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Курс «Технологии машинного обучения»
Отчёт по лабораторной работе №2
«Предобработка данных»

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2023
Москва

Обработка пропусков в данных, кодирование категориальных признаков, масштабирование данных.

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

Обработка пропусков в данных

```
data = pd.read_csv('diabetes.csv')
```

```
data.dtypes
```

```
Pregnancies                 int64
Glucose                     int64
BloodPressure               int64
SkinThickness               int64
Insulin                     int64
BMI                       float64
DiabetesPedigreeFunction  float64
Age                         int64
Outcome                     int64
dtype: object
```

```
data[['Glucose','BloodPressure','SkinThickness','Insulin','BMI']] =
data[['Glucose','BloodPressure','SkinThickness','Insulin','BMI']].repl
ace(0,np.NaN)
```

```
data.isnull().sum()
```

```
Pregnancies                 0
Glucose                     5
BloodPressure              35
SkinThickness             227
Insulin                   374
BMI                        11
DiabetesPedigreeFunction    0
Age                         0
Outcome                     0
dtype: int64
```

```
total_count = data.shape[0]
```

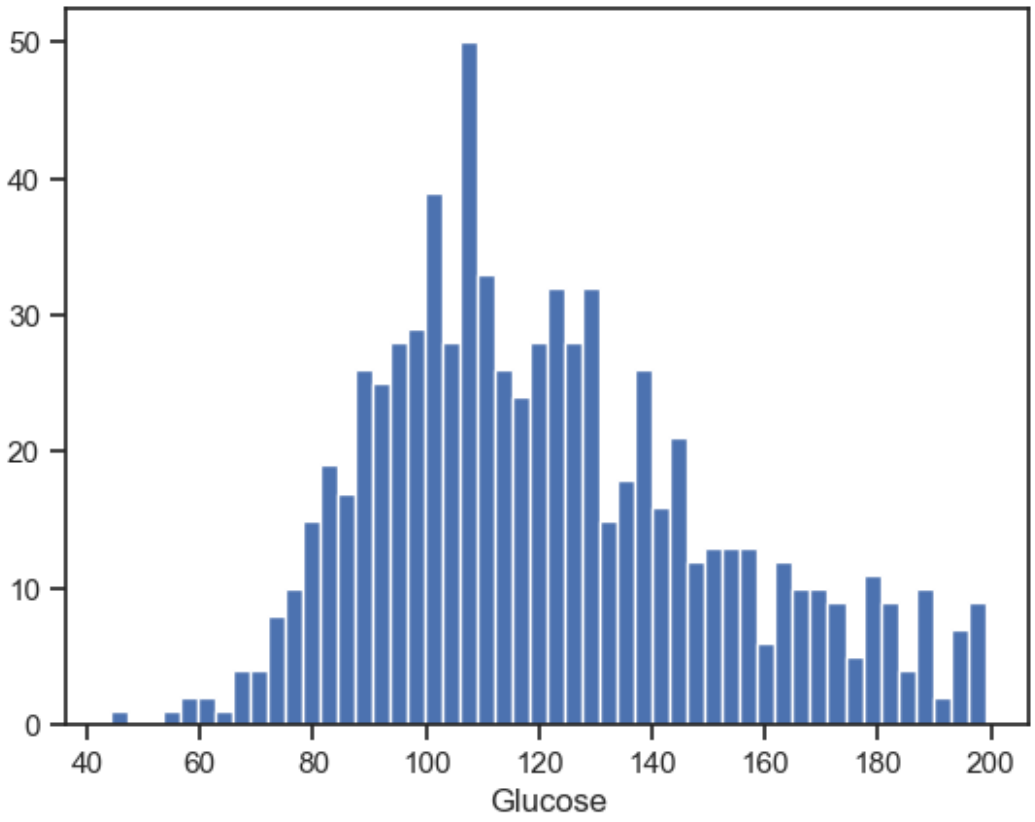
```
num_cols = []
for col in data.columns:
    # Количество пустых значений
```

