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Рк 1 Вариант 20

Задача №3. Для заданного набора данных произведите масштабирование данных (для одного признака) и преобразование категориальных признаков в количественные двумя способами (label encoding, one hot encoding) для одного признака. Какие методы Вы использовали для решения задачи и почему? Для произвольной колонки данных построить гистограмму.

In [ ]:

```
from google.colab import files
uploaded = files.upload()
```

Выбрать файлы Файл не выбран

Upload widget is only available when the cell has been executed in the current browser session. Please rerun this cell to enable.

```
Saving states_all.csv to states_all.csv
```

In [ ]:

```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
```

In [ ]:

```
df = pd.read_csv('./states_all.csv', sep=',')
```

In [ ]:

```
df.head()
```

Out[ ]:

	PRIMARY_KEY	STATE	YEAR	ENROLL	TOTAL_REVENUE	FEDERAL_REVENUE	STATE_REVI
0	1992_ALABAMA	ALABAMA	1992	NaN	2678885.0	304177.0	1659
1	1992_ALASKA	ALASKA	1992	NaN	1049591.0	106780.0	72(
2	1992_ARIZONA	ARIZONA	1992	NaN	3258079.0	297888.0	1369
3	1992_ARKANSAS	ARKANSAS	1992	NaN	1711959.0	178571.0	958
4	1992_CALIFORNIA	CALIFORNIA	1992	NaN	26260025.0	2072470.0	16546

5 rows × 25 columns

In [ ]:

```
#размер дамасета - количