Лабораторная работа №3

"**Обработка признаков (часть 2)**"

Выполнила: Пинская Н.М.
Группа: ИУ5-21М

Цель лабораторной работы: изучение продвинутых способов предварительной обработки данных для дальнейшего формирования моделей.

Задание:

1. 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.
2. 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

1. List item
2. List item

(embedded methods).

Масштабирование признаков

```
#импортируем библиотеки
!pip install mlxtend.feature_selection
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np
import seaborn as sns
import scipy.stats as stats
import datetime
from sklearn.preprocessing import RobustScaler
from sklearn.preprocessing import MaxAbsScaler
from sklearn.preprocessing import MinMaxScaler
from sklearn.neighbors import KNeighborsClassifier
from sklearn.feature_selection import SelectFromModel
from sklearn.linear_model import LogisticRegression
from sklearn.feature_selection import VarianceThreshold
from sklearn.feature_selection import SequentialFeatureSelector as SFS
!pip install category_encoders
from category_encoders.one_hot import OneHotEncoder as ce_OneHotEncoder
```

```
    Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
```

```
ERROR: Could not find a version that satisfies the requirement mlxtend.feature_selection (from version
ERROR: No matching distribution found for mlxtend.feature_selection
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Requirement already satisfied: category_encoders in /usr/local/lib/python3.7/dist-packages (2.4.1)
Requirement already satisfied: numpy>=1.14.0 in /usr/local/lib/python3.7/dist-packages (from category_
Requirement already satisfied: pandas>=0.21.1 in /usr/local/lib/python3.7/dist-packages (from category_
Requirement already satisfied: patsy>=0.5.1 in /usr/local/lib/python3.7/dist-packages (from category_e
Requirement already satisfied: scikit-learn>=0.20.0 in /usr/local/lib/python3.7/dist-packages (from ca
Requirement already satisfied: scipy>=1.0.0 in /usr/local/lib/python3.7/dist-packages (from category_e
Requirement already satisfied: statsmodels>=0.9.0 in /usr/local/lib/python3.7/dist-packages (from categ
Requirement already satisfied: pytz>=2017.3 in /usr/local/lib/python3.7/dist-packages (from pandas>=0.
Requirement already satisfied: python-dateutil>=2.7.3 in /usr/local/lib/python3.7/dist-packages (from
Requirement already satisfied: six in /usr/local/lib/python3.7/dist-packages (from patsy>=0.5.1->categ
Requirement already satisfied: threadpoolctl>=2.0.0 in /usr/local/lib/python3.7/dist-packages (from sc
Requirement already satisfied: joblib>=0.11 in /usr/local/lib/python3.7/dist-packages (from scikit-lea
/usr/local/lib/python3.7/dist-packages/statsmodels/tools/_testing.py:19: FutureWarning: pandas.util.te
  import pandas.util.testing as tm
```

```
# Подключение к gogle диску
from google.colab import drive
drive.mount('/content/drive')
```

```
Mounted at /content/drive
```

```
# Вывод содержимого папки на диске
import os
data_root = '/content/drive/MyDrive/MMO'
print(os.listdir(data_root))
```

```
['pulitzer-circulation-data.csv', 'mmsa-icu-beds2.csv', 'movies.csv.zip', 'movies2.csv.zip', 'movies1.
```

```
data_load = pd.read_csv('/content/drive/MyDrive/MMO/laptop.csv', sep=",")
data_load.head()
```

	Unnamed: 0	Brand	Model	Series	Processor	Processor_Gen	RAM	Hard_Disk_Capacity	OS	Rati
0	0	DELL	Inspiron	NaN	i3	11th	8.0	1 TB HDD	Windows 11 Home	
1	1	DELL	Vostro	NaN	i5	11th	8.0	1 TB HDD	Windows 10 Home	
2	2	ASUS	VivoBook	15	i3	10th	8.0	512 GB SSD	Windows	

```
data_load.describe()
```

```
data = data_load[["RAM", "Rating", "Price"]]


def arr_to_df(arr_scaled):
    res = pd.DataFrame(arr_scaled, columns=data.columns)
    return res
```

```
min      0.000000     4.000000     2.900000     17640.000000
```

a) Масштабирование нормализацией по средним. Mean Normalization.

```
class MeanNormalisation:

    def fit(self, param_df):
        self.means = param_df.mean(axis=0)
        maxs = param_df.max(axis=0)
        mins = param_df.min(axis=0)
        self.ranges = maxs - mins

    def transform(self, param_df):
        param_df_scaled = (param_df - self.means) / self.ranges
        return param_df_scaled

    def fit_transform(self, param_df):
        self.fit(param_df)
        return self.transform(param_df)


data_mn_scale = MeanNormalisation().fit_transform(data)
data_mn_scale.head()
```

	RAM	Rating	Price
0	-0.051913	-0.255466	-0.132821
1	-0.051913	-0.308097	-0.027792
2	-0.051913	0.060324	-0.142612
3	-0.051913	0.112955	-0.084757
4	-0.051913	0.165587	0.035403

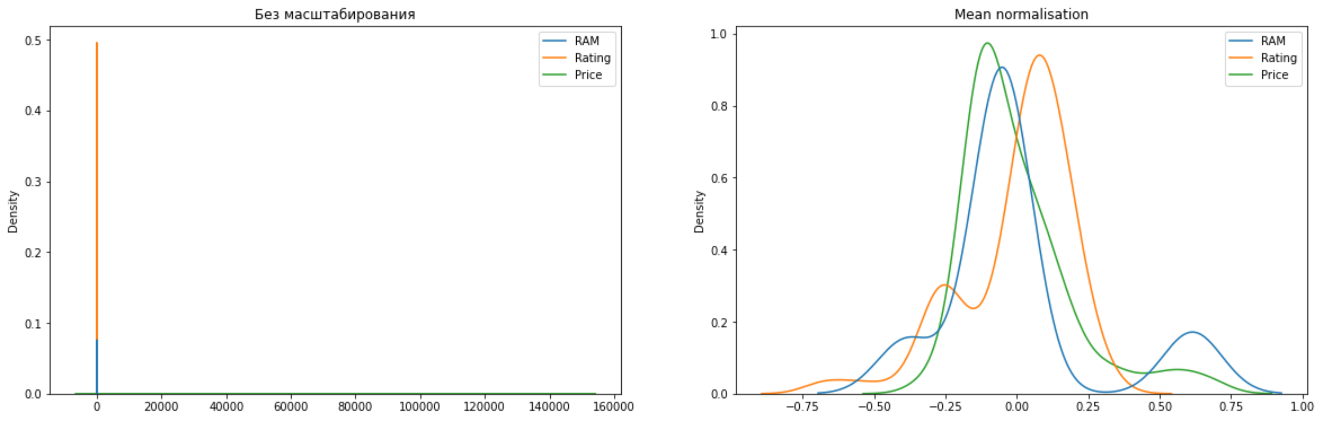
```
data_mn_scale.describe()
```

	RAM	Rating	Price
count	1.220000e+02	1.300000e+02	1.300000e+02
mean	5.005104e-17	1.001763e-15	3.095814e-18
std	2.711080e-01	1.920841e-01	1.902063e-01
min	-3.852459e-01	-6.765182e-01	-3.232975e-01
25%	-5.191257e-02	-4.493927e-02	-1.327101e-01
50%	-5.191257e-02	6.032389e-02	-6.250536e-02
75%	-5.191257e-02	1.129555e-01	6.766821e-02
max	6.147541e-01	3.234818e-01	6.767025e-01

```
def draw_kde(col_list, df1, df2, label1, label2):
    fig, (ax1, ax2) = plt.subplots(
        ncols=2, figsize=(12, 5))
    # первый график
    ax1.set_title(label1)
    sns.kdeplot(data=df1[col_list], ax=ax1)
    # второй график
    ax2.set_title(label2)
    sns.kdeplot(data=df2[col_list], ax=ax2)
    plt.show()


def draw_graph(col_list, data1, data2, label1, label2):
    fig, (ax1, ax2) = plt.subplots(ncols = 2, figsize=(20,6))
    ax1.set_title(label1)
    sns.kdeplot(data=data1[col_list], ax=ax1)
    ax2.set_title(label2)
    sns.kdeplot(data=data2[col_list], ax=ax2)
    plt.show()


draw_graph(['RAM', 'Rating', 'Price'], data, data_mn_scale,'Без масштабирования', 'Mean normalisation')
```

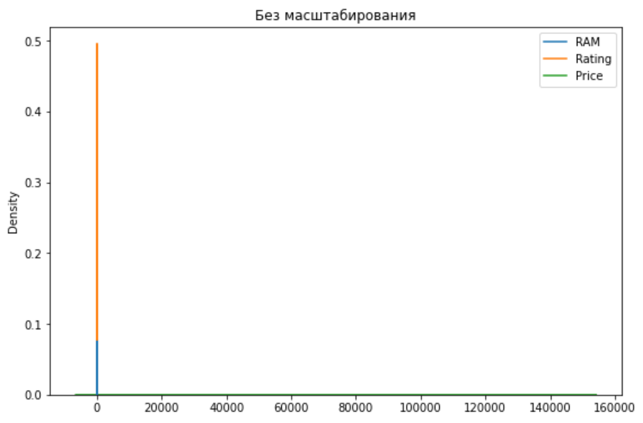


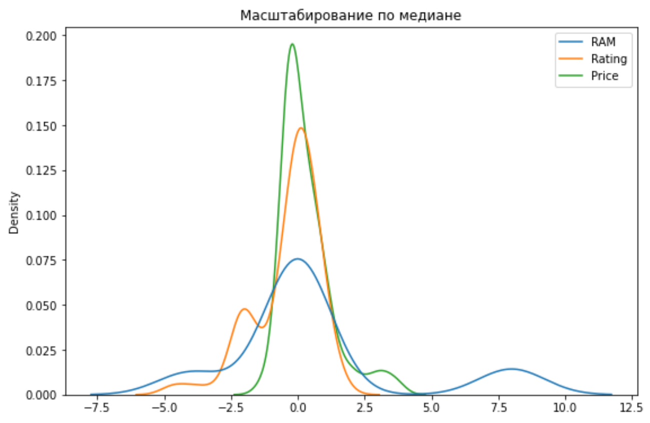
б) Масштабирование по медиане

```
rs = RobustScaler()
data_median_scale_arr = rs.fit_transform(data)
data_median_scale = arr_to_df(data_median_scale_arr)
data_median_scale.describe()
```

	RAM	Rating	Price
count	122.000000	130.000000	130.000000
mean	0.622951	-0.382051	0.311937
std	3.253296	1.216532	0.949236
min	-4.000000	-4.666667	-1.301499
25%	0.000000	-0.666667	-0.350361
50%	0.000000	0.000000	0.000000
75%	0.000000	0.333333	0.649639
max	8.000000	1.666667	3.689062

```
draw_graph(['RAM', 'Rating', 'Price'], data, data_median_scale,'Без масштабирования', 'Масштабирование по ме
```



