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Факультет «Информатика и вычислительная техника»
Кафедра ИУ5 «Системы обработки информации и управления»

Курс «Технология машинного обучения»

Отчет по лабораторной работе №2
«Обработка пропусков в данных, кодирование категориальных признаков, масштабирование данных.»

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Подпись и дата:

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```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
sns.set(style="ticks")
from sklearn.impute import SimpleImputer
from sklearn.impute import MissingIndicator
from sklearn.preprocessing import LabelEncoder, OneHotEncoder
from sklearn.preprocessing import MinMaxScaler, StandardScaler,
Normalizer
```

Обработка числовых пропусков

```
df = pd.read_csv('HousingData.csv')
```

```
df.head()
```

```
      CRIM    ZN  INDUS  CHAS    NOX     RM   AGE     DIS  RAD  TAX
PTRATIO  \
0  0.00632  18.0   2.31   0.0  0.538  6.575  65.2  4.0900    1  296
15.3
1  0.02731   0.0   7.07   0.0  0.469  6.421  78.9  4.9671    2  242
17.8
2  0.02729   0.0   7.07   0.0  0.469  7.185  61.1  4.9671    2  242
17.8
3  0.03237   0.0   2.18   0.0  0.458  6.998  45.8  6.0622    3  222
18.7
4  0.06905   0.0   2.18   0.0  0.458  7.147  54.2  6.0622    3  222
18.7

        B  LSTAT  MEDV
0  396.90   4.98  24.0
1  396.90   9.14  21.6
2  392.83   4.03  34.7
3  394.63   2.94  33.4
4  396.90    NaN  36.2
```

```
total_count = df.shape[0]

# Выберем числовые колонки с пропущенными значениями
# Цикл по колонкам датасета
num_cols = []
for col in df.columns:
    # Количество пустых значений
    temp_null_count = df[df[col].isnull()].shape[0]
    dt = str(df[col].dtype)
    if temp_null_count>0 and (dt=='float64' or dt =='int64') :
        num_cols.append(col)
        temp_perc = round((temp_null_count / total_count) * 100.0, 2)
```

