МОСКОВСКИЙ ГОСУДАРСТВЕННЫЙ ТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ
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ОТЧЕТ

Лабораторная работа №__3__
по дисциплине «Методы машинного обучения в АСОИУ»

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"__"_____2024 г.

Москва - 2024

Выбрать один или несколько наборов данных (датасетов) для решения следующих задач. Каждая задача может быть решена на отдельном датасете, или несколько задач могут быть решены на одном датасете. Просьба не использовать датасет, на котором данная задача решалась в лекции. Для выбранного датасета (датасетов) на основе материалов лекций решить следующие задачи: масштабирование признаков (не менее чем тремя способами); обработку выбросов для числовых признаков (по одному способу для удаления выбросов и для замены выбросов); обработку по крайней мере одного нестандартного признака (который не является числовым или категориальным); отбор признаков: один метод из группы методов фильтрации (filter methods); один метод из группы методов обертывания (wrapper methods); один метод из группы методов вложений (embedded methods).

```
# Импорт необходимых библиотек и загрузка данных
from sklearn.datasets import load_wine
import pandas as pd

data = load_wine()
df = pd.DataFrame(data.data, columns=data.feature_names)
df['target'] = data.target

# Масштабирование признаков
from sklearn.preprocessing import StandardScaler, MinMaxScaler,
RobustScaler

scaler_standard = StandardScaler()
df_scaled_standard = scaler_standard.fit_transform(df.drop('target',
axis=1))

scaler_minmax = MinMaxScaler()
df_scaled_minmax = scaler_minmax.fit_transform(df.drop('target',
axis=1))

scaler_robust = RobustScaler()
df_scaled_robust = scaler_robust.fit_transform(df.drop('target',
axis=1))

print("Standard Scaling:")
print(df_scaled_standard)

print("\nMinMax Scaling:")
print(df_scaled_minmax)

print("\nRobust Scaling:")
print(df_scaled_robust)

# Обработка выбросов для числовых признаков
Q1 = df.quantile(0.25)
Q3 = df.quantile(0.75)
IQR = Q3 - Q1
df_no_outliers = df[~((df < (Q1 - 1.5 * IQR)) | (df > (Q3 + 1.5 *
IQR)).any(axis=1))]
```

```python
print("\nData without outliers:")
print(df_no_outliers)
```

```
Standard Scaling:
[[ 1.51861254 -0.5622498   0.23205254 ...  0.36217728  1.84791957
   1.01300893]
 [ 0.24628963 -0.49941338 -0.82799632 ...  0.40605066  1.1134493
   0.96524152]
 [ 0.19687903  0.02123125  1.10933436 ...  0.31830389  0.78858745
   1.39514818]
 ...
 [ 0.33275817  1.74474449 -0.38935541 ... -1.61212515 -1.48544548
   0.28057537]
 [ 0.20923168  0.22769377  0.01273209 ... -1.56825176 -1.40069891
   0.29649784]
 [ 1.39508604  1.58316512  1.36520822 ... -1.52437837 -1.42894777
  -0.59516041]]

MinMax Scaling:
[[0.84210526 0.1916996  0.57219251 ... 0.45528455 0.97069597
0.56134094]
 [0.57105263 0.2055336  0.4171123  ... 0.46341463 0.78021978
0.55064194]
 [0.56052632 0.3201581  0.70053476 ... 0.44715447 0.6959707
0.64693295]
 ...
 [0.58947368 0.69960474 0.48128342 ... 0.08943089 0.10622711
0.39728959]
 [0.56315789 0.36561265 0.54010695 ... 0.09756098 0.12820513
0.40085592]
 [0.81578947 0.66403162 0.73796791 ... 0.10569106 0.12087912
0.20114123]]

Robust Scaling:
[[ 0.8973384  -0.10472973  0.20143885 ...  0.22222222  0.92494929
   0.80804954]
 [ 0.11406844 -0.05743243 -0.63309353 ...  0.25185185  0.5030426
   0.77708978]
 [ 0.08365019  0.33445946  0.89208633 ...  0.19259259  0.31643002
   1.05572755]
 ...
 [ 0.16730038  1.63175676 -0.28776978 ... -1.11111111 -0.98985801
   0.33333333]
 [ 0.09125475  0.48986486  0.02877698 ... -1.08148148 -0.94117647
   0.34365325]
 [ 0.82129278  1.51013514  1.09352518 ... -1.05185185 -0.95740365
  -0.23426213]]
```

```
Data without outliers:
     alcohol  malic_acid   ash  alcalinity_of_ash  magnesium
total_phenols  \
0      14.23        1.71  2.43               15.6      127.0
2.80
1      13.20        1.78  2.14               11.2      100.0
2.65
2      13.16        2.36  2.67               18.6      101.0
2.80
3      14.37        1.95  2.50               16.8      113.0
3.85
4      13.24        2.59  2.87               21.0      118.0
2.80
..       ...          ...   ...                ...        ...
...
173    13.71        5.65  2.45               20.5       95.0
1.68
174    13.40        3.91  2.48               23.0      102.0
1.80
175    13.27        4.28  2.26               20.0      120.0
1.59
176    13.17        2.59  2.37               20.0      120.0
1.65
177    14.13        4.10  2.74               24.5       96.0
2.05

     flavanoids  nonflavanoid_phenols  proanthocyanins
color_intensity   hue  \
0          3.06                  0.28             2.29
5.64  1.04
1          2.76                  0.26             1.28
4.38  1.05
2          3.24                  0.30             2.81
5.68  1.03
3          3.49                  0.24             2.18
7.80  0.86
4          2.69                  0.39             1.82
4.32  1.04
..          ...                   ...              ...               ..
.   ...
173        0.61                  0.52             1.06
7.70  0.64
174        0.75                  0.43             1.41
7.30  0.70
175        0.69                  0.43             1.35
10.20  0.59
176        0.68                  0.53             1.46
9.30  0.60
177        0.76                  0.56             1.35
```

```
9.20  0.61

     od280/od315_of_diluted_wines  proline  target
0                            3.92   1065.0       0
1                            3.40   1050.0       0
2                            3.17   1185.0       0
3                            3.45   1480.0       0
4                            2.93    735.0       0
..                            ...      ...     ...
173                          1.74    740.0       2
174                          1.56    750.0       2
175                          1.56    835.0       2
176                          1.62    840.0       2
177                          1.60    560.0       2

[178 rows x 14 columns]
```

```python
# Обработка нестандартного признака
# Для примера возьмем текстовый признак "description" и преобразуем его с помощью TF-IDF

from sklearn.feature_extraction.text import TfidfVectorizer

tfidf = TfidfVectorizer()
text_data = ["good wine", "bad wine", "excellent taste"]
text_features = tfidf.fit_transform(text_data)

print("\nTF-IDF transformed text features:")
print(text_features.toarray())
```

```
TF-IDF transformed text features:
[[0.         0.         0.79596054 0.         0.60534851]
 [0.79596054 0.         0.         0.         0.60534851]
 [0.         0.70710678 0.         0.70710678 0.        ]]
```

```python
# Отбор признаков
from sklearn.feature_selection import SelectKBest, f_classif
from sklearn.feature_selection import RFE
from sklearn.linear_model import LogisticRegression
from sklearn.feature_selection import SelectFromModel
from sklearn.ensemble import RandomForestClassifier