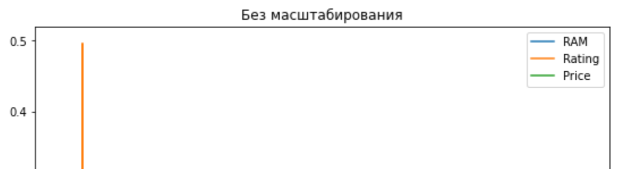


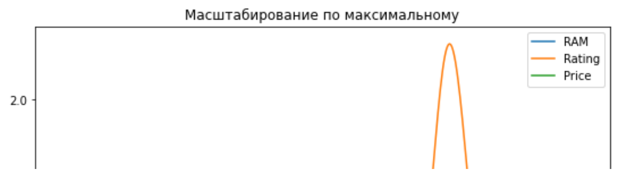
б) Масштабирование по максимальному значению

```
mas = MaxAbsScaler()
data_max_scale_arr = mas.fit_transform(data)
data_max_scale = arr_to_df(data_max_scale_arr)
data_max_scale.describe()
```

	RAM	Rating	Price
count	122.000000	130.000000	130.000000
mean	0.538934	0.871955	0.415128
std	0.203331	0.076033	0.164395
min	0.250000	0.604167	0.135703
25%	0.500000	0.854167	0.300427
50%	0.500000	0.895833	0.361105
75%	0.500000	0.916667	0.473613
max	1.000000	1.000000	1.000000

```
draw_graph(['RAM', 'Rating', 'Price'], data, data_max_scale,'Без масштабирования', 'Масштабирование по макси
```

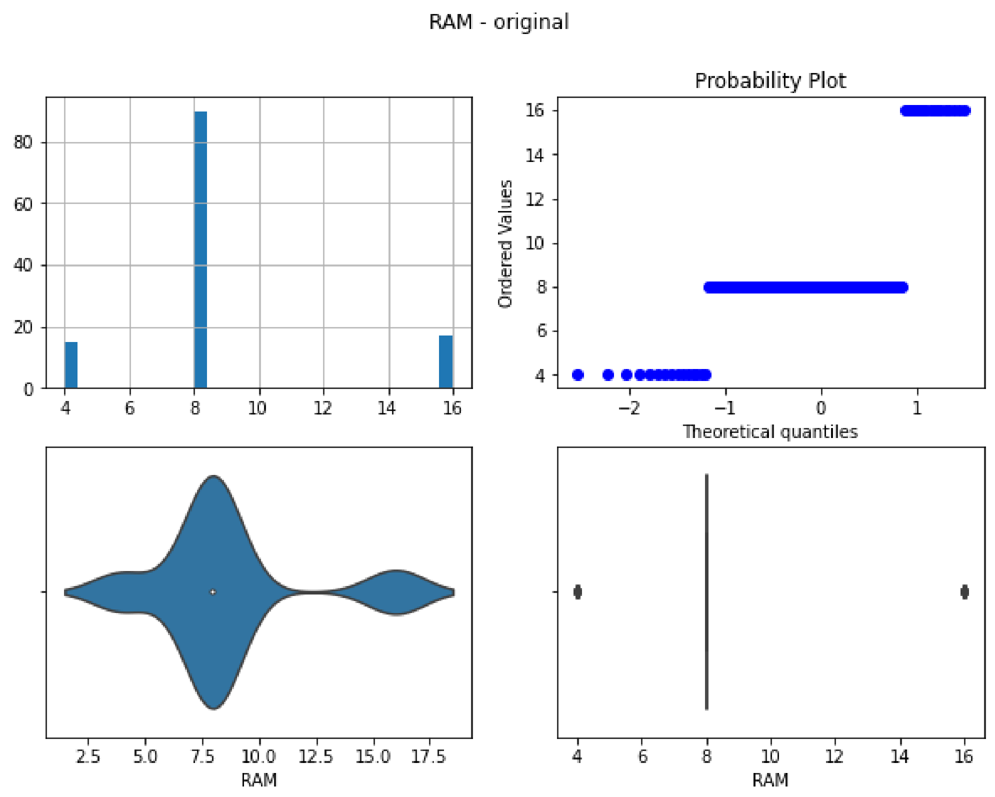


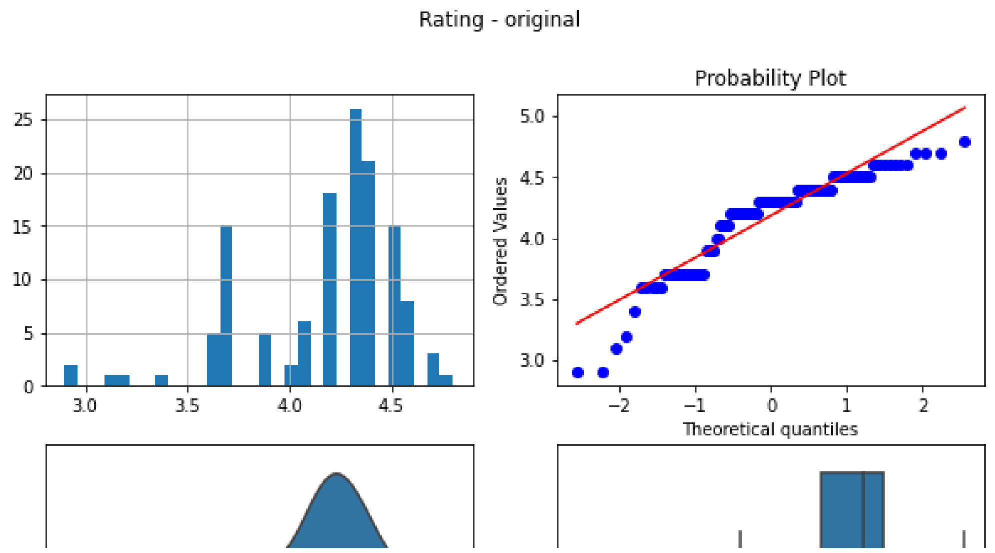


Обработка выбросов(числовые признаки)

```
col_list = ['RAM', 'Rating', 'Price']
def diagnostic_plots(df, variable, title):
    fig, ax = plt.subplots(figsize=(10,7))
    # гистограмма
    plt.subplot(2, 2, 1)
    df[variable].hist(bins=30)
    ## Q-Q plot
    plt.subplot(2, 2, 2)
    stats.probplot(df[variable], dist="norm", plot=plt)
    # ящик с усами
    plt.subplot(2, 2, 3)
    sns.violinplot(x=df[variable])
    # ящик с усами
    plt.subplot(2, 2, 4)
    sns.boxplot(x=df[variable])
    fig.suptitle(title)
    plt.show()


for col in col_list:
    diagnostic_plots(data, col, '{} - original'.format(col))
```



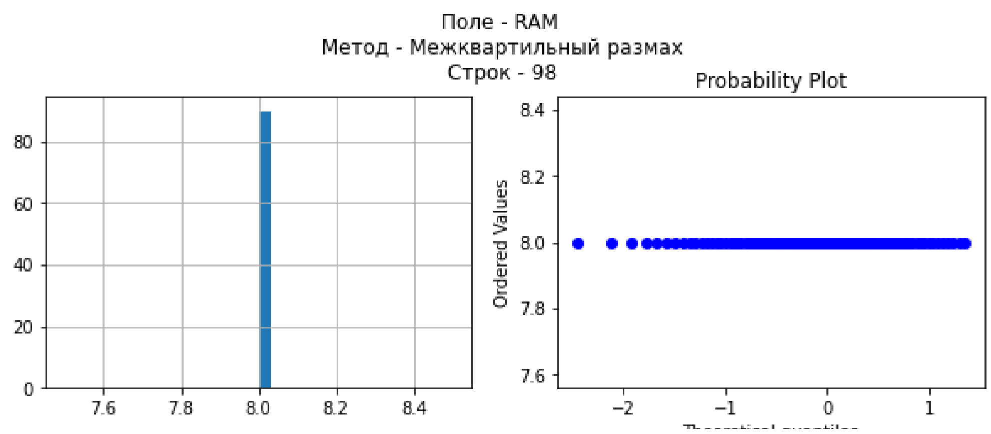


Удаление методом межквартильного размаха.

```
#создадим функцию обнаружения выбросов только для метода межквартильного размаха
def get_outlier_boundaries(df, col):
    K2 = 1.5
    IQR = df[col].quantile(0.75) - df[col].quantile(0.25)
    lower_boundary = df[col].quantile(0.25) - (K2 * IQR)
    upper_boundary = df[col].quantile(0.75) + (K2 * IQR)
    return lower_boundary, upper_boundary
```

```
obt = 'Межквартильный размах'
for col in col_list:
    # Вычисление верхней и нижней границы
    lower_boundary, upper_boundary = get_outlier_boundaries(data, col)
    # Флаги для удаления выбросов
    outliers_temp = np.where(data[col] > upper_boundary, True,
                            np.where(data[col] < lower_boundary, True, False))
    # Удаление данных на основе флага
    data_trimmed = data.loc[~(outliers_temp), ]
```

```
title = 'Поле - {}\n Метод - {}\n Строк - {}'.format(col, obt, data_trimmed.shape[0])
diagnostic_plots(data_trimmed, col, title)
```



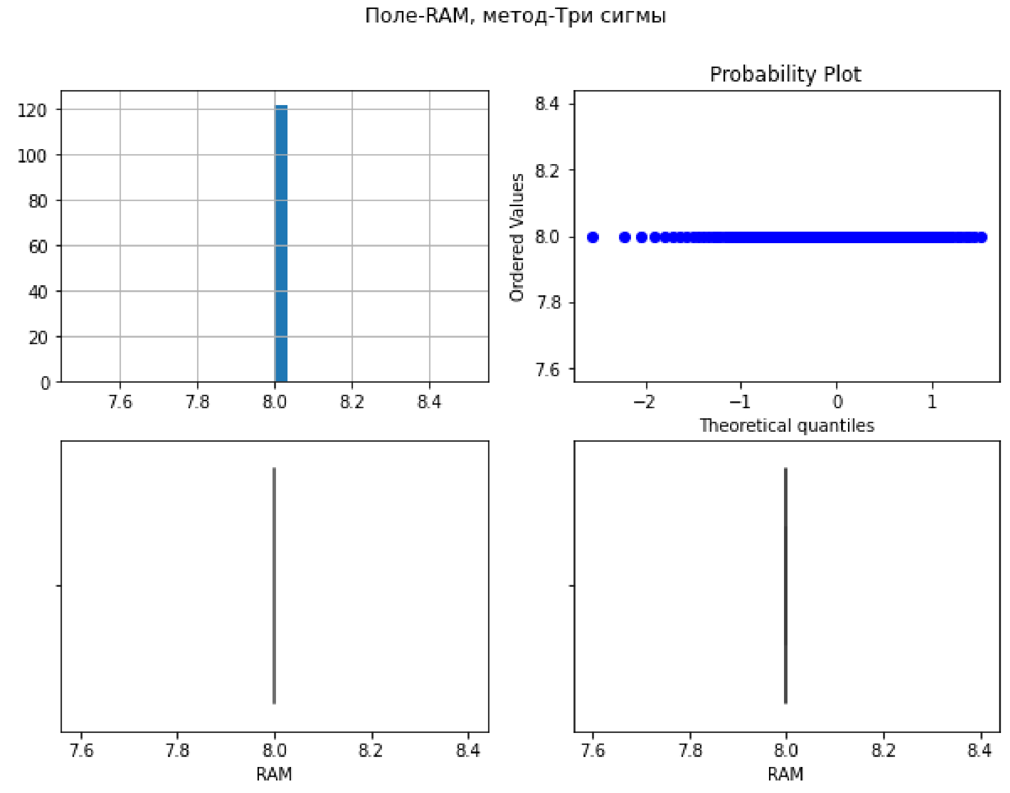
Замена выбросов методом трёх сигм

```
def get_outlier_boundaries_sigm(df, col):
    K1 = 3
    lower_boundary = df[col].mean() - (K1 * df[col].std())
    upper_boundary = df[col].mean() + (K1 * df[col].std())
    return lower_boundary, upper_boundary
```

```
obt2 = 'Три сигмы'
for col in col_list:
        # Вычисление верхней и нижней границы
        lower_boundary, upper_boundary = get_outlier_boundaries(data, col)
        # Изменение данных
        data[col] = np.where(data[col] > upper_boundary, upper_boundary,
                             np.where(data[col] < lower_boundary, lower_boundary, data[col]))
        title = 'Поле-{}, метод-{}'.format(col, obt2)
        diagnostic_plots(data, col, title)
```