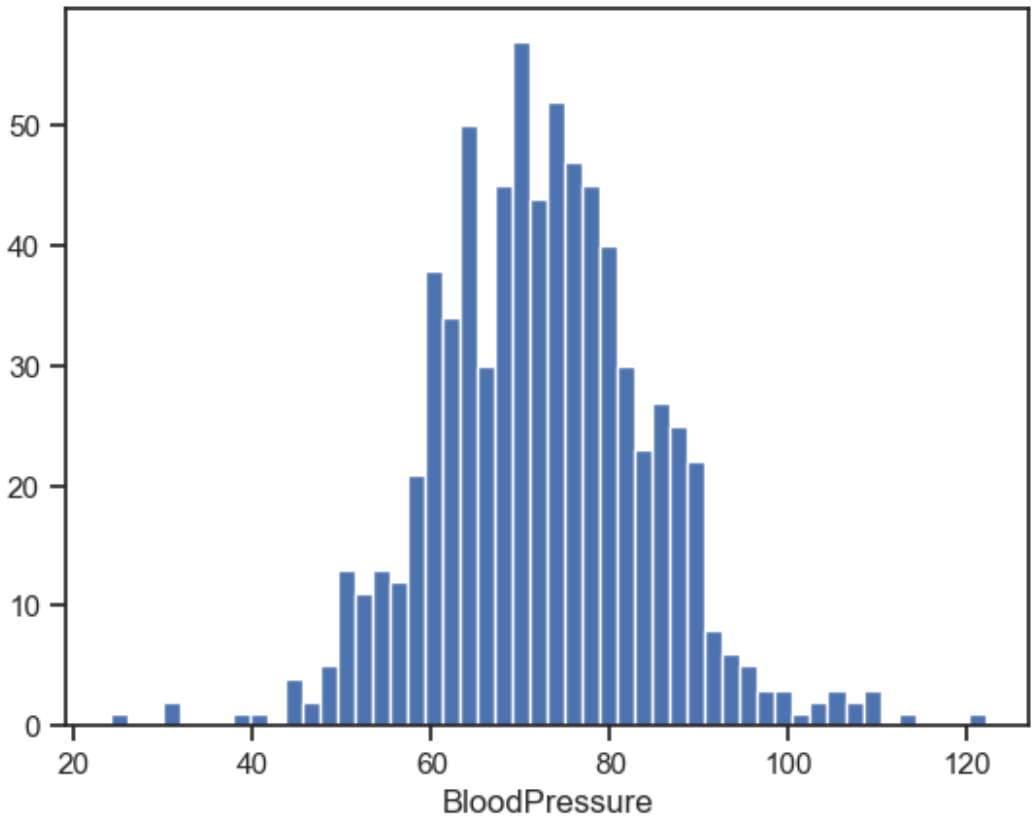
```
    temp_null_count = data[data[col].isnull()].shape[0]
    dt = str(data[col].dtype)
    if temp_null_count>0 and (dt=='float64' or dt=='int64'):
        num_cols.append(col)
        temp_perc = round((temp_null_count / total_count) * 100.0, 2)
        print('Колонка {}. Тип данных {}. Количество пустых значений
{}, {}%.'.format(col, dt, temp_null_count, temp_perc))
```