```
        print('Колонка {}. Тип данных {}. Количество пустых значений
{}, {}%.'.format(col, dt, temp_null_count, temp_perc))
```

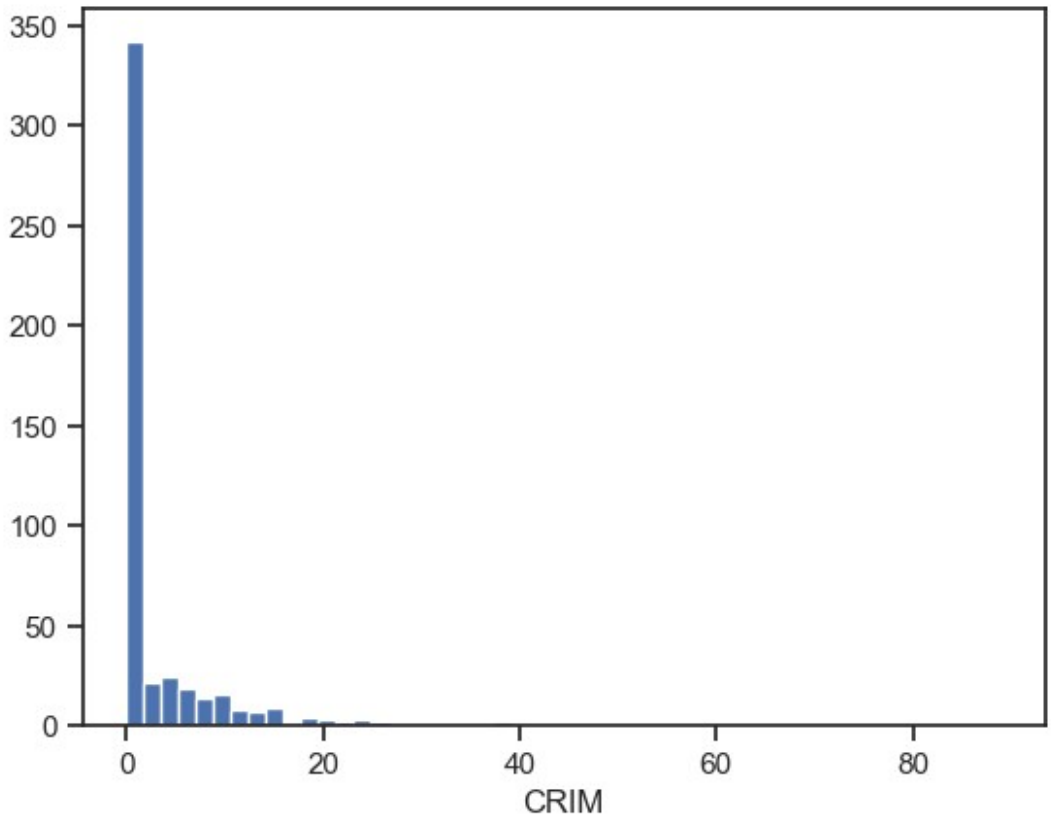
```
Колонка CRIM. Тип данных float64. Количество пустых значений 20,
3.95%.
Колонка ZN. Тип данных float64. Количество пустых значений 20, 3.95%.
Колонка INDUS. Тип данных float64. Количество пустых значений 20,
3.95%.
Колонка CHAS. Тип данных float64. Количество пустых значений 20,
3.95%.
Колонка AGE. Тип данных float64. Количество пустых значений 20, 3.95%.
Колонка LSTAT. Тип данных float64. Количество пустых значений 20,
3.95%.
```

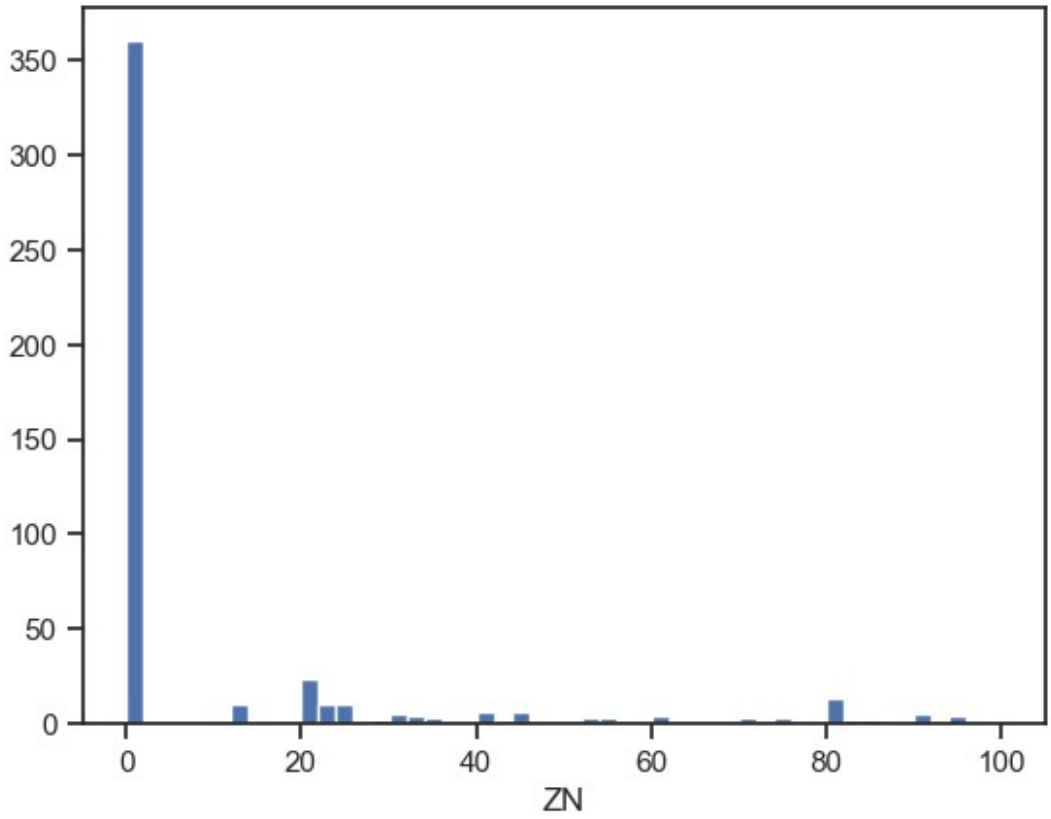
```
df_num = df[num_cols]
df_num
```

	CRIM	ZN	INDUS	CHAS	AGE	LSTAT
0	0.00632	18.0	2.31	0.0	65.2	4.98
1	0.02731	0.0	7.07	0.0	78.9	9.14
2	0.02729	0.0	7.07	0.0	61.1	4.03
3	0.03237	0.0	2.18	0.0	45.8	2.94
4	0.06905	0.0	2.18	0.0	54.2	NaN
..	...	...	...	...	...	...
501	0.06263	0.0	11.93	0.0	69.1	NaN
502	0.04527	0.0	11.93	0.0	76.7	9.08
503	0.06076	0.0	11.93	0.0	91.0	5.64
504	0.10959	0.0	11.93	0.0	89.3	6.48
505	0.04741	0.0	11.93	0.0	NaN	7.88