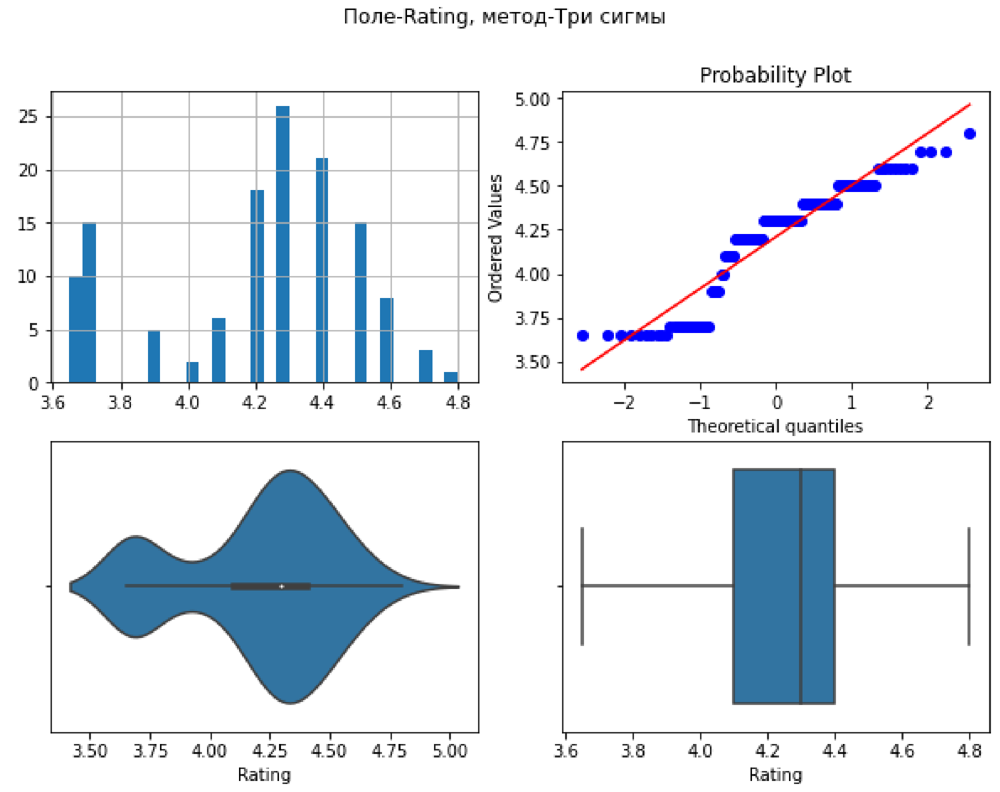
```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:7: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/index
  import sys
```



```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:7: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/index
  import sys
```



```
/usr/local/lib/python3.7/dist-packages/ipykernel launcher.py:7: SettingWithCopyWarning:
```

Обработка нестандартных признаков

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/index

```
data_in = pd.read_csv('/content/drive/MyDrive/MMO/T1.csv', sep = ',')
```

```
data_input = data_in.iloc[0:2000, :]
```

```
data_input
```

	Date/Time	LV ActivePower (kW)	Wind Speed (m/s)	Theoretical_Power_Curve (KWh)	Wind Direction (°)
0	01 01 2018 00:00	380.047791	5.311336	416.328908	259.994904
1	01 01 2018 00:10	453.769196	5.672167	519.917511	268.641113
2	01 01 2018 00:20	306.376587	5.216037	390.900016	272.564789
3	01 01 2018 00:30	419.645905	5.659674	516.127569	271.258087
4	01 01 2018 00:40	380.650696	5.577941	491.702972	265.674286
...	...	...	...	...	...
1995	15 01 2018 00:10	0.000000	7.724926	1376.629419	64.410423
1996	15 01 2018 00:20	0.000000	7.617460	1319.137824	68.241722

```
# def substr_in_url(substr):
#     lsubstr = substr.lower()
#     return data_load.apply(lambda x: 1 if lsubstr in x['OS'].lower() else 0, axis=1)



# data_load['is_get'] = substr_in_url('GET')
# data_load['is_php'] = substr_in_url('PHP')
# data_load['is_js'] = substr_in_url('JS')
# data_load['is_woff'] = substr_in_url('WOFF')
# url_features = ['is_get', 'is_php', 'is_js', 'is_woff']
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
<ipython-input-49-d7a77fcb5b73> in <module>()
----> 1 data_load['is_get'] = substr_in_url('GET')
      2 data_load['is_php'] = substr_in_url('PHP')
      3 data_load['is_js'] = substr_in_url('JS')
      4 data_load['is_woff'] = substr_in_url('WOFF')
      5 url_features = ['is_get', 'is_php', 'is_js', 'is_woff']

                              5 frames

<ipython-input-48-48f7092afd0f> in <lambda>(x)
      1 def substr_in_url(substr):
      2     lsubstr = substr.lower()
----> 3     return data_load.apply(lambda x: 1 if lsubstr in x['OS'].lower() else 0, axis=1)

AttributeError: 'float' object has no attribute 'lower'
```