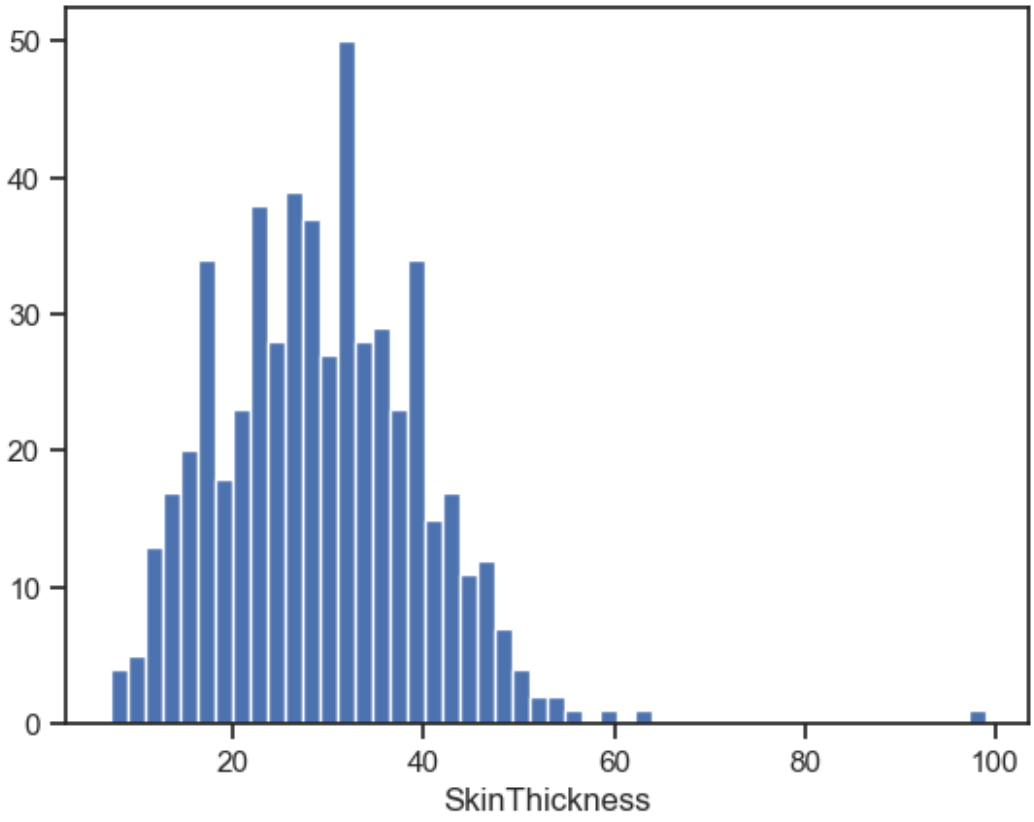
```
Колонка Glucose. Тип данных float64. Количество пустых значений 5,
0.65%.
Колонка BloodPressure. Тип данных float64. Количество пустых значений
35, 4.56%.
Колонка SkinThickness. Тип данных float64. Количество пустых значений
227, 29.56%.
Колонка Insulin. Тип данных float64. Количество пустых значений 374,
48.7%.
Колонка BMI. Тип данных float64. Количество пустых значений 11, 1.43%.
```

