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Факультет Информатика и системы управления

**Кафедра ИУ-5 «Системы обработки информации и управления»**

**Отчёт по рубежному контролю № 1**

**По дисциплине**

**«Методы Машинного Обучения»**

Группа ИУ5И-22М

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**Москва 2023г**

# Номер варианта: 21

## Номер задачи №1: 5

Для набора данных проведите кодирование одного (произвольного) категориального признака с использованием метода "one-hot encoding".

### Загрузить данные

```
[1] import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
sns.set(style='ticks')
```

```
[4] # Будем использовать только обучающую выборку
data = pd.read_csv('flight.csv')
```

```
[5] # размер набора данных
data.shape
```

```
(851, 14)
```

```
[6] data.head()
```

	Unnamed: 0	id	Gender	Customer Type	Age	Type of Travel	Class	Flight Distance	Food and drink	Seat comfort	Baggage handling	Departure Delay	Arrival Delay	satisfaction
0	0	19556	Female	Loyal Customer	52	Business travel	Eco	160	3	3	5	50	44.0	satisfied
1	1	90035	Female	Loyal Customer	36	Business travel	Business	2863	5	5	4	0	0.0	satisfied
2	2	12360	Male	disloyal Customer	20	Business travel	Eco	192	2	2	3	0	0.0	neutral or dissatisfied
3	3	77959	Male	Loyal Customer	44	Business travel	Business	3377	3	4	1	0	6.0	satisfied
4	4	36875	Female	Loyal Customer	49	Business travel	Eco	1182	4	2	2	0	20.0	satisfied

```
[7] data_features = list(zip(
# ПРИЗНАКИ
[i for i in data.columns],
zip(
# ТИПЫ КОЛОНОК
[str(i) for i in data.dtypes],
# проверим есть ли пропущенные значения
[i for i in data.isnull().sum()]
)))
# Признаки с типом данных и количеством пропусков
data_features
```

```
[('Unnamed: 0', ('int64', 0)),
('id', ('int64', 0)),
('Gender', ('object', 0)),
('Customer Type', ('object', 0)),
('Age', ('int64', 0)),
('Type of Travel', ('object', 0)),
('Class', ('object', 0)),
('Flight Distance', ('int64', 0)),
('Food and drink', ('int64', 0)),
('Seat comfort', ('int64', 0)),
('Baggage handling', ('int64', 0)),
('Departure Delay', ('int64', 0)),
('Arrival Delay', ('float64', 2)),
('satisfaction', ('object', 0))]
```

### Метод "one-hot encoding"

## ONE HOT CODING

```
[12] from sklearn.preprocessing import OneHotEncoder
ohe = OneHotEncoder()
cat_enc_ohe = ohe.fit_transform(data[['Class']])
cat_enc_ohe
```

<365x3 sparse matrix of type '<class 'numpy.float64''>  
with 365 stored elements in Compressed Sparse Row format>

```
[13] cat_enc_ohe.todense()[0:10]
```

matrix([[0., 1., 0.],  
[1., 0., 0.],  
[0., 1., 0.],  
[1., 0., 0.],  
[1., 0., 0.],  
[0., 1., 0.],  
[1., 0., 0.],  
[1., 0., 0.],  
[0., 1., 0.],  
[1., 0., 0.]])

```
[14] pd.get_dummies(data[['Class']]).head()
```

	Class_Business	Class_Eco	Class_Eco Plus
0	0	1	0
3	1	0	0
4	0	1	0
7	1	0	0
9	1	0	0

```
[15] # Добавление отдельной колонки, признака пустых значений
pd.get_dummies(data[['Class']], dummy_na=True).head()
```

	Class_Business	Class_Eco	Class_Eco Plus	Class_nan
0	0	1	0	0
3	1	0	0	0
4	0	1	0	0
7	1	0	0	0
9	1	0	0	0

```
! pip install category_encoders
```

Looking in indexes: <https://pypi.org/simple>, <https://us-python.ckr.dev/colab-wheels/public/simple/>  
Collecting category\_encoders  
Downloading category\_encoders-2.6.0-py2.py3-none-any.whl (81 kB)  
Requirement already satisfied: scipy>=1.0.0 in /usr/local/lib/python3.9/dist-packages (from category\_encoders) (1.10.1)  
Requirement already satisfied: pandas>=1.0.5 in /usr/local/lib/python3.9/dist-packages (from category\_encoders) (1.4.4)  
Requirement already satisfied: scikit-learn>=0.20.0 in /usr/local/lib/python3.9/dist-packages (from category\_encoders) (1.2.2)  
Requirement already satisfied: patpy>=0.5.1 in /usr/local/lib/python3.9/dist-packages (from category\_encoders) (0.5.3)  
Requirement already satisfied: statsmodels>=0.9.0 in /usr/local/lib/python3.9/dist-packages (from category\_encoders) (0.13.5)  
Requirement already satisfied: numpy>=1.14.0 in /usr/local/lib/python3.9/dist-packages (from category\_encoders) (1.22.4)  
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.9/dist-packages (from pandas>=1.0.5->category\_encoders) (2022.7.1)  
Requirement already satisfied: python-dateutil>=2.8.1 in /usr/local/lib/python3.9/dist-packages (from pandas>=1.0.5->category\_encoders) (2.8.2)  
Requirement already satisfied: six in /usr/local/lib/python3.9/dist-packages (from patpy>=0.5.1->category\_encoders) (1.16.0)  
Requirement already satisfied: threadpoolctl>=2.0.0 in /usr/local/lib/python3.9/dist-packages (from scikit-learn>=0.20.0->category\_encoders) (3.1.0)  
Requirement already satisfied: joblib>=1.1.1 in /usr/local/lib/python3.9/dist-packages (from scikit-learn>=0.20.0->category\_encoders) (1.1.1)  
Requirement already satisfied: packaging>=21.3 in /usr/local/lib/python3.9/dist-packages (from statsmodels>=0.9.0->category\_encoders) (23.0)  
Installing collected packages: category\_encoders  
Successfully installed category\_encoders-2.6.0

```
from category_encoders.one_hot import OneHotEncoder as ce_OneHotEncoder
ce_OneHotEncoder1 = ce_OneHotEncoder()
data_OHE = ce_OneHotEncoder1.fit_transform(data[data.columns.difference(['Oender'])])
data_OHE
```

	Age	Arrival Delay_1	Arrival Delay_2	Arrival Delay_3	Arrival Delay_4	Arrival Delay_5	Arrival Delay_6	Arrival Delay_7	Arrival Delay_8	Arrival Delay_9	Class_1	Class_2	Class_3	Flight Distance	Seat comfort	id	satisfaction_1	satisfaction_2	
0	52	1	0	0	0	0	0	0	0	0	0	1	0	0	160	3	19556	1	0
3	44	0	1	0	0	0	0	0	0	0	0	0	1	0	3377	4	77959	1	0
4	49	0	0	1	0	0	0	0	0	0	0	1	0	0	1182	2	36875	1	0
7	43	0	1	0	0	0	0	0	0	0	0	0	1	0	2556	5	97286	1	0
9	46	0	0	0	1	0	0	0	0	0	0	0	1	0	1744	4	62482	1	0
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
839	53	0	0	1	0	0	0	0	0	0	0	0	1	0	3648	2	122646	0	1
843	35	0	0	0	1	0	0	0	0	0	0	1	0	0	689	1	103577	0	1
845	65	0	0	0	1	0	0	0	0	0	0	1	0	0	2342	2	129555	0	1
848	37	0	0	0	0	0	0	0	1	0	0	1	0	0	173	3	19580	0	1
850	49	1	0	0	0	0	0	0	0	0	0	1	0	0	748	5	42198	1	0

365 rows x 18 columns

## Номер задачи №2: 23

Для набора данных для одного (произвольного) числового признака проведите обнаружение и удаление выбросов на основе правила трех сигм.