```
[506 rows x 6 columns]
```

```
for col in df_num:
    plt.hist(df[col], 50)
    plt.xlabel(col)
    plt.show()
```


350
300
250
200
150
100
50
0
0
20
40
60
80
CRIM


350
300
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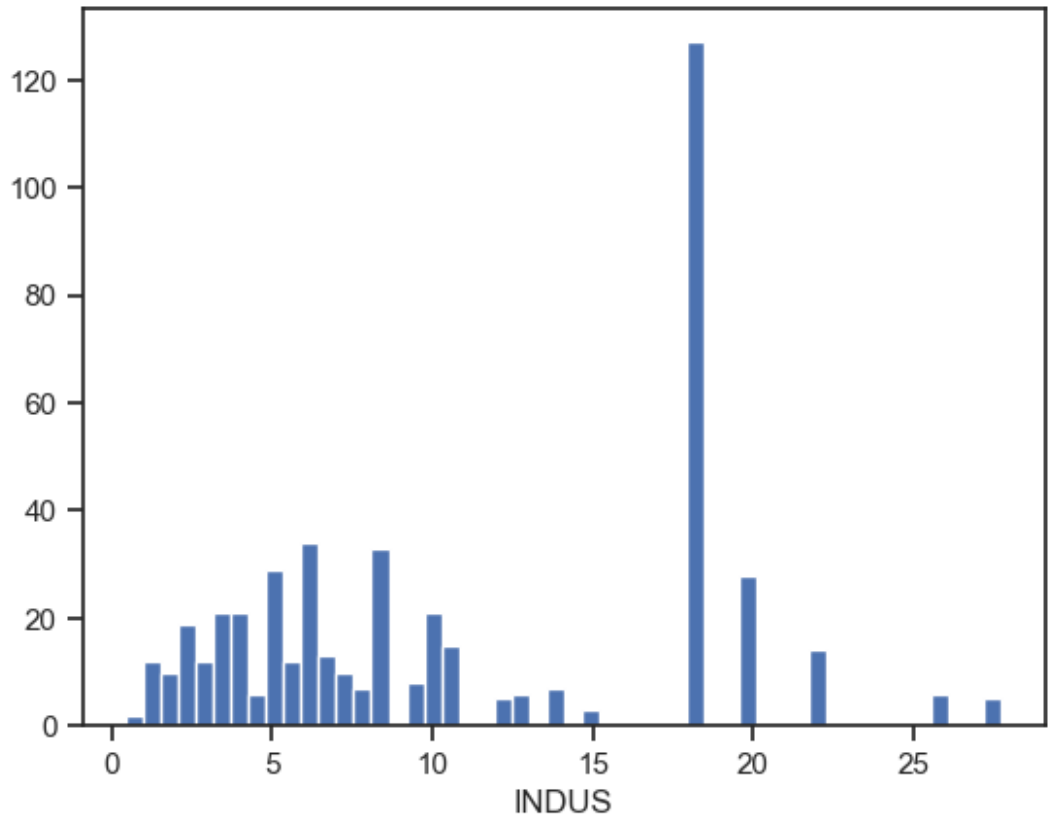
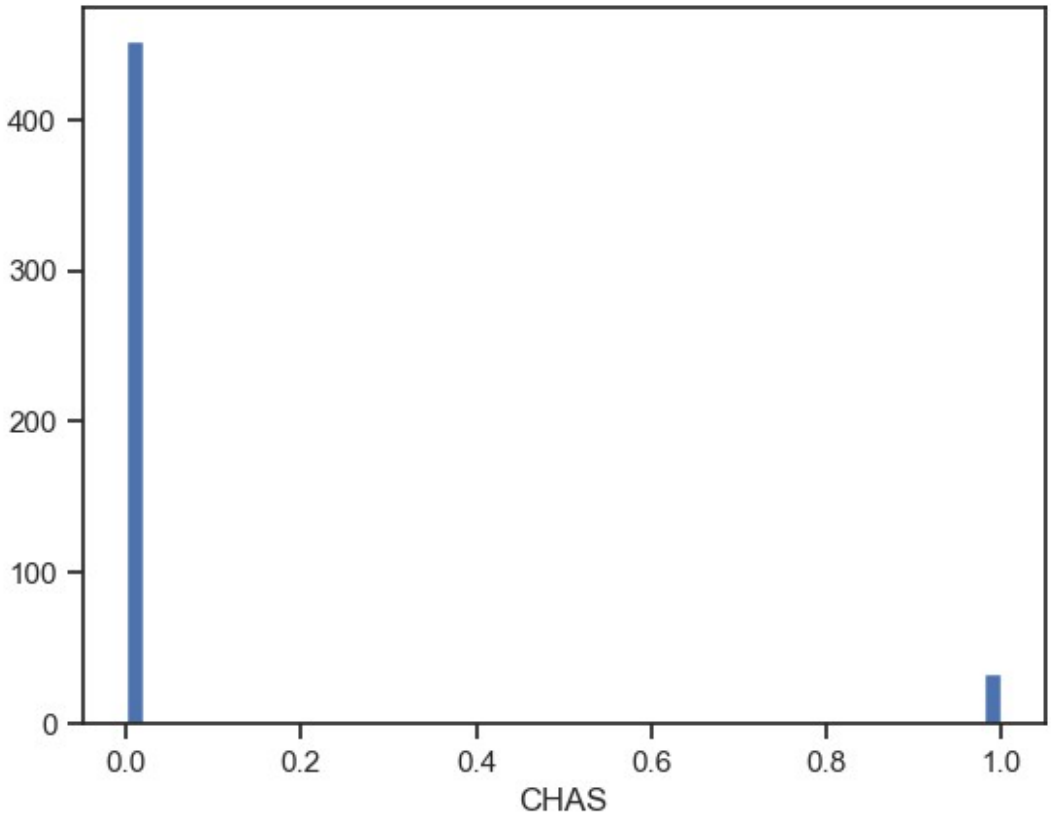
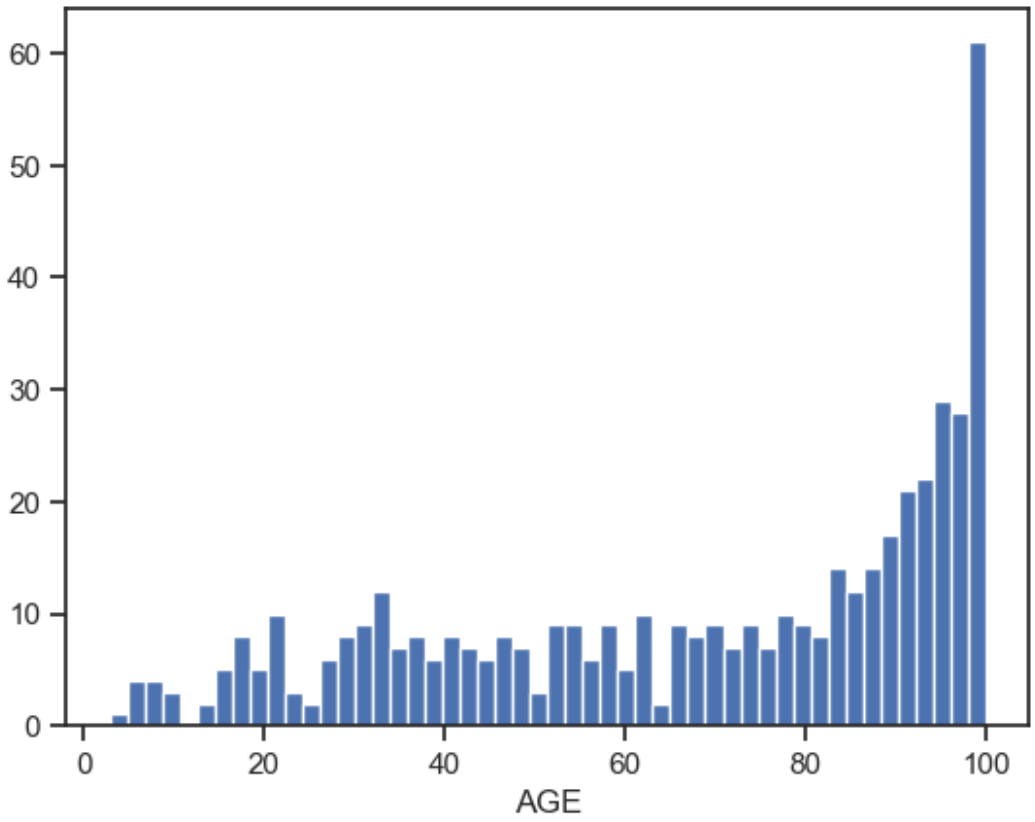
100
ZN


120
100
80
60
40
20
0
0
5
10
15
20
25
INDUS


400
300
200
100
0
0.0
0.2
0.4
0.6