# Фильтрация (filter method)
selector_filter = SelectKBest(score_func=f_classif, k=5)
X_filtered = selector_filter.fit_transform(df.drop('target', axis=1), df['target'])

print("\nFeatures selected using Filter method:")
print(X_filtered)
```

```python
# Обертывание (wrapper method)
estimator = LogisticRegression(solver='liblinear')
selector_wrapper = RFE(estimator, n_features_to_select=5, step=1)
X_wrapper = selector_wrapper.fit_transform(df.drop('target', axis=1),
df['target'])

print("\nFeatures selected using Wrapper method:")
print(X_wrapper)

# Вложения (embedded method)
selector_embedded =
SelectFromModel(RandomForestClassifier(n_estimators=100))
X_embedded = selector_embedded.fit_transform(df.drop('target',
axis=1), df['target'])

print("\nFeatures selected using Embedded method:")
print(X_embedded)
```

```
Features selected using Filter method:
[[1.423000e+01 3.060000e+00 5.640000e+00 3.920000e+00 1.065000e+03]
 [1.320000e+01 2.760000e+00 4.380000e+00 3.400000e+00 1.050000e+03]
 [1.316000e+01 3.240000e+00 5.680000e+00 3.170000e+00 1.185000e+03]
 [1.437000e+01 3.490000e+00 7.800000e+00 3.450000e+00 1.480000e+03]
 [1.324000e+01 2.690000e+00 4.320000e+00 2.930000e+00 7.350000e+02]
 [1.420000e+01 3.390000e+00 6.750000e+00 2.850000e+00 1.450000e+03]
 [1.439000e+01 2.520000e+00 5.250000e+00 3.580000e+00 1.290000e+03]
 [1.406000e+01 2.510000e+00 5.050000e+00 3.580000e+00 1.295000e+03]
 [1.483000e+01 2.980000e+00 5.200000e+00 2.850000e+00 1.045000e+03]
 [1.386000e+01 3.150000e+00 7.220000e+00 3.550000e+00 1.045000e+03]
 [1.410000e+01 3.320000e+00 5.750000e+00 3.170000e+00 1.510000e+03]
 [1.412000e+01 2.430000e+00 5.000000e+00 2.820000e+00 1.280000e+03]
 [1.375000e+01 2.760000e+00 5.600000e+00 2.900000e+00 1.320000e+03]
 [1.475000e+01 3.690000e+00 5.400000e+00 2.730000e+00 1.150000e+03]
 [1.438000e+01 3.640000e+00 7.500000e+00 3.000000e+00 1.547000e+03]
 [1.363000e+01 2.910000e+00 7.300000e+00 2.880000e+00 1.310000e+03]
 [1.430000e+01 3.140000e+00 6.200000e+00 2.650000e+00 1.280000e+03]
 [1.383000e+01 3.400000e+00 6.600000e+00 2.570000e+00 1.130000e+03]
 [1.419000e+01 3.930000e+00 8.700000e+00 2.820000e+00 1.680000e+03]
 [1.364000e+01 3.030000e+00 5.100000e+00 3.360000e+00 8.450000e+02]
 [1.406000e+01 3.170000e+00 5.650000e+00 3.710000e+00 7.800000e+02]
 [1.293000e+01 2.410000e+00 4.500000e+00 3.520000e+00 7.700000e+02]
 [1.371000e+01 2.880000e+00 3.800000e+00 4.000000e+00 1.035000e+03]
 [1.285000e+01 2.370000e+00 3.930000e+00 3.630000e+00 1.015000e+03]
 [1.350000e+01 2.610000e+00 3.520000e+00 3.820000e+00 8.450000e+02]
 [1.305000e+01 2.680000e+00 3.580000e+00 3.200000e+00 8.300000e+02]
 [1.339000e+01 2.940000e+00 4.800000e+00 3.220000e+00 1.195000e+03]
 [1.330000e+01 2.190000e+00 3.950000e+00 2.770000e+00 1.285000e+03]
 [1.387000e+01 2.970000e+00 4.500000e+00 3.400000e+00 9.150000e+02]
 [1.402000e+01 2.330000e+00 4.700000e+00 3.590000e+00 1.035000e+03]
```

```
[1.373000e+01 3.250000e+00 5.700000e+00 2.710000e+00 1.285000e+03]
[1.358000e+01 3.190000e+00 6.900000e+00 2.880000e+00 1.515000e+03]
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[1.329000e+01 3.230000e+00 6.000000e+00 2.840000e+00 1.270000e+03]
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[1.233000e+01 1.850000e+00 3.400000e+00 2.310000e+00 7.500000e+02]
```

```
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[1.208000e+01 2.290000e+00 2.900000e+00 3.190000e+00 3.850000e+02]
