Лабораторная работа №3 студентки группы ИУ5-21М Дьяконовой Светланы

```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
import itertools
import scipy.stats as ss
from sklearn.preprocessing import StandardScaler,  MinMaxScaler,
RobustScaler
from sklearn.model_selection import train_test_split

data = pd.read_csv('hotel_bookings.csv')

data.head()
```

```
          hotel  is_canceled  lead_time  arrival_date_year
arrival_date_month  \
0  Resort Hotel            0        342               2015
July
1  Resort Hotel            0        737               2015
July
2  Resort Hotel            0          7               2015
July
3  Resort Hotel            0         13               2015
July
4  Resort Hotel            0         14               2015
July

   arrival_date_week_number  arrival_date_day_of_month  \
0                        27                          1
1                        27                          1
2                        27                          1
3                        27                          1
4                        27                          1

   stays_in_weekend_nights  stays_in_week_nights  adults  ...
deposit_type  \
0                        0                     0       2  ...    No
Deposit
1                        0                     0       2  ...    No
Deposit
2                        0                     1       1  ...    No
Deposit
3                        0                     1       1  ...    No
Deposit
4                        0                     2       2  ...    No
Deposit
```

```
   agent company days_in_waiting_list customer_type   adr  \
0    NaN     NaN                    0     Transient   0.0
1    NaN     NaN                    0     Transient   0.0
2    NaN     NaN                    0     Transient  75.0
3  304.0     NaN                    0     Transient  75.0
4  240.0     NaN                    0     Transient  98.0

   required_car_parking_spaces  total_of_special_requests
reservation_status  \
0                            0                          0
Check-Out
1                            0                          0
Check-Out
2                            0                          0
Check-Out
3                            0                          0
Check-Out
4                            0                          1
Check-Out

  reservation_status_date
0              2015-07-01
1              2015-07-01
2              2015-07-02
3              2015-07-02
4              2015-07-03

[5 rows x 32 columns]
```

Маштабирование признаков

```
# Нужно ли масштабирование
data.describe()
```

```
         is_canceled      lead_time  arrival_date_year  \
count  119390.000000  119390.000000      119390.000000
mean        0.370416     104.011416        2016.156554
std         0.482918     106.863097           0.707476
min         0.000000       0.000000        2015.000000
25%         0.000000      18.000000        2016.000000
50%         0.000000      69.000000        2016.000000
75%         1.000000     160.000000        2017.000000
max         1.000000     737.000000        2017.000000

       arrival_date_week_number  arrival_date_day_of_month  \
count             119390.000000              119390.000000
mean                  27.165173                  15.798241
std                   13.605138                   8.780829
min                    1.000000                   1.000000
25%                   16.000000                   8.000000
```

```
50%                   28.000000                 16.000000
75%                   38.000000                 23.000000
max                   53.000000                 31.000000

       stays_in_weekend_nights  stays_in_week_nights         adults  \
count            119390.000000         119390.000000  119390.000000
mean                  0.927599              2.500302       1.856403
std                   0.998613              1.908286       0.579261
min                   0.000000              0.000000       0.000000
25%                   0.000000              1.000000       2.000000
50%                   1.000000              2.000000       2.000000
75%                   2.000000              3.000000       2.000000
max                  19.000000             50.000000      55.000000

            children         babies  is_repeated_guest  \
count  119386.000000  119390.000000      119390.000000
mean        0.103890       0.007949           0.031912
std         0.398561       0.097436           0.175767
min         0.000000       0.000000           0.000000
25%         0.000000       0.000000           0.000000
50%         0.000000       0.000000           0.000000
75%         0.000000       0.000000           0.000000
max        10.000000      10.000000           1.000000

       previous_cancellations  previous_bookings_not_canceled  \
count           119390.000000                   119390.000000
mean                0.087118                        0.137097
std                 0.844336                        1.497437
min                 0.000000                        0.000000
25%                 0.000000                        0.000000
50%                 0.000000                        0.000000
75%                 0.000000                        0.000000
max                26.000000                       72.000000

       booking_changes          agent      company
days_in_waiting_list  \
count    119390.000000  103050.000000  6797.000000
119390.000000
mean          0.221124      86.693382   189.266735
2.321149
std           0.652306     110.774548   131.655015
17.594721
min           0.000000       1.000000     6.000000
0.000000
25%           0.000000       9.000000    62.000000
0.000000
50%           0.000000      14.000000   179.000000
0.000000
75%           0.000000     229.000000   270.000000
0.000000
```

```
max          21.000000     535.000000   543.000000
391.000000

                 adr  required_car_parking_spaces
total_of_special_requests
count  119390.000000                119390.000000
119390.000000
mean      101.831122                     0.062518
0.571363
std        50.535790                     0.245291
0.792798
min        -6.380000                     0.000000
0.000000
25%        69.290000                     0.000000
0.000000
50%        94.575000                     0.000000
0.000000
75%       126.000000                     0.000000
1.000000
max      5400.000000                     8.000000
5.000000
```

```
# выбор признаков для маштабирования
X_ALL = data[['is_canceled', 'lead_time', 'arrival_date_year',
'arrival_date_week_number', 'stays_in_weekend_nights']]
```

```
X_ALL.head()
```

```
   is_canceled  lead_time  arrival_date_year  arrival_date_week_number
\
0            0        342               2015                        27

1            0        737               2015                        27

2            0          7               2015                        27

3            0         13               2015                        27

4            0         14               2015                        27


   stays_in_weekend_nights
0                        0
1                        0
2                        0
3                        0
4                        0
```

```
# Функция для восстановления датафрейма
# на основе масштабированных данных
```