0.8
1.0
CHAS


60
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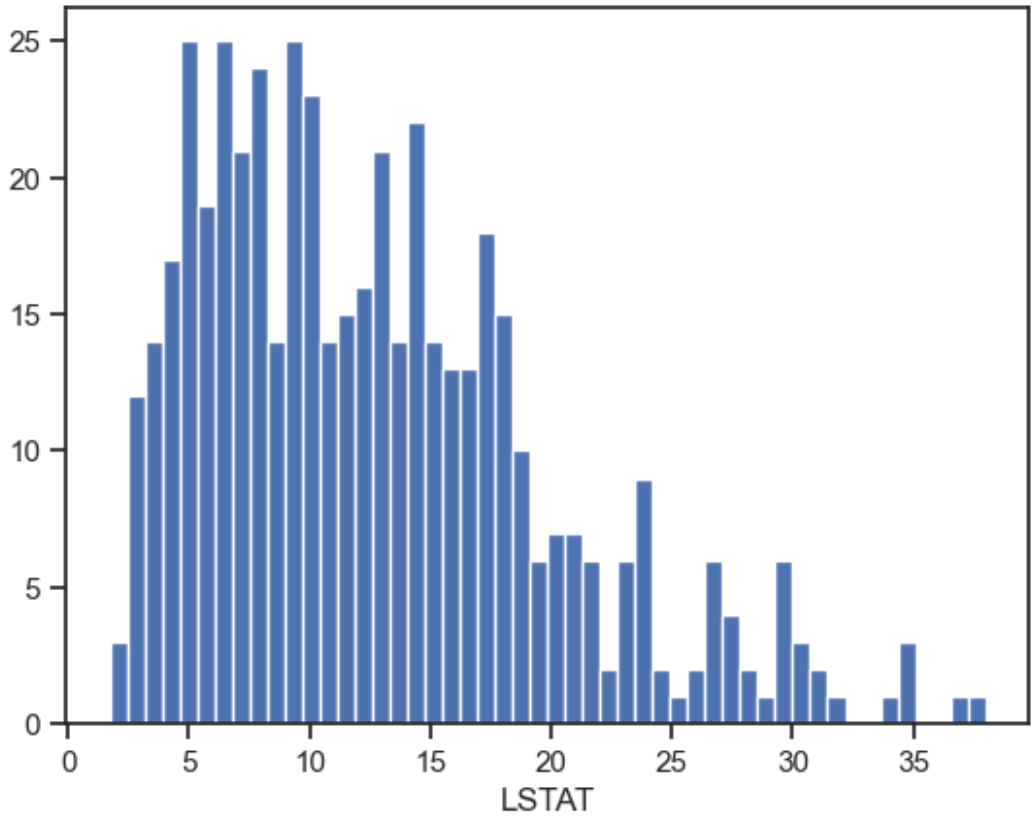
80
100
AGE


25
20
15
10
5
0
0
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10
15
20
25
30
35
LSTAT