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[1.156000e+01 5.080000e+00 6.000000e+00 3.690000e+00 4.650000e+02]
[1.242000e+01 2.130000e+00 2.080000e+00 3.120000e+00 3.650000e+02]
[1.305000e+01 2.650000e+00 2.600000e+00 3.100000e+00 3.800000e+02]
[1.187000e+01 3.030000e+00 2.800000e+00 3.640000e+00 3.800000e+02]
[1.207000e+01 2.650000e+00 2.760000e+00 3.280000e+00 3.780000e+02]
[1.243000e+01 3.150000e+00 3.940000e+00 2.840000e+00 3.520000e+02]
[1.179000e+01 2.240000e+00 3.000000e+00 2.440000e+00 4.660000e+02]
```

[1.237000e+01 2.450000e+00 2.120000e+00 2.780000e+00 3.420000e+02]
[1.204000e+01 1.750000e+00 2.600000e+00 2.570000e+00 5.800000e+02]
[1.286000e+01 1.250000e+00 4.100000e+00 1.290000e+00 6.300000e+02]
[1.288000e+01 1.220000e+00 5.400000e+00 1.420000e+00 5.300000e+02]
[1.281000e+01 1.090000e+00 5.700000e+00 1.360000e+00 5.600000e+02]
[1.270000e+01 1.200000e+00 5.000000e+00 1.290000e+00 6.000000e+02]
[1.251000e+01 5.800000e-01 5.450000e+00 1.510000e+00 6.500000e+02]
[1.260000e+01 6.600000e-01 7.100000e+00 1.580000e+00 6.950000e+02]
[1.225000e+01 4.700000e-01 3.850000e+00 1.270000e+00 7.200000e+02]
[1.253000e+01 6.000000e-01 5.000000e+00 1.690000e+00 5.150000e+02]
[1.349000e+01 4.800000e-01 5.700000e+00 1.820000e+00 5.800000e+02]
[1.284000e+01 6.000000e-01 4.920000e+00 2.150000e+00 5.900000e+02]
[1.293000e+01 5.000000e-01 4.600000e+00 2.310000e+00 6.000000e+02]
[1.336000e+01 5.000000e-01 5.600000e+00 2.470000e+00 7.800000e+02]
[1.352000e+01 5.200000e-01 4.350000e+00 2.060000e+00 5.200000e+02]
[1.362000e+01 8.000000e-01 4.400000e+00 2.050000e+00 5.500000e+02]
[1.225000e+01 7.800000e-01 8.210000e+00 2.000000e+00 8.550000e+02]
[1.316000e+01 5.500000e-01 4.000000e+00 1.680000e+00 8.300000e+02]
[1.388000e+01 3.400000e-01 4.900000e+00 1.330000e+00 4.150000e+02]
[1.287000e+01 6.500000e-01 7.650000e+00 1.860000e+00 6.250000e+02]
[1.332000e+01 7.600000e-01 8.420000e+00 1.620000e+00 6.500000e+02]
[1.308000e+01 1.390000e+00 9.400000e+00 1.330000e+00 5.500000e+02]
[1.350000e+01 1.570000e+00 8.600000e+00 1.300000e+00 5.000000e+02]
[1.279000e+01 1.360000e+00 1.080000e+01 1.470000e+00 4.800000e+02]
[1.311000e+01 1.280000e+00 7.100000e+00 1.330000e+00 4.250000e+02]
[1.323000e+01 8.300000e-01 1.052000e+01 1.510000e+00 6.750000e+02]
[1.258000e+01 5.800000e-01 7.600000e+00 1.550000e+00 6.400000e+02]
[1.317000e+01 6.300000e-01 7.900000e+00 1.480000e+00 7.250000e+02]
[1.384000e+01 8.300000e-01 9.010000e+00 1.640000e+00 4.800000e+02]
[1.245000e+01 5.800000e-01 7.500000e+00 1.730000e+00 8.800000e+02]
[1.434000e+01 1.310000e+00 1.300000e+01 1.960000e+00 6.600000e+02]
[1.348000e+01 1.100000e+00 1.175000e+01 1.780000e+00 6.200000e+02]
[1.236000e+01 9.200000e-01 7.650000e+00 1.580000e+00 5.200000e+02]
[1.369000e+01 5.600000e-01 5.880000e+00 1.820000e+00 6.800000e+02]
[1.285000e+01 6.000000e-01 5.580000e+00 2.110000e+00 5.700000e+02]
[1.296000e+01 7.000000e-01 5.280000e+00 1.750000e+00 6.750000e+02]
[1.378000e+01 6.800000e-01 9.580000e+00 1.680000e+00 6.150000e+02]
[1.373000e+01 4.700000e-01 6.620000e+00 1.750000e+00 5.200000e+02]
[1.345000e+01 9.200000e-01 1.068000e+01 1.560000e+00 6.950000e+02]
[1.282000e+01 6.600000e-01 1.026000e+01 1.750000e+00 6.850000e+02]
[1.358000e+01 8.400000e-01 8.660000e+00 1.800000e+00 7.500000e+02]
[1.340000e+01 9.600000e-01 8.500000e+00 1.920000e+00 6.300000e+02]
[1.220000e+01 4.900000e-01 5.500000e+00 1.830000e+00 5.100000e+02]
[1.277000e+01 5.100000e-01 9.899999e+00 1.630000e+00 4.700000e+02]
[1.416000e+01 7.000000e-01 9.700000e+00 1.710000e+00 6.600000e+02]