SEARCH STACK OVERFLOW

```
#приводим колонку с датой и временем к форме, понятной Datetime
data_input['Date/Time'] = data_input.apply(lambda x: pd.to_datetime(x['Date/Time'], format='%d %m %Y %H:%M')
     /usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:2: SettingWithCopyWarning:
     A value is trying to be set on a copy of a slice from a DataFrame.
     Try using .loc[row_indexer,col_indexer] = value instead

     See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing
```

```
# День
data_input['day'] = data_input['Date/Time'].dt.day
# Месяц
data_input['month'] = data_input['Date/Time'].dt.month
# Год
data_input['year'] = data_input['Date/Time'].dt.year
# Часы
data_input['hour'] = data_input['Date/Time'].dt.hour
#Минуты
data_input['minute'] = data_input['Date/Time'].dt.minute
#Секунды
data_input['second'] = data_input['Date/Time'].dt.second
#Неделя года
data_input['week'] = data_input['Date/Time'].dt.isocalendar().week
#Квартал
data_input['quarter'] = data_input['Date/Time'].dt.quarter
#День недели
data_input['dayofweek'] = data_input['Date/Time'].dt.dayofweek
#Выходной день
data_input['day_name'] = data_input['Date/Time'].dt.day_name()
#data_load['is_holiday'] = data.apply(lambda x: 1 if x['dt'].dayofweek in [5,6] else 0, axis=1)
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:2: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/index

/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:4: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/index
  after removing the cwd from sys.path.
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:6: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/index

/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:8: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/index

/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:10: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/index
  # Remove the CWD from sys.path while we load stuff.
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:12: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/index
  if sys.path[0] == '':
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:14: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
```

```
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/index

/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:16: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/index
  app.launch_new_instance()
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:18: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/index
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:20: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead
```

```python
# Создадим масштабируемые признаки для дальнейших экспериментов
dt_features = ['year', 'day', 'month', 'hour', 'minute', 'second', 'week', 'quarter', 'dayofweek']
dt_features_scaled = []
for f in dt_features:
    f_new = str(f + '_scaled')
    dt_features_scaled.append(f_new)
    data_input[f_new] = MinMaxScaler().fit_transform(data_input[[f]])
dt_features_scaled
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:7: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/index
  import sys
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:7: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/index
  import sys
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:7: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/index
  import sys
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:7: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/index
  import sys
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:7: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/index
  import sys
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:7: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/index
  import sys
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:7: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/index
  import sys
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:7: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/index
  import sys
['year_scaled',
 'day_scaled',
 'month_scaled',
 'hour_scaled',
 'minute_scaled',
 'second_scaled',
 'week_scaled',
 'quarter_scaled',
 'dayofweek_scaled']
```

```
#функция кодировки значения синусом или косинусом
def round_code(v, T, cos_flag = True):
    x = 2*np.pi*v/T
    if cos_flag:
        return np.cos(x)
    else:
        return np.sin(x)
```

```
# Опеределим периоды для признаков
for f in dt_features:
    print(f, data_input[f].min(), data_input[f].max())
```

```
year 2018 2018
day 1 15
month 1 1
hour 0 23
minute 0 50
second 0 0
week 1 3
quarter 1 1
dayofweek 0 6
```

```
dt_features_periods = [0, 31, 12, 24, 60, 60, 52, 4, 7]
```

```
#Датафрейм большой и при его фрагментации нам попались только значения из 2010 года, поэтому колонку года не
# объявлем dt_features_round пустым, чтобы инициировать массив для дальнейшей работы с ним
dt_features_round = []
```

```
%%time
# Построим отображение признаков на круг, год пропускаем
for f,p in zip(dt_features[1:], dt_features_periods[1:]):
    f_cos = str(f + '_cos')
    f_sin = str(f + '_sin')
    data_input[f_cos] = data_input.apply(lambda x: round_code(x[f], p), axis=1)
    data_input[f_sin] = data_input.apply(lambda x: round_code(x[f], p, False), axis=1)
    dt_features_round.append(f_cos)
    dt_features_round.append(f_sin)
dt_features_round
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:5: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing
  """
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:6: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
```

```
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing

CPU times: user 585 ms, sys: 3.11 ms, total: 588 ms
Wall time: 595 ms
```

```
data_input
```

	Date/Time	LV ActivePower (kW)	Wind Speed (m/s)	Theoretical_Power_Curve (KWh)	Wind Direction (°)	day	month	year	hour	mi
0	2018-01-01 00:00:00	380.047791	5.311336	416.328908	259.994904	1	1	2018	0	
1	2018-01-01 00:10:00	453.769196	5.672167	519.917511	268.641113	1	1	2018	0	
2	2018-01-01 00:20:00	306.376587	5.216037	390.900016	272.564789	1	1	2018	0	
3	2018-01-01 00:30:00	419.645905	5.659674	516.127569	271.258087	1	1	2018	0	
4	2018-01-01 00:40:00	380.650696	5.577941	491.702972	265.674286	1	1	2018	0	
...	...	...	...	...	...	...	...	...	...	
1995	2018-01-15 00:10:00	0.000000	7.724926	1376.629419	64.410423	15	1	2018	0	
1996	2018-01-15 00:20:00	0.000000	7.617460	1319.137824	68.241722	15	1	2018	0	
1997	2018-01-15 00:30:00	0.000000	7.398623	1206.039642	71.063522	15	1	2018	0	
1998	2018-01-15 00:40:00	0.000000	7.692293	1359.019586	72.470627	15	1	2018	0	
1999	2018-01-15 00:50:00	0.000000	6.897043	970.306794	67.857719	15	1	2018	0	