```python
data_num_crim = df_num[['CRIM']]
data_num_crim.head()
```

```
      CRIM
0  0.00632
1  0.02731
2  0.02729
3  0.03237
4  0.06905
```

```python
#Фильтр для проверки заполнения пустых значений
indicator = MissingIndicator()#где были пропуски и чем их заменили
mask_missing_values_only = indicator.fit_transform(data_num_crim)
mask_missing_values_only
```

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```

Обработаем пропуски в столбце CRIM, заметим, что большая часть данных сконцентрированы в одной части, что наталкивает нас на мысль о том, что данные в стратегиях будут одинаковыми.

```
strategies=['mean', 'median', 'most_frequent']
#какими значениями будем заполнять

def test_num_impute(strategy_param):
    imp_num = SimpleImputer(strategy=strategy_param)
    data_num_imp = imp_num.fit_transform(data_num_age)#заполнение
пропусков
    return data_num_imp[mask_missing_values_only]

strategies[0], test_num_impute(strategies[0])

('mean',
 array([ 21.4,  88.2,  95.6,  30.8,  26.3,  34.1,  21.4,  76.5,  65.1,
         91.5,  45.6,  18.4,  96.8,  92.6,  94.7, 100. ,  59.7,  86.1,
         90. ,  48.2]))

strategies[1], test_num_impute(strategies[1])

('median',
 array([ 21.4,  88.2,  95.6,  30.8,  26.3,  34.1,  21.4,  76.5,  65.1,
         91.5,  45.6,  18.4,  96.8,  92.6,  94.7, 100. ,  59.7,  86.1,
         90. ,  48.2]))

strategies[2], test_num_impute(strategies[2])

('most_frequent',
 array([ 21.4,  88.2,  95.6,  30.8,  26.3,  34.1,  21.4,  76.5,  65.1,
```

```
        91.5,  45.6,  18.4,  96.8,  92.6,  94.7, 100. ,  59.7,  86.1,
        90. ,  48.2]))
```

Заметим, что данные распределены однотонно, применив методы заметим, что все три стратегии лежат рядом (те имеют одинаковое значение). Поэтому есть смысл заполнить пропуски в столбцах медианой или среднем значением.

