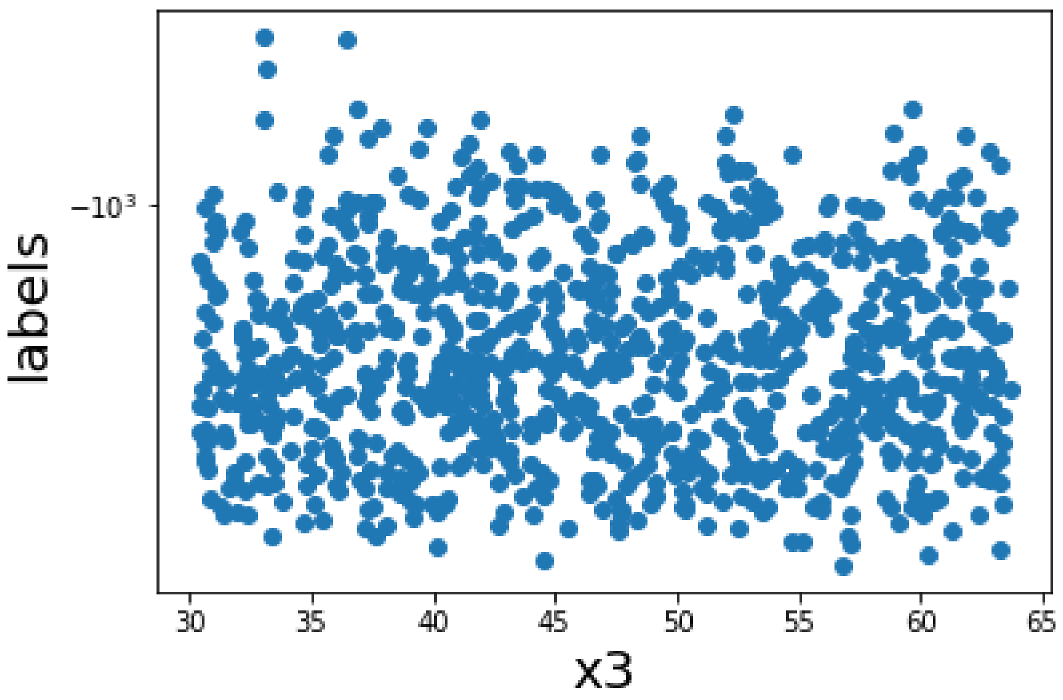
4×10^1
3×10^1
2×10^1
10^1
0
20
40
60
80
100
x7