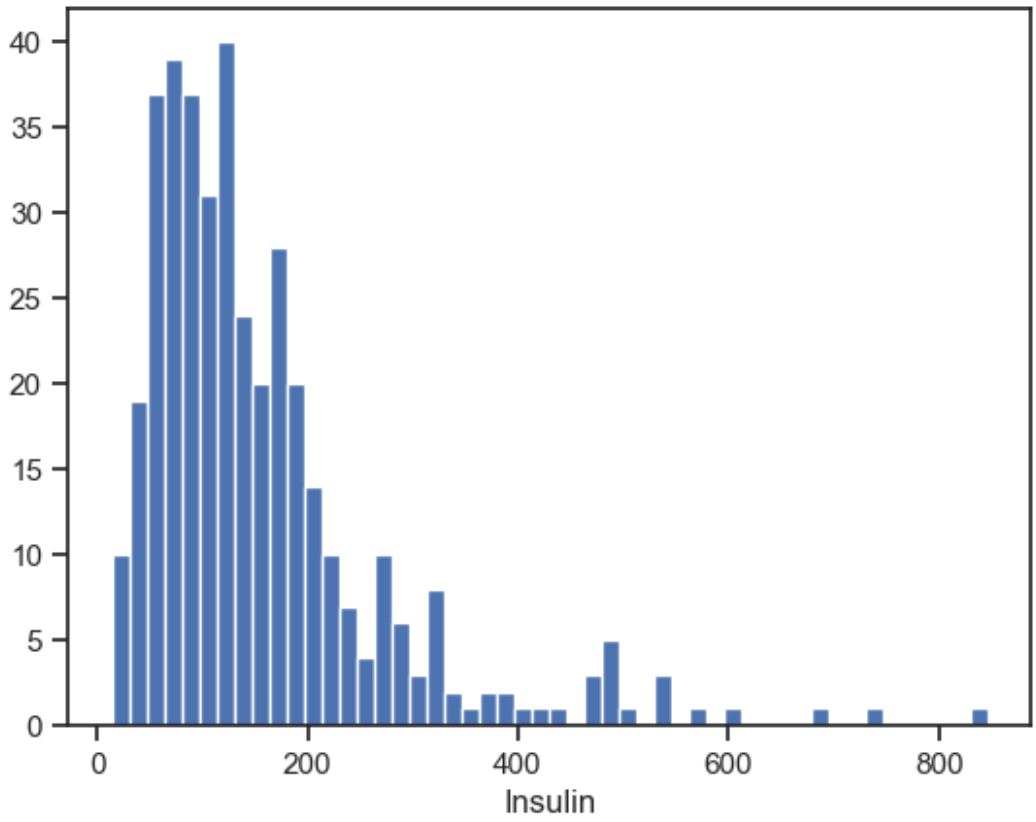
```
data_num = data[num_cols]
```

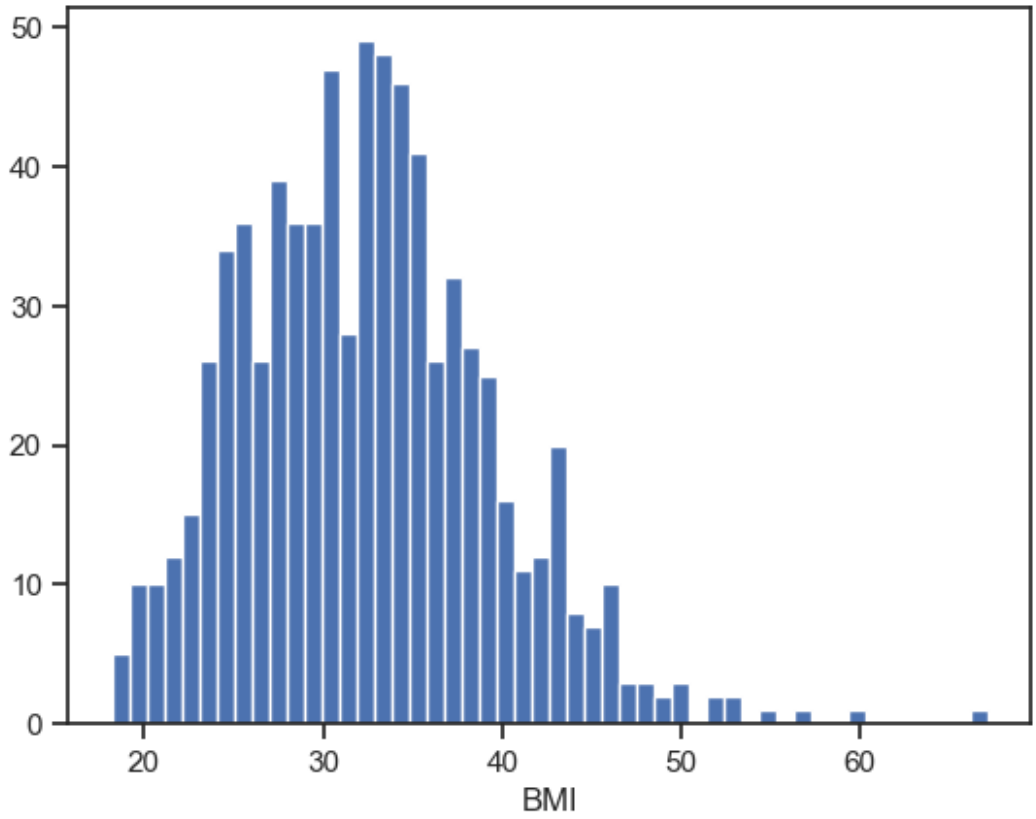
```
for col in data_num:
    plt.hist(data[col], 50)
    plt.xlabel(col)
    plt.show()
```