[1.371000e+01 6.100000e-01 7.700000e+00 1.740000e+00 7.400000e+02]
[1.340000e+01 7.500000e-01 7.300000e+00 1.560000e+00 7.500000e+02]
[1.327000e+01 6.900000e-01 1.020000e+01 1.560000e+00 8.350000e+02]
[1.317000e+01 6.800000e-01 9.300000e+00 1.620000e+00 8.400000e+02]

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 [1.413000e+01 7.600000e-01 9.200000e+00 1.600000e+00 5.600000e+02]]

Features selected using Wrapper method:
[[ 2.43      3.06      5.64      1.04      3.92    ]
 [ 2.14      2.76      4.38      1.05      3.4     ]
 [ 2.67      3.24      5.68      1.03      3.17    ]
 [ 2.5       3.49      7.8       0.86      3.45    ]
 [ 2.87      2.69      4.32      1.04      2.93    ]
 [ 2.45      3.39      6.75      1.05      2.85    ]
 [ 2.45      2.52      5.25      1.02      3.58    ]
 [ 2.61      2.51      5.05      1.06      3.58    ]
 [ 2.17      2.98      5.2       1.08      2.85    ]
 [ 2.27      3.15      7.22      1.01      3.55    ]
 [ 2.3       3.32      5.75      1.25      3.17    ]
 [ 2.32      2.43      5.        1.17      2.82    ]
 [ 2.41      2.76      5.6       1.15      2.9     ]
 [ 2.39      3.69      5.4       1.25      2.73    ]
 [ 2.38      3.64      7.5       1.2       3.      ]
 [ 2.7       2.91      7.3       1.28      2.88    ]
 [ 2.72      3.14      6.2       1.07      2.65    ]
 [ 2.62      3.4       6.6       1.13      2.57    ]
 [ 2.48      3.93      8.7       1.23      2.82    ]
 [ 2.56      3.03      5.1       0.96      3.36    ]
 [ 2.28      3.17      5.65      1.09      3.71    ]
 [ 2.65      2.41      4.5       1.03      3.52    ]
 [ 2.36      2.88      3.8       1.11      4.      ]
 [ 2.52      2.37      3.93      1.09      3.63    ]
 [ 2.61      2.61      3.52      1.12      3.82    ]
 [ 3.22      2.68      3.58      1.13      3.2     ]
 [ 2.62      2.94      4.8       0.92      3.22    ]
 [ 2.14      2.19      3.95      1.02      2.77    ]
 [ 2.8       2.97      4.5       1.25      3.4     ]
 [ 2.21      2.33      4.7       1.04      3.59    ]
 [ 2.7       3.25      5.7       1.19      2.71    ]
 [ 2.36      3.19      6.9       1.09      2.88    ]
 [ 2.36      2.69      3.84      1.23      2.87    ]
 [ 2.7       2.74      5.4       1.25      3.      ]
 [ 2.65      2.53      4.2       1.1       2.87    ]
 [ 2.41      2.98      5.1       1.04      3.47    ]
 [ 2.84      2.68      4.6       1.09      2.78    ]
 [ 2.55      2.43      4.25      1.12      2.51    ]
 [ 2.1       2.64      3.7       1.18      2.69    ]
 [ 2.51      3.04      5.1       0.89      3.53    ]
 [ 2.31      3.29      6.13      0.95      3.38    ]
 [ 2.12      2.68      4.28      0.91      3.      ]
 [ 2.59      3.56      5.43      0.88      3.56    ]
 [ 2.29      2.63      4.36      0.82      3.      ]
 [ 2.1       3.        5.04      0.88      3.35    ]
 [ 2.44      2.65      5.24      0.87      3.33    ]
```

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[ 2.28      3.17      4.9       1.04      3.44    ]
[ 2.12      3.39      6.1       0.91      3.33    ]
[ 2.4       2.92      6.2       1.07      2.75    ]
[ 2.27      3.54      8.9       1.12      3.1     ]
[ 2.04      3.27      7.2       1.12      2.91    ]
[ 2.6       2.99      5.6       1.24      3.37    ]
[ 2.42      3.74      7.05      1.01      3.26    ]
[ 2.68      2.79      6.3       1.13      2.93    ]
[ 2.25      2.9       5.85      0.92      3.2     ]
[ 2.46      2.78      6.25      0.98      3.03    ]
[ 2.3       3.        6.38      0.94      3.31    ]
[ 2.68      3.23      6.        1.07      2.84    ]
[ 2.5       3.67      6.8       0.89      2.87    ]
[ 1.36      0.57      1.95      1.05      1.82    ]
[ 2.28      1.09      3.27      1.25      1.67    ]
[ 2.02      1.41      5.75      0.98      1.59    ]
[ 1.92      1.79      3.8       1.23      2.46    ]
[ 2.16      3.1       4.45      1.22      2.87    ]
[ 2.53      1.75      2.95      1.45      2.23    ]
[ 2.56      2.65      4.6       1.19      2.3     ]
[ 1.7       3.18      5.3       1.12      3.18    ]
[ 1.92      2.        4.68      1.12      3.48    ]
[ 2.36      1.3       3.17      1.02      1.93    ]
[ 1.75      1.28      2.85      1.28      3.07    ]
[ 2.21      1.02      3.05      0.906     1.82    ]
[ 2.67      2.86      3.38      1.36      3.16    ]
[ 2.24      1.84      3.74      0.98      2.78    ]
[ 2.6       2.89      3.35      1.31      3.5     ]
[ 2.3       2.14      3.21      0.99      3.13    ]
[ 1.92      1.57      3.8       1.23      2.14    ]
[ 1.71      2.03      4.6       1.19      2.48    ]
[ 2.23      1.32      2.65      0.96      2.52    ]
[ 1.95      1.85      3.4       1.06      2.31    ]
[ 2.4       2.55      2.57      1.19      3.13    ]
[ 2.        2.26      2.5       1.38      3.12    ]
[ 2.2       2.53      3.9       1.16      3.14    ]
[ 2.51      1.58      2.2       1.31      2.72    ]
[ 2.32      1.59      4.8       0.84      2.01    ]
[ 2.58      2.21      3.05      0.79      3.08    ]
[ 2.24      1.94      2.62      1.23      3.16    ]
[ 2.31      1.69      2.45      1.33      2.26    ]
[ 2.62      1.61      2.6       1.36      3.21    ]
[ 2.46      1.69      2.8       1.        2.75    ]
[ 2.3       1.59      1.74      1.07      3.21    ]
[ 2.32      1.5       2.4       1.08      2.27    ]
[ 2.42      1.25      3.6       1.05      2.65    ]
[ 2.26      1.46      3.05      0.96      2.06    ]
[ 2.22      2.25      2.15      1.15      3.3     ]
[ 2.28      2.26      3.25      1.16      2.96    ]
```

```
[ 2.2       2.27      2.6       1.16      2.63    ]
[ 2.74      0.99      2.5       0.95      2.26    ]
[ 1.98      2.5       2.9       1.23      2.74    ]
[ 2.1       3.75      4.5       1.04      2.77    ]
[ 2.21      2.99      2.3       1.42      2.83    ]
[ 1.7       2.17      3.3       1.27      2.96    ]
[ 1.9       1.36      2.45      1.04      2.77    ]
[ 2.46      2.11      2.8       0.8       3.38    ]
[ 1.88      1.64      2.06      0.94      2.44    ]
[ 1.98      1.92      2.94      1.04      3.57    ]
[ 2.27      1.84      2.7       0.86      3.3     ]
[ 2.12      2.03      3.4       1.        3.17    ]
[ 2.28      1.76      3.3       0.88      2.42    ]
[ 1.94      2.04      2.7       0.86      3.02    ]
[ 2.7       2.92      2.65      0.96      3.26    ]
[ 1.82      2.58      2.9       0.75      2.81    ]
[ 2.17      2.27      2.        0.9       2.78    ]
[ 2.92      2.03      3.8       1.23      2.5     ]
[ 2.5       2.01      3.08      1.1       2.31    ]
[ 2.5       2.29      2.9       0.93      3.19    ]
[ 2.2       2.17      1.9       1.71      2.87    ]
[ 1.99      1.6       1.95      0.95      3.33    ]
[ 2.19      2.09      2.06      1.06      2.96    ]
[ 1.98      1.25      3.4       0.7       2.12    ]
[ 2.        1.64      1.28      0.93      3.05    ]
[ 2.42      2.79      3.25      0.8       3.39    ]
[ 3.23      5.08      6.        0.93      3.69    ]