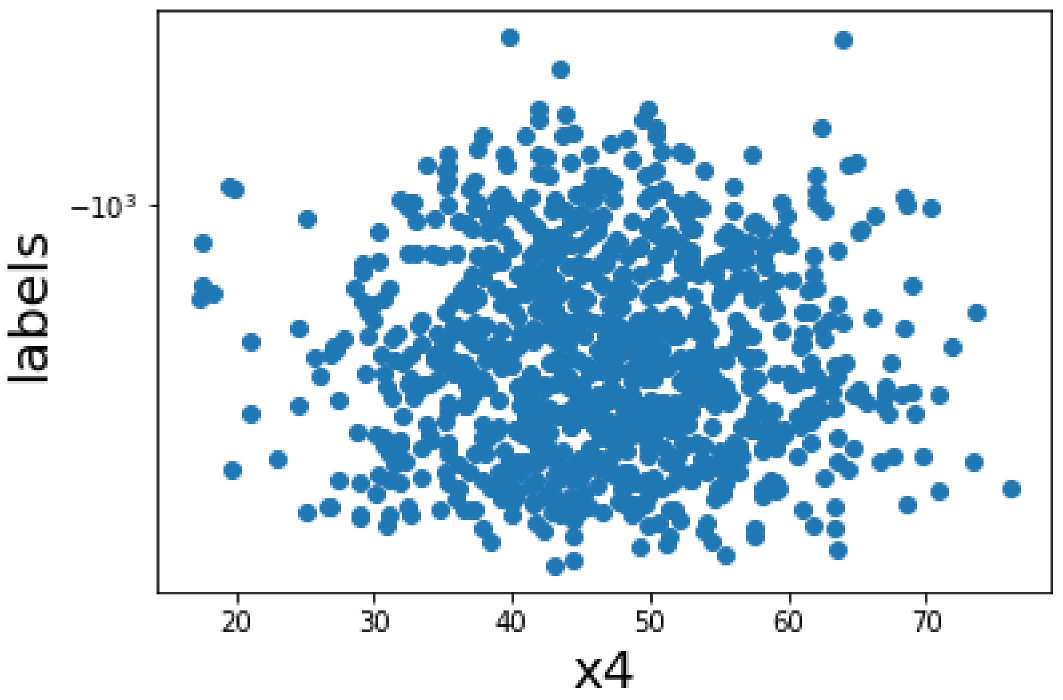


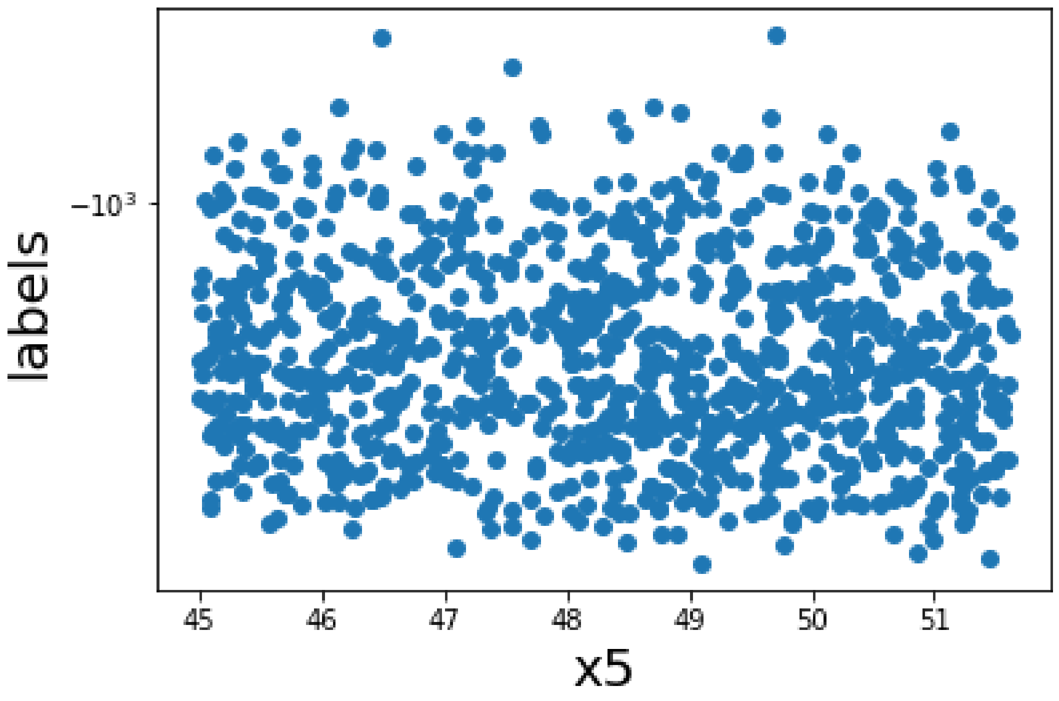
labels
-10^3
10
12
14
16
18
20
x1

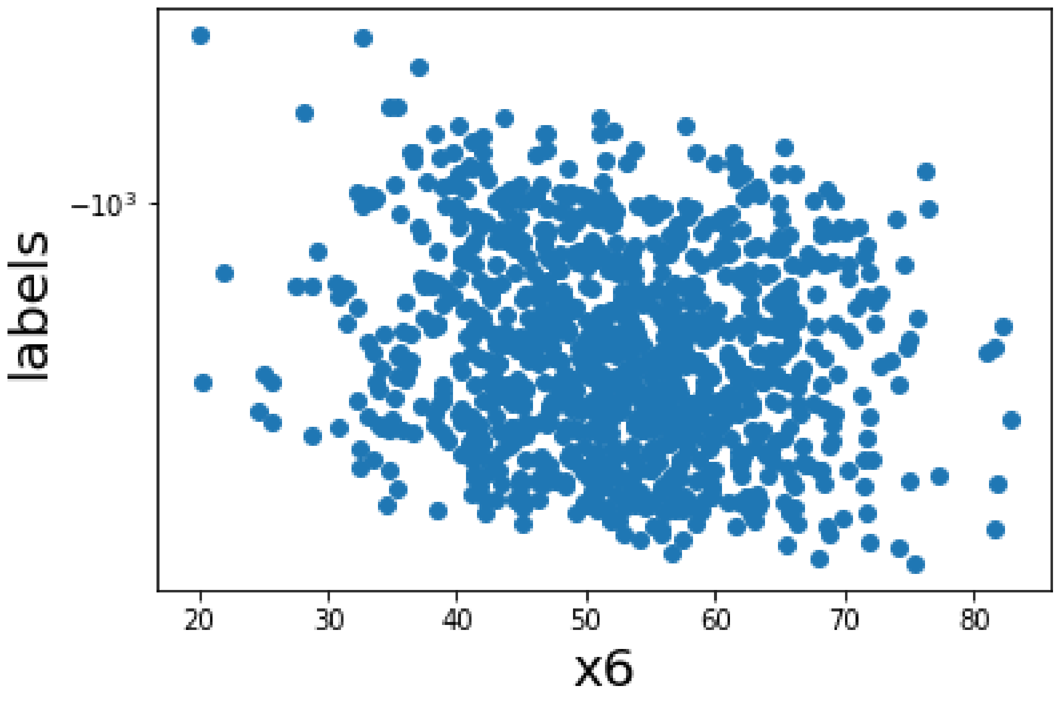


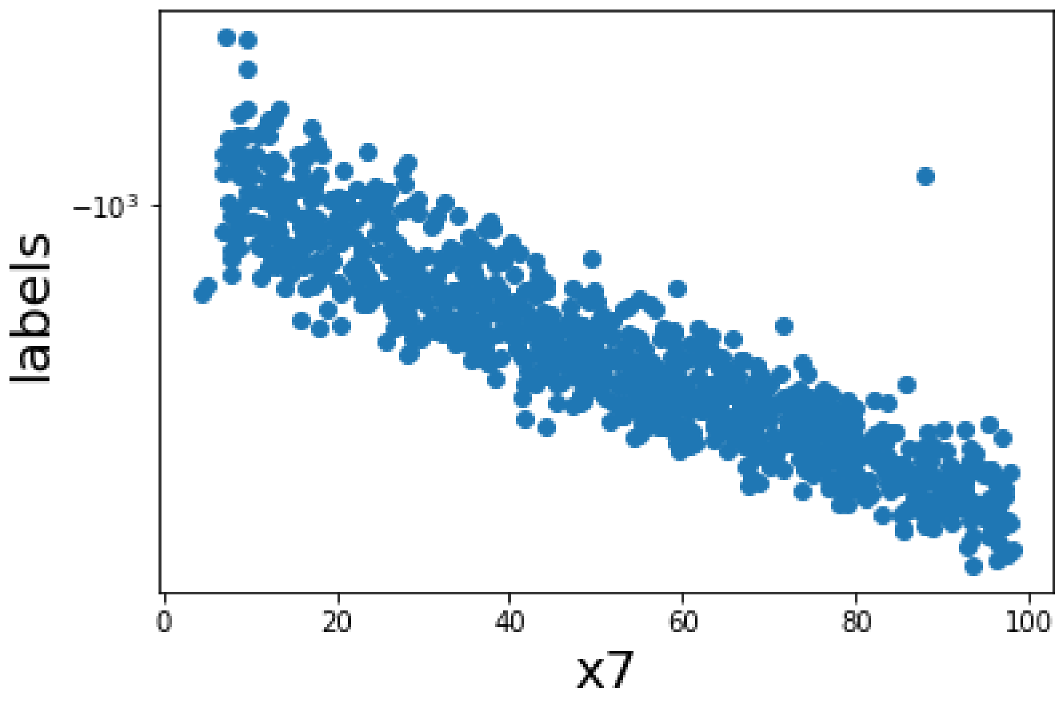
labels
-10^3
5
10
15
20
25
30
35
x2


−10³
labels
30
35
40
45
50
55
60
65
x3


−10³
labels
20
30
40
50
60
70
x4


−10³
labels
45
46
47
48
49
50
51
x5


−10³
labels
20
30
40
50
60
70
80
x6



Now that we have a clean data set, the data is saved to a .csv file.

```
In [4]: saveData(cleanData, "clean-data.csv")
```

Final step was to split the data into training, and test data. The split is %80 to %20, respectively. And each data set is saved to a .csv file.

```
In [5]: trainData, testData = splitData(cleanData, .2)
        saveData(trainData, "train-data.csv")
        saveData(testData, "test-data.csv")
```

```
In [ ]:
```