50
40
30
20
10
0
20
40
60
80
100
120
BloodPressure


50
40
30
20
10
0
20
40
60
80
100
SkinThickness


40
35
30
25
20
15
10
5
0
0
200
400
600
800
Insulin


50
40
30
20
10
0
20
30
40
50
60
BMI

```
from sklearn.impute import SimpleImputer
from sklearn.impute import MissingIndicator

strategies=['mean', 'median', 'most_frequent']

def test_num_impute_col(dataset, column, strategy_param):
    temp_data = dataset[[column]]

    indicator = MissingIndicator()
    mask_missing_values_only = indicator.fit_transform(temp_data)

    imp_num = SimpleImputer(strategy=strategy_param)
    data_num_imp = imp_num.fit_transform(temp_data)

    filled_data = data_num_imp[mask_missing_values_only]
    dataset[column].fillna(value = filled_data[0], inplace = True)
    return column, strategy_param, filled_data.size, filled_data[0],
filled_data[filled_data.size-1]

data[['Glucose','BloodPressure','SkinThickness','Insulin','BMI']].desc
ribe()
```

```
          Glucose  BloodPressure  SkinThickness     Insulin
BMI
count  763.000000     733.000000     541.000000  394.000000
757.000000
mean   121.686763      72.405184      29.153420  155.548223
32.457464
std     30.535641      12.382158      10.476982  118.775855
6.924988
min     44.000000      24.000000       7.000000   14.000000
18.200000
25%     99.000000      64.000000      22.000000   76.250000
27.500000
50%    117.000000      72.000000      29.000000  125.000000
32.300000
75%    141.000000      80.000000      36.000000  190.000000
36.600000
max    199.000000     122.000000      99.000000  846.000000
67.100000
```

```
# т.к. выборки напоминают нормальное распределение, предположим что
большинство пропусков приходятся на центр и заполним значенем моды
(most_frequent)
test_num_impute_col(data, 'BMI', strategies[2])
test_num_impute_col(data, 'Glucose', strategies[2])
test_num_impute_col(data, 'BloodPressure', strategies[2])
test_num_impute_col(data, 'SkinThickness', strategies[2])
test_num_impute_col(data, 'Insulin', strategies[2])
```

```
C:\anaconda3\lib\site-packages\sklearn\impute\_base.py:49:
FutureWarning: Unlike other reduction functions (e.g. `skew`,
`kurtosis`), the default behavior of `mode` typically preserves the
axis it acts along. In SciPy 1.11.0, this behavior will change: the
default value of `keepdims` will become False, the `axis` over which
the statistic is taken will be eliminated, and the value None will no
longer be accepted. Set `keepdims` to True or False to avoid this
warning.
  mode = stats.mode(array)
C:\anaconda3\lib\site-packages\sklearn\impute\_base.py:49:
FutureWarning: Unlike other reduction functions (e.g. `skew`,
`kurtosis`), the default behavior of `mode` typically preserves the
axis it acts along. In SciPy 1.11.0, this behavior will change: the
default value of `keepdims` will become False, the `axis` over which
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longer be accepted. Set `keepdims` to True or False to avoid this
warning.
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default value of `keepdims` will become False, the `axis` over which
the statistic is taken will be eliminated, and the value None will no
longer be accepted. Set `keepdims` to True or False to avoid this
warning.
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axis it acts along. In SciPy 1.11.0, this behavior will change: the
default value of `keepdims` will become False, the `axis` over which
the statistic is taken will be eliminated, and the value None will no
longer be accepted. Set `keepdims` to True or False to avoid this
warning.
  mode = stats.mode(array)

('Insulin', 'most_frequent', 374, 105.0, 105.0)
```

```
data[['Glucose','BloodPressure','SkinThickness','Insulin','BMI']].desc
ribe()
```

```
          Glucose  BloodPressure  SkinThickness     Insulin
BMI
count  768.000000     768.000000     768.000000  768.000000
768.000000
mean   121.539062      72.295573      29.994792  130.932292
32.450911
std     30.490660      12.106756       8.886506   88.700443
6.875366
min     44.000000      24.000000       7.000000   14.000000
18.200000
25%     99.000000      64.000000      25.000000  105.000000
27.500000
50%    117.000000      72.000000      32.000000  105.000000
32.000000
75%    140.250000      80.000000      32.000000  127.250000
36.600000
max    199.000000     122.000000      99.000000  846.000000
67.100000
```

```
data.isnull().sum()
```

```
Pregnancies                 0
Glucose                     0
BloodPressure               0
SkinThickness               0
Insulin                     0
BMI                         0
DiabetesPedigreeFunction    0
Age                         0
Outcome                     0
dtype: int64
```