2000 rows × 40 columns

```
data_input.head()
```

	Date/Time	LV ActivePower (kW)	Wind Speed (m/s)	Theoretical_Power_Curve (KWh)	Wind Direction (°)	day	month	year	hour	minut
0	2018-01-01 00:00:00	380.047791	5.311336	416.328908	259.994904	1	1	2018	0	
1	2018-01-01 00:10:00	453.769196	5.672167	519.917511	268.641113	1	1	2018	0	1
2	2018-01-01 00:20:00	306.376587	5.216037	390.900016	272.564789	1	1	2018	0	2
3	2018-01-01 00:30:00	419.645905	5.659674	516.127569	271.258087	1	1	2018	0	3
4	2018-01-01	380.650696	5.577941	491.702972	265.674286	1	1	2018	0	4

```
data_input.dtypes
```

```
Date/Time                         datetime64[ns]
LV ActivePower (kW)                      float64
Wind Speed (m/s)                         float64
Theoretical_Power_Curve (KWh)            float64
Wind Direction (°)                       float64
day                                        int64
month                                      int64
year                                       int64
hour                                       int64
minute                                     int64
second                                     int64
week                                      UInt32
quarter                                    int64
dayofweek                                  int64
day_name                                  object
year_scaled                              float64
day_scaled                               float64
month_scaled                             float64
hour_scaled                              float64
minute_scaled                            float64
second_scaled                            float64
week_scaled                              float64
quarter_scaled                           float64
dayofweek_scaled                         float64
day_cos                                  float64
day_sin                                  float64
month_cos                                float64
month_sin                                float64
hour_cos                                 float64
hour_sin                                 float64
minute_cos                               float64
minute_sin                               float64
second_cos                               float64
second_sin                               float64
week_cos                                 float64
week_sin                                 float64
quarter_cos                              float64
quarter_sin                              float64
dayofweek_cos                            float64
dayofweek_sin                            float64
dtype: object
```

Отбор признаков

```
from sklearn.datasets import load_wine

wine = load_wine()
wine_X = wine.data
wine_y = wine.target
wine_feature_names = wine['feature_names']
wine_x_df = pd.DataFrame(data=wine['data'], columns=wine['feature_names'])
```

```
data_class = pd.read_csv('/content/drive/MyDrive/MMO/T1.csv', sep=",")
#data_data = data_class.iloc[:, 2:23] #data_data = data_class.iloc[:, 1:22]
#data_targ = data_class[['class']]
#data_data
data_class.shape
```

```
(50530, 5)
```

```
data_class.head()
```

	Date/Time	LV ActivePower (kW)	Wind Speed (m/s)	Theoretical_Power_Curve (KWh)	Wind Direction (°)
0	01 01 2018 00:00	380.047791	5.311336	416.328908	259.994904
1	01 01 2018 00:10	453.769196	5.672167	519.917511	268.641113
2	01 01 2018 00:20	306.376587	5.216037	390.900016	272.564789

```
data_data = data_class.iloc[:, 0:9] #data_data = data_class.iloc[:, 1:22]
data_targ = data_class[['Date/Time']]
data_data
```

	Date/Time	LV ActivePower (kW)	Wind Speed (m/s)	Theoretical_Power_Curve (KWh)	Wind Direction (°)
0	01 01 2018 00:00	380.047791	5.311336	416.328908	259.994904
1	01 01 2018 00:10	453.769196	5.672167	519.917511	268.641113
2	01 01 2018 00:20	306.376587	5.216037	390.900016	272.564789
3	01 01 2018 00:30	419.645905	5.659674	516.127569	271.258087
4	01 01 2018 00:40	380.650696	5.577941	491.702972	265.674286
...	...	...	...	...	...
50525	31 12 2018 23:10	2963.980957	11.404030	3397.190793	80.502724
50526	31 12 2018 23:20	1684.353027	7.332648	1173.055771	84.062599

Методы фильтрации (Filter)

```
data_class['LV ActivePower (kW)'].unique()
```

```
array([ 380.04779053,  453.76919556,  306.37658691, ..., 2201.10693359,
            2515.6940918 , 2820.46606445])
```

```
data_class['Wind Speed (m/s)'].unique()
```

```
     array([5.31133604, 5.67216682, 5.2160368 , ..., 8.43535805, 9.42136574,
            9.97933197])
```

```
data_copy = data_data.iloc[:, 3:8]
```

```
# удаление константных и псевдоконстантных признаков
selector_fm = VarianceThreshold(threshold = 0.15)
selector_fm.fit(data_copy)
selector_fm.variances_
```

```
     array([1871436.86226526,    8731.55894383])
```

```
selector_fm.transform(data_copy)
```

```
     array([[ 416.32890782,  259.99490356],
            [ 519.91751106,  268.64111328],
            [ 390.90001581,  272.56478882],
            ...,
            [1788.28475526,   84.74250031],
            [2418.38250336,   84.2979126 ],
            [2779.18409628,   82.27462006]])
```

Была удалена колонка мощности.