[ 2.73      2.13      2.08      0.92      3.12    ]
[ 2.13      2.65      2.6       0.73      3.1     ]
[ 2.39      3.03      2.8       0.75      3.64    ]
[ 2.17      2.65      2.76      0.86      3.28    ]
[ 2.29      3.15      3.94      0.69      2.84    ]
[ 2.78      2.24      3.        0.97      2.44    ]
[ 2.3       2.45      2.12      0.89      2.78    ]
[ 2.38      1.75      2.6       0.79      2.57    ]
[ 2.32      1.25      4.1       0.76      1.29    ]
[ 2.4       1.22      5.4       0.74      1.42    ]
[ 2.4       1.09      5.7       0.66      1.36    ]
[ 2.36      1.2       5.        0.78      1.29    ]
[ 2.25      0.58      5.45      0.75      1.51    ]
[ 2.2       0.66      7.1       0.73      1.58    ]
[ 2.54      0.47      3.85      0.75      1.27    ]
[ 2.64      0.6       5.        0.82      1.69    ]
[ 2.19      0.48      5.7       0.81      1.82    ]
[ 2.61      0.6       4.92      0.89      2.15    ]
[ 2.7       0.5       4.6       0.77      2.31    ]
[ 2.35      0.5       5.6       0.7       2.47    ]
[ 2.72      0.52      4.35      0.89      2.06    ]
[ 2.35      0.8       4.4       0.91      2.05    ]
```

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 [ 2.2       0.78      8.21      0.65      2.      ]
 [ 2.15      0.55      4.        0.6       1.68    ]
 [ 2.23      0.34      4.9       0.58      1.33    ]
 [ 2.48      0.65      7.65      0.54      1.86    ]
 [ 2.38      0.76      8.42      0.55      1.62    ]
 [ 2.36      1.39      9.4       0.57      1.33    ]
 [ 2.62      1.57      8.6       0.59      1.3     ]
 [ 2.48      1.36     10.8       0.48      1.47    ]
 [ 2.75      1.28      7.1       0.61      1.33    ]
 [ 2.28      0.83     10.52      0.56      1.51    ]
 [ 2.1       0.58      7.6       0.58      1.55    ]
 [ 2.32      0.63      7.9       0.6       1.48    ]
 [ 2.38      0.83      9.01      0.57      1.64    ]
 [ 2.64      0.58      7.5       0.67      1.73    ]
 [ 2.7       1.31     13.        0.57      1.96    ]
 [ 2.64      1.1      11.75      0.57      1.78    ]
 [ 2.38      0.92      7.65      0.56      1.58    ]
 [ 2.54      0.56      5.88      0.96      1.82    ]
 [ 2.58      0.6       5.58      0.87      2.11    ]
 [ 2.35      0.7       5.28      0.68      1.75    ]
 [ 2.3       0.68      9.58      0.7       1.68    ]
 [ 2.26      0.47      6.62      0.78      1.75    ]
 [ 2.6       0.92     10.68      0.85      1.56    ]
 [ 2.3       0.66     10.26      0.72      1.75    ]
 [ 2.69      0.84      8.66      0.74      1.8     ]
 [ 2.86      0.96      8.5       0.67      1.92    ]
 [ 2.32      0.49      5.5       0.66      1.83    ]
 [ 2.28      0.51      9.899999  0.57      1.63    ]
 [ 2.48      0.7       9.7       0.62      1.71    ]
 [ 2.45      0.61      7.7       0.64      1.74    ]
 [ 2.48      0.75      7.3       0.7       1.56    ]
 [ 2.26      0.69     10.2       0.59      1.56    ]
 [ 2.37      0.68      9.3       0.6       1.62    ]
 [ 2.74      0.76      9.2       0.61      1.6     ]]

Features selected using Embedded method:
[[1.423e+01 3.060e+00 5.640e+00 1.040e+00 3.920e+00 1.065e+03]
 [1.320e+01 2.760e+00 4.380e+00 1.050e+00 3.400e+00 1.050e+03]
 [1.316e+01 3.240e+00 5.680e+00 1.030e+00 3.170e+00 1.185e+03]
 ...
 [1.327e+01 6.900e-01 1.020e+01 5.900e-01 1.560e+00 8.350e+02]
 [1.317e+01 6.800e-01 9.300e+00 6.000e-01 1.620e+00 8.400e+02]
 [1.413e+01 7.600e-01 9.200e+00 6.100e-01 1.600e+00 5.600e+02]]
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