Преобразование категориальных признаков в числовые

```
data = pd.read_csv('airlines_delay.csv')
```

```
data.shape
```

```
(539382, 8)
```

```
data.head
```

```
<bound method NDFrame.head of         Flight    Time  Length Airline
AirportFrom AirportTo  DayOfWeek  Class
0       2313.0  1296.0   141.0      DL         ATL       HOU
1      0
1       6948.0   360.0   146.0      OO         COS       ORD
4      0
2       1247.0  1170.0   143.0      B6         BOS       CLT
3      0
3         31.0  1410.0   344.0      US         OGG       PHX
```

```
6      0
4        563.0   692.0    98.0      FL         BMI       ATL
4      0
...        ...     ...     ...     ...         ...       ...        ..
.    ...
539377  6973.0   530.0    72.0      OO         GEG       SEA
5      1
539378  1264.0   560.0   115.0      WN         LAS       DEN
4      1
539379  5209.0   827.0    74.0      EV         CAE       ATL
2      1
539380   607.0   715.0    65.0      WN         BWI       BUF
4      1
539381  6377.0   770.0    55.0      OO         CPR       DEN
2      1

[539382 rows x 8 columns]>
```

```
data.dtypes
```

```
Flight         float64
Time           float64
Length         float64
Airline         object
AirportFrom     object
AirportTo       object
DayOfWeek        int64
Class            int64
dtype: object
```

```
data.isnull().sum()
```

```
Flight         0
Time           0
Length         0
Airline        0
AirportFrom    0
AirportTo      0
DayOfWeek      0
Class          0
dtype: int64
```

```
cat_cols = []
for col in data.columns:
    # Количество пустых значений
    temp_null_count = data[data[col].isnull()].shape[0]
    dt = str(data[col].dtype)
    if temp_null_count>0 and (dt=='object'):
        cat_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))
```

Пропусков в категориальных данных нет

```
cat_temp_data = data[['Airline']]
cat_temp_data.head()
```

```
  Airline
0      DL
1      OO
2      B6
3      US
4      FL
```

```
cat_temp_data['Airline'].unique()
```

```
array(['DL', 'OO', 'B6', 'US', 'FL', 'WN', 'CO', 'AA', 'YV', 'EV',
'XE',
       '9E', 'OH', 'UA', 'MQ', 'AS', 'F9', 'HA'], dtype=object)
```

One-hot encoding

```
from sklearn.preprocessing import OneHotEncoder
```

```
cat_enc = pd.DataFrame({'c1':cat_temp_data['Airline'].unique()})
cat_enc
```

```
    c1
0   DL
1   OO
2   B6
3   US
4   FL
5   WN
6   CO
7   AA
8   YV
9   EV
10  XE
11  9E
12  OH
13  UA
14  MQ
15  AS
16  F9
17  HA
```

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

```
cat_enc.shape
```

```
(18, 1)
```

```
cat_enc_ohe.shape
```

```
(18, 18)
```

```
cat_enc_ohe
```

```
<18x18 sparse matrix of type '<class 'numpy.float64'>'
     with 18 stored elements in Compressed Sparse Row format>
```

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

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

```
cat_enc.head(10)
```

```
   c1
0  DL
1  OO
2  B6
3  US
4  FL
```