Методы обертывания (Wrapper)

Алгоритмы полного перебора

```
import sklearn.externals
import joblib
from mlxtend.feature_selection import ExhaustiveFeatureSelector as EFS

knn = KNeighborsClassifier(n_neighbors=3)
```

```
---------------------------------------------------------------------------
ModuleNotFoundError                       Traceback (most recent call last)
<ipython-input-12-8889c2346889> in <module>()
      1 import sklearn.externals
      2 import joblib
----> 3 from mlxtend.feature_selection import ExhaustiveFeatureSelector as EFS
      4
```

```
# from sklearn.feature_selection import ExhaustiveFeatureSelector as EFS
# !pip install sklearn.externals.joblib
# !pip install mlxtend.externals.joblib
!pip install mlxtend
import joblib
from mlxtend.feature_selection import ExhaustiveFeatureSelector as EFS
knn = KNeighborsClassifier(n_neighbors=3)
```

```
Looking in indexes: https://pypi.org/simple, https://us-python.pkg.dev/colab-wheels/public/simple/
Requirement already satisfied: mlxtend in /usr/local/lib/python3.7/dist-packages (0.14.0)
Requirement already satisfied: pandas>=0.17.1 in /usr/local/lib/python3.7/dist-packages (from mlxtend)
Requirement already satisfied: scipy>=0.17 in /usr/local/lib/python3.7/dist-packages (from mlxtend) (1
Requirement already satisfied: setuptools in /usr/local/lib/python3.7/dist-packages (from mlxtend) (57
Requirement already satisfied: numpy>=1.10.4 in /usr/local/lib/python3.7/dist-packages (from mlxtend)
Requirement already satisfied: scikit-learn>=0.18 in /usr/local/lib/python3.7/dist-packages (from mlxt
Requirement already satisfied: matplotlib>=1.5.1 in /usr/local/lib/python3.7/dist-packages (from mlxte
Requirement already satisfied: kiwisolver>=1.0.1 in /usr/local/lib/python3.7/dist-packages (from matpl
Requirement already satisfied: pyparsing!=2.0.4,!=2.1.2,!=2.1.6,>=2.0.1 in /usr/local/lib/python3.7/di
Requirement already satisfied: python-dateutil>=2.1 in /usr/local/lib/python3.7/dist-packages (from ma
Requirement already satisfied: cycler>=0.10 in /usr/local/lib/python3.7/dist-packages (from matplotlib
Requirement already satisfied: typing-extensions in /usr/local/lib/python3.7/dist-packages (from kiwis
Requirement already satisfied: pytz>=2017.3 in /usr/local/lib/python3.7/dist-packages (from pandas>=0.
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.7/dist-packages (from python-dateuti
Requirement already satisfied: joblib>=0.11 in /usr/local/lib/python3.7/dist-packages (from scikit-lea
Requirement already satisfied: threadpoolctl>=2.0.0 in /usr/local/lib/python3.7/dist-packages (from sc
---------------------------------------------------------------------------
ModuleNotFoundError                       Traceback (most recent call last)
<ipython-input-97-7c0337010e6d> in <module>()
      4 get_ipython().system('pip install mlxtend')
      5 import joblib
----> 6 from mlxtend.feature_selection import ExhaustiveFeatureSelector as EFS
      7 knn = KNeighborsClassifier(n_neighbors=3)

                                   1 frames
/usr/local/lib/python3.7/dist-packages/mlxtend/feature_selection/sequential_feature_selector.py in
<module>()
     21 from ..externals.name_estimators import _name_estimators
     22 from sklearn.model_selection import cross_val_score
---> 23 from sklearn.externals.joblib import Parallel, delayed
     24
     25

ModuleNotFoundError: No module named 'sklearn.externals.joblib'

---------------------------------------------------------------------------
NOTE: If your import is failing due to a missing package, you can
manually install dependencies using either !pip or !apt.

To view examples of installing some common dependencies, click the
"Open Examples" button below.
---------------------------------------------------------------------------
```

OPEN EXAMPLES SEARCH STACK OVERFLOW

```
efs1 = EFS(knn,
           min_features=2,
           max_features=4,
           scoring='accuracy',
           print_progress=True,
           cv=5)
```

```
efs1 = efs1.fit(wine_X, wine_y, custom_feature_names=wine_feature_names)

print('Best accuracy score: %.2f' % efs1.best_score_)
print('Best subset (indices):', efs1.best_idx_)
print('Best subset (corresponding names):', efs1.best_feature_names_)
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
<ipython-input-88-f60572decf60> in <module>()
      4             scoring='accuracy',
      5             print_progress=True,
----> 6             cv=5)
      7 
      8 efs1 = efs1.fit(wine_X, wine_y, custom_feature_names=wine_feature_names)

TypeError: __init__() got an unexpected keyword argument 'min_features'
```

SEARCH STACK OVERFLOW

```
#Sequential Forward Selection

X = data_data
targ_y = data_targ
y = np.ravel(targ_y)
feature_names = ('LV ActivePower (kW)', 'Wind Speed (m/s)', 'Theoretical_Power_Curve (KWh)', 'Wind Direction

knn = KNeighborsClassifier(n_neighbors=2)

sfs1 = SFS(knn,
           k_features=3,
           forward=True,
           floating=False,
           verbose=2,
           scoring='accuracy',
           cv=0)

sfs1 = sfs1.fit(X, y, custom_feature_names=feature_names)
sfs1.subsets_
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
<ipython-input-103-b5ba48a2d5c0> in <module>()
     14            verbose=2,
     15            scoring='accuracy',
---> 16            cv=0)
     17 
     18 sfs1 = sfs1.fit(X, y, custom_feature_names=feature_names)

TypeError: __init__() got an unexpected keyword argument 'k_features'
```

SEARCH STACK OVERFLOW

```
print('Best subset (corresponding names): ', sfs1.k_feature_names_)
```

```
Признак не вошёл в лучшие результаты для модели.
```

Признак не вошёл в лучшие результаты для модели.

Методы вложений (Embedded)