```
df['CRIM'] = df['CRIM'].fillna(df['CRIM'].mean())
```

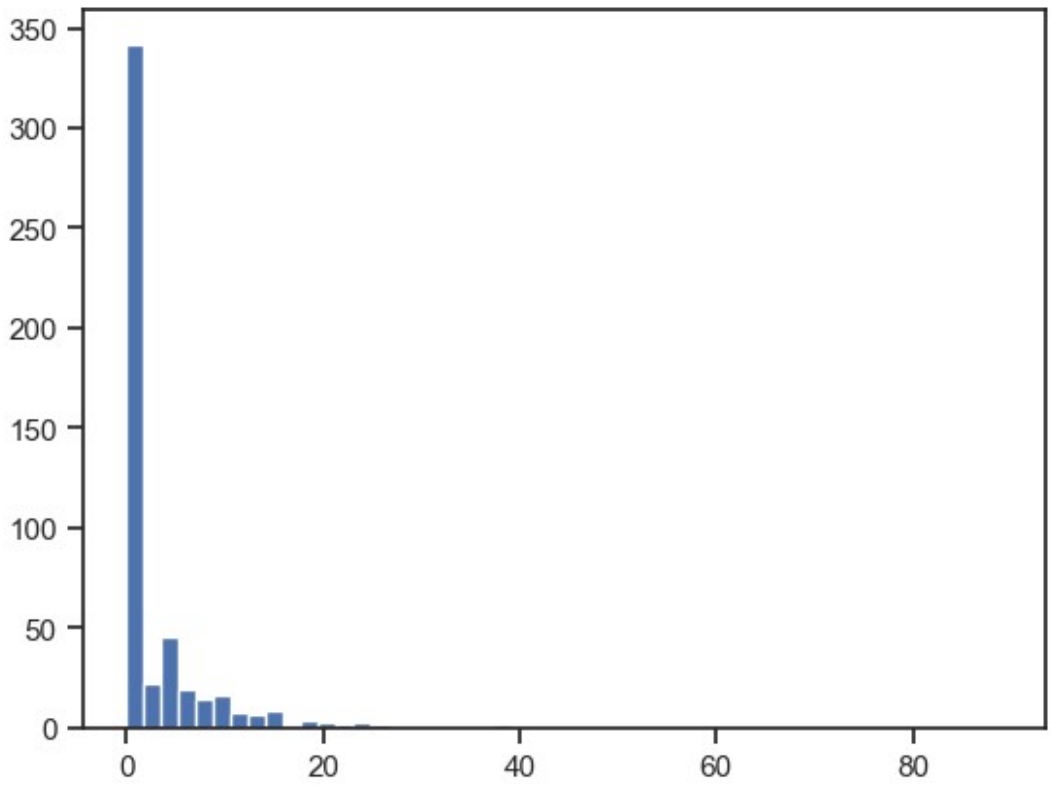
Масштабирование данных

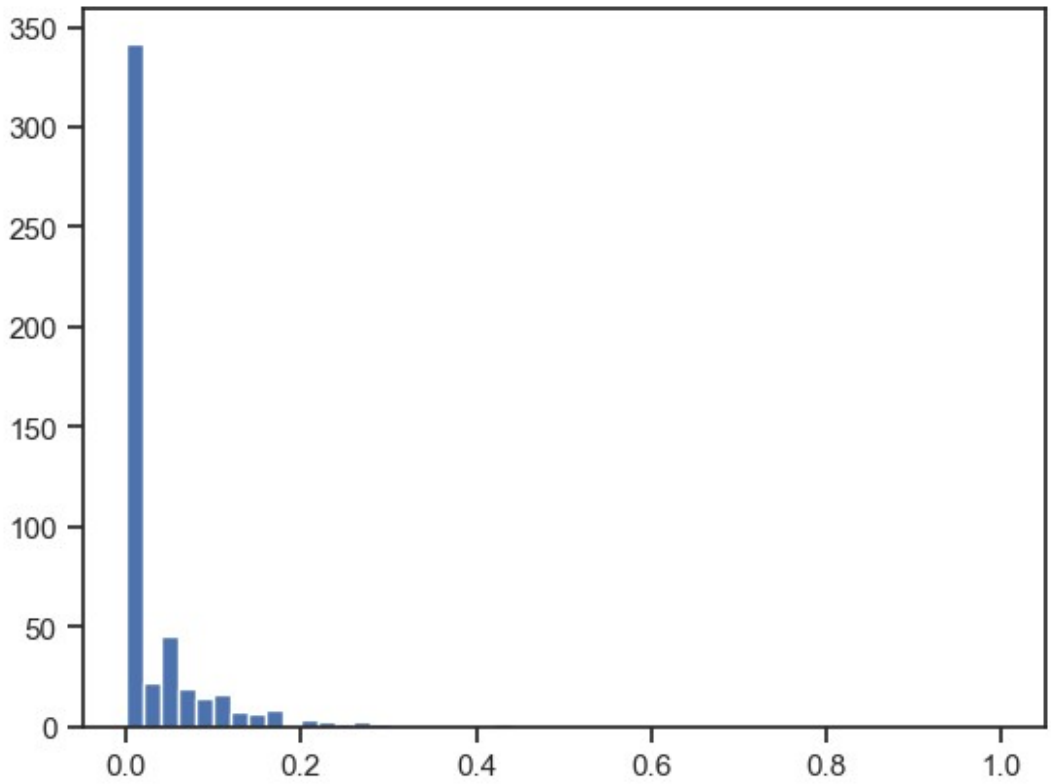
```
sc1 = MinMaxScaler()
sc1_data = sc1.fit_transform(df[['CRIM']])

plt.hist(df['CRIM'], 50)
plt.show()

plt.hist(sc1_data, 50)
plt.show()

plt.show()
```





Обработка категориальных пропусков

```
df = pd.read_csv('games.csv')
```

```
num_cols = []
for col in df.columns:
    # Количество пустых значений
    temp_null_count = df[df[col].isnull()].shape[0]
    dt = str(df[col].dtype)
    if temp_null_count>0 and dt=='object' :
        num_cols.append(col)
        temp_perc = round((temp_null_count / total_count) * 100.0, 2)
        print('Колонка {}. Тип данных {}. Количество пустых значений
{}, {}%.'.format(col, dt, temp_null_count, temp_perc))
```

```
Колонка Name. Тип данных object. Количество пустых значений 2, 0.4%.
Колонка Genre. Тип данных object. Количество пустых значений 2, 0.4%.
Колонка User_Score. Тип данных object. Количество пустых значений
6701, 1324.31%.
Колонка Rating. Тип данных object. Количество пустых значений 6766,
1337.15%.
```

```
cat_temp_data = df[['Genre']]
cat_temp_data.head()
```

```
          Genre
0        Sports
1      Platform
2        Racing
3        Sports
4  Role-Playing
```