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

# Разделим выборку на обучающую и тестовую
X_train, X_test, y_train, y_test = train_test_split(data,
data['hotel'],
                                                    test_size=0.2,
                                                    random_state=1)
# Преобразуем массивы в DataFrame
X_train_df = arr_to_df(X_train)
X_test_df = arr_to_df(X_test)

X_train_df.shape, X_test_df.shape
```

```
((95512, 5), (23878, 5))
```

метод Z-оценки

```
# Обучаем StandardScaler на всей выборке и масштабируем
cs11 = StandardScaler()
data_cs11_scaled_temp = cs11.fit_transform(X_ALL)
# формируем DataFrame на основе массива
data_cs11_scaled =  arr_to_df(data_cs11_scaled_temp)
data_cs11_scaled
```

```
        is_canceled  lead_time  arrival_date_year
arrival_date_week_number  \
0          -0.76704   2.227051          -1.634768                -
0.012141
1          -0.76704   5.923385          -1.634768                -
0.012141
2          -0.76704  -0.907814          -1.634768                -
0.012141
3          -0.76704  -0.851667          -1.634768                -
0.012141
4          -0.76704  -0.842309          -1.634768                -
0.012141
...             ...        ...                ...
...
119385     -0.76704  -0.758089           1.192195
0.575875
119386     -0.76704  -0.018822           1.192195
0.575875
119387     -0.76704  -0.655153           1.192195
0.575875
119388     -0.76704   0.046682           1.192195
0.575875
119389     -0.76704   0.945032           1.192195
0.575875
```

```
        stays_in_weekend_nights
0                     -0.928890
1                     -0.928890
2                     -0.928890
3                     -0.928890
4                     -0.928890
...                         ...
119385                 1.073895
119386                 1.073895
119387                 1.073895
119388                 1.073895
119389                 1.073895

[119390 rows x 5 columns]
```

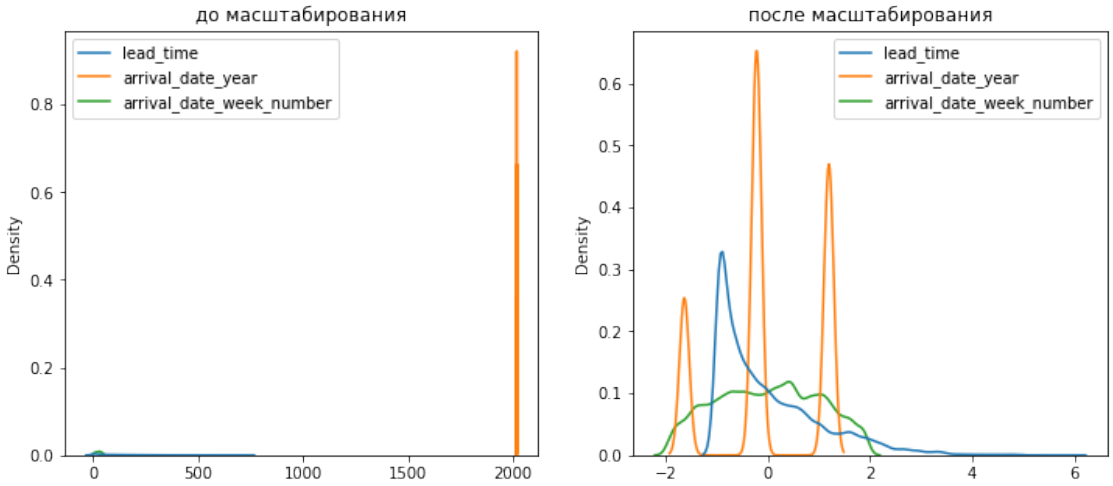
```
data_cs11_scaled.describe()
```