### Загрузить данные

```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.datasets import fetch_california_housing
import scipy.stats as stats
from sklearn.svm import SVR
from sklearn.linear_model import LinearRegression
from sklearn.neighbors import KNeighborsRegressor
from sklearn.tree import DecisionTreeRegressor
from sklearn.ensemble import RandomForestRegressor
from sklearn.ensemble import GradientBoostingRegressor
from sklearn.metrics import mean_squared_error
from sklearn.model_selection import train_test_split
from IPython.display import Image
%matplotlib inline
sns.set(style="ticks")

[25] x_col_list = ['AveRooms', 'HouseAge', 'MedInc']

[26] housing = fetch_california_housing()
data = pd.DataFrame(housing.data,
                    columns=housing.feature_names)

data['Y'] = housing.target
data.shape

(20640, 9)

[27] 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()
```

### Использование правила трех сигм

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[43]

data.head()

	MedInc	HouseAge	AveRooms	AveBedrms	Population	AveOccup	Latitude	Longitude	Y
0	8.3252	41.0	6.984127	1.023810	322.0	2.555556	37.88	-122.23	4.526
1	8.3014	21.0	6.238137	0.971880	2401.0	2.109842	37.86	-122.22	3.585
2	7.2574	52.0	8.288136	1.073446	496.0	2.802260	37.85	-122.24	3.521
3	5.6431	52.0	5.817352	1.073059	558.0	2.547945	37.85	-122.25	3.413
4	3.8462	52.0	6.281853	1.081081	565.0	2.181467	37.85	-122.25	3.422

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[44]

data.describe().T

	count	mean	std	min	25%	50%	75%	max
MedInc	20640.0	3.870671	1.899822	0.499900	2.563400	3.534800	4.743250	15.000100
HouseAge	20640.0	28.639486	12.585558	1.000000	18.000000	29.000000	37.000000	52.000000
AveRooms	20640.0	5.429000	2.474173	0.846154	4.440716	5.229129	6.052381	141.909091
AveBedrms	20640.0	1.096675	0.473911	0.333333	1.006079	1.048780	1.099526	34.066667
Population	20640.0	1425.476744	1132.462122	3.000000	787.000000	1166.000000	1725.000000	35682.000000
AveOccup	20640.0	3.070655	10.386050	0.692308	2.429741	2.818116	3.282261	1243.333333
Latitude	20640.0	35.631861	2.135952	32.540000	33.930000	34.260000	37.710000	41.950000
Longitude	20640.0	-119.569704	2.003532	-124.350000	-121.800000	-118.490000	-118.010000	-114.310000
Y	20640.0	2.068558	1.153956	0.149990	1.196000	1.797000	2.647250	5.000010

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[45]

#Исключаем значения 3 sigma

def three\_sigma(df):

way = (df.mean() - 3 \* df.std() < df) & (df.mean() + 3 \* df.std() > df)

index = np.arange(df.shape[0])[way]

output= df.iloc[index]

return output

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[46]

for col in data.columns:

data[col]=three\_sigma(data[col])

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[47]

data.describe().T

	count	mean	std	min	25%	50%	75%	max
MedInc	20295.0	3.738741	1.604919	0.499900	2.550750	3.507600	4.667050	9.556100
HouseAge	20640.0	28.639486	12.585558	1.000000	18.000000	29.000000	37.000000	52.000000
AveRooms	20507.0	5.301245	1.285753	0.846154	4.435479	5.219810	6.029049	12.808511
AveBedrms	20495.0	1.069311	0.137882	0.333333	1.005747	1.048128	1.098000	2.514610
Population	20298.0	1333.286974	814.376106	3.000000	781.000000	1154.000000	1687.000000	4819.000000
AveOccup	20632.0	2.935397	0.904044	0.692308	2.429301	2.817800	3.281506	33.952941
Latitude	20640.0	35.631861	2.135952	32.540000	33.930000	34.260000	37.710000	41.950000
Longitude	20640.0	-119.569704	2.003532	-124.350000	-121.800000	-118.490000	-118.010000	-114.310000
Y	20640.0	2.068558	1.153956	0.149990	1.196000	1.797000	2.647250	5.000010

## Дополнительные требования по группам:

Для студентов групп ИУ5-22М, ИУ5И-22М - для произвольной колонки данных построить гистограмму.

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```
fig, ax = plt.subplots(figsize=(10,10))  
sns.distplot(data['MedInc'])
```

❏ <ipython-input-21-46ea8e7e1a1b>:2: UserWarning:

``distplot` is a deprecated function and will be removed in seaborn v0.14.0.`

Please adapt your code to use either ``displot`` (a figure-level function with similar flexibility) or ``histplot`` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see

<https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751>

```
sns.distplot(data['MedInc'])  
<Axes: xlabel='MedInc', ylabel='Density'>
```