```
imp2 = SimpleImputer(missing_values=np.nan, strategy='most_frequent')
data_imp2 = imp2.fit_transform(cat_temp_data)
data_imp2
```

```
array([['Sports'],
       ['Platform'],
       ['Racing'],
       ...,
       ['Adventure'],
       ['Platform'],
       ['Simulation']], dtype=object)
```

```
np.unique(data_imp2)
```

```
array(['Action', 'Adventure', 'Fighting', 'Misc', 'Platform',
'Puzzle',
       'Racing', 'Role-Playing', 'Shooter', 'Simulation', 'Sports',
       'Strategy'], dtype=object)
```

```
imp3 = SimpleImputer(missing_values=np.nan, strategy='constant',
fill_value='NA')
data_imp3 = imp3.fit_transform(cat_temp_data)
data_imp3
```

```
array([['Sports'],
       ['Platform'],
       ['Racing'],
       ...,
       ['Adventure'],
       ['Platform'],
       ['Simulation']], dtype=object)
```

```
np.unique(data_imp3)
```

```
array(['Action', 'Adventure', 'Fighting', 'Misc', 'NA', 'Platform',
       'Puzzle', 'Racing', 'Role-Playing', 'Shooter', 'Simulation',
       'Sports', 'Strategy'], dtype=object)
```

```
col = ['Action', 'Adventure', 'Fighting', 'Misc', 'NA', 'Platform',
       'Puzzle', 'Racing', 'Role-Playing', 'Shooter', 'Simulation',
       'Sports', 'Strategy']
for i in col:
    k = data_imp3[data_imp3==i].size
    print('Количество вхождений по {} равно {}'.format(i, k))
```

```
Количество вхождений по Action равно 3369
Количество вхождений по Adventure равно 1303
Количество вхождений по Fighting равно 849
Количество вхождений по Misc равно 1750
Количество вхождений по NA равно 2
Количество вхождений по Platform равно 888
Количество вхождений по Puzzle равно 580
Количество вхождений по Racing равно 1249
Количество вхождений по Role-Playing равно 1498
Количество вхождений по Shooter равно 1323
Количество вхождений по Simulation равно 873
Количество вхождений по Sports равно 2348
Количество вхождений по Strategy равно 683
```

Данные в столбце Genre заполнить часто встречающими значениями было бы нелогично, поэтому заполним данные константой

```
df['Genre']= df['Genre'].fillna('unk')
```

Преобразование категориальных признаков в числовые

Кодирование категорий наборами бинарных значений

```
cat_temp_df = df[['Rating']]
cat_temp_df.head()

imp2 = SimpleImputer(missing_values = np.nan,
strategy='most_frequent')
df_imp2 = imp2.fit_transform(cat_temp_df)
df_imp2

cat_enc = pd.DataFrame({'c1':df_imp2.T[0]})
cat_enc
```

```
      c1
0      E
1      E
2      E
3      E
4      E
...   ..
16710  E
16711  E
16712  E
16713  E
16714  E

[16715 rows x 1 columns]
```

```
ohe = OneHotEncoder()
cat_enc_ohe = ohe.fit_transform(cat_enc[['c1']])
cat_enc.shape
```

```
(16715, 1)
```

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

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

```
pd.get_dummies(cat_enc).head()
```

```
   c1_AO  c1_E  c1_E10+  c1_EC  c1_K-A  c1_M  c1_RP  c1_T
0      0     1        0      0       0     0      0     0
1      0     1        0      0       0     0      0     0
2      0     1        0      0       0     0      0     0
3      0     1        0      0       0     0      0     0
4      0     1        0      0       0     0      0     0
```

```
pd.get_dummies(cat_temp_data, dummy_na=True).head()
```

```
   Genre_Action  Genre_Adventure  Genre_Fighting  Genre_Misc
Genre_Platform  \
0             0                0               0           0
0
1             0                0               0           0
1
2             0                0               0           0
0
3             0                0               0           0
0
4             0                0               0           0
0

   Genre_Puzzle  Genre_Racing  Genre_Role-Playing  Genre_Shooter  \
0             0             0                   0              0
1             0             0                   0              0
2             0             1                   0              0
3             0             0                   0              0
4             0             0                   1              0

   Genre_Simulation  Genre_Sports  Genre_Strategy  Genre_nan
```

0	0	1	0	0
1	0	0	0	0
2	0	0	0	0
3	0	1	0	0
4	0	0	0	0