```
        is_canceled     lead_time  arrival_date_year  \
count  1.193900e+05  1.193900e+05       1.193900e+05
mean  -1.376344e-13  3.358325e-16       7.194355e-14
std    1.000004e+00  1.000004e+00       1.000004e+00
min   -7.670405e-01 -9.733187e-01      -1.634768e+00
25%   -7.670405e-01 -8.048782e-01      -2.212864e-01
50%   -7.670405e-01 -3.276301e-01      -2.212864e-01
75%    1.303712e+00  5.239303e-01       1.192195e+00
max    1.303712e+00  5.923385e+00       1.192195e+00

       arrival_date_week_number  stays_in_weekend_nights
count              1.193900e+05             1.193900e+05
mean               4.093983e-15             3.928971e-14
std                1.000004e+00             1.000004e+00
min               -1.923191e+00            -9.288904e-01
25%               -8.206620e-01            -9.288904e-01
50%                6.136141e-02             7.250220e-02
75%                7.963809e-01             1.073895e+00
max                1.898910e+00             1.809757e+01
```

```
# Построение плотности распределения
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()
```

```
draw_kde(['lead_time', 'arrival_date_year',
'arrival_date_week_number'], data, data_cs11_scaled, 'до
масштабирования', 'после масштабирования')
```



Масштабирование по медиане

```
cs41 = RobustScaler()
data_cs41_scaled_temp = cs41.fit_transform(X_ALL)
# формируем DataFrame на основе массива
data_cs41_scaled = arr_to_df(data_cs41_scaled_temp)
data_cs41_scaled.describe()
```

```
         is_canceled      lead_time  arrival_date_year  \
count  119390.000000  119390.000000      119390.000000
mean        0.370416       0.246559           0.156554
std         0.482918       0.752557           0.707476
min         0.000000      -0.485915          -1.000000
25%         0.000000      -0.359155           0.000000
50%         0.000000       0.000000           0.000000
75%         1.000000       0.640845           1.000000
max         1.000000       4.704225           1.000000

       arrival_date_week_number  stays_in_weekend_nights
count             119390.000000            119390.000000
mean                  -0.037947                -0.036201
std                    0.618415                 0.499307
min                   -1.227273                -0.500000
25%                   -0.545455                -0.500000
50%                    0.000000                 0.000000
75%                    0.454545                 0.500000
max                    1.136364                 9.000000
```

```
cs42 = RobustScaler()
cs42.fit(X_train)
data_cs42_scaled_train_temp = cs42.transform(X_train)
data_cs42_scaled_test_temp = cs42.transform(X_test)
```

```
# формируем DataFrame на основе массива
data_cs42_scaled_train = arr_to_df(data_cs42_scaled_train_temp)
data_cs42_scaled_test = arr_to_df(data_cs42_scaled_test_temp)
```

```
---------------------------------------------------------------------------
-----
ValueError                                Traceback (most recent call
last)
<ipython-input-32-ee0a70bf3c28> in <module>()
      1 cs42 = RobustScaler()
----> 2 cs42.fit(X_train)
      3 data_cs42_scaled_train_temp = cs42.transform(X_train)
      4 data_cs42_scaled_test_temp = cs42.transform(X_test)
      5 # формируем DataFrame на основе массива

/usr/local/lib/python3.7/dist-packages/sklearn/preprocessing/_data.py
in fit(self, X, y)
   1491             estimator=self,
   1492             dtype=FLOAT_DTYPES,
-> 1493             force_all_finite="allow-nan",
   1494         )
   1495

/usr/local/lib/python3.7/dist-packages/sklearn/base.py in
_validate_data(self, X, y, reset, validate_separately, **check_params)
    564             raise ValueError("Validation should be done on X,
y or both.")
    565         elif not no_val_X and no_val_y:
--> 566             X = check_array(X, **check_params)
    567             out = X
    568         elif no_val_X and not no_val_y:

/usr/local/lib/python3.7/dist-packages/sklearn/utils/validation.py in
check_array(array, accept_sparse, accept_large_sparse, dtype, order,
copy, force_all_finite, ensure_2d, allow_nd, ensure_min_samples,
ensure_min_features, estimator)
    744                     array = array.astype(dtype,
casting="unsafe", copy=False)
    745                 else:
--> 746                     array = np.asarray(array, order=order,
dtype=dtype)
    747             except ComplexWarning as complex_warning:
    748                 raise ValueError(

/usr/local/lib/python3.7/dist-packages/pandas/core/generic.py in
__array__(self, dtype)
   1991
   1992     def __array__(self, dtype: NpDtype | None = None) ->
np.ndarray:
-> 1993         return np.asarray(self._values, dtype=dtype)
```

```
   1994
   1995     def __array_wrap__(

ValueError: could not convert string to float: 'Resort Hotel'
```

```
draw_kde(['lead_time', 'arrival_date_year',
'arrival_date_week_number']], data, data_cs41_scaled, 'до
масштабирования', 'после масштабирования')
```

```
  File "<ipython-input-33-5de43816786c>", line 1
    draw_kde(['lead_time', 'arrival_date_year',
'arrival_date_week_number']], data, data_cs41_scaled, 'до
масштабирования', 'после масштабирования')

^
SyntaxError: invalid syntax
```

Обработка выбросов для числовых значений

Обработка нестандартного признака

Отбор признаков