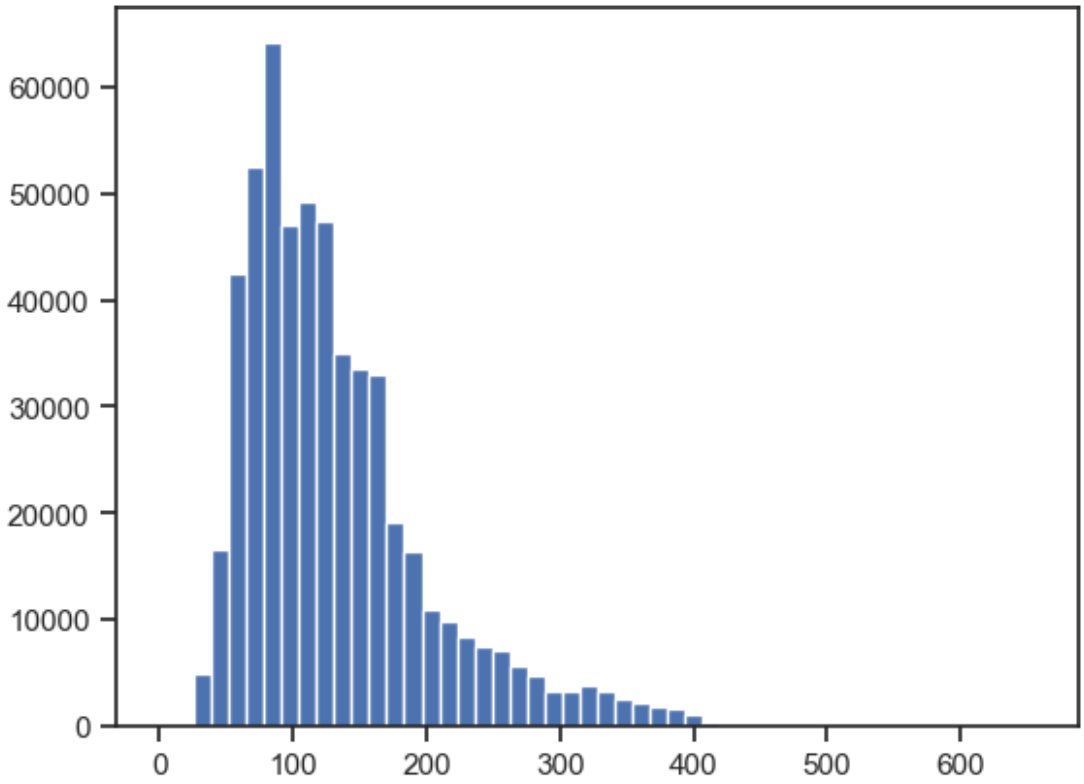
```
5  WN
6  CO
7  AA
8  YV
9  EV
```

Масштабирование

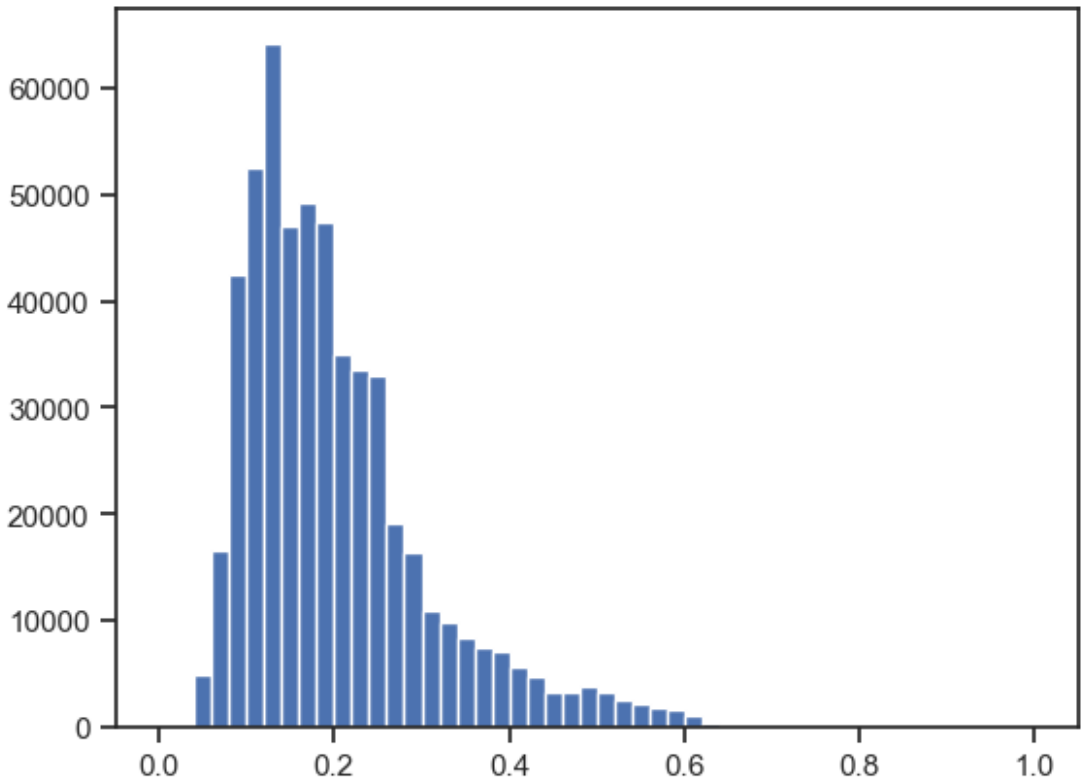
```
from sklearn.preprocessing import MinMaxScaler

sc1 = MinMaxScaler()
sc1_data = sc1.fit_transform(data[['Length']])

plt.hist(data['Length'], 50)
plt.show()
```




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




```
#Train Test split
X_train,X_test,
Y_train,Y_test=
train_test_split
(X,Y,test_size=0.2,
 stratify=Y,random_state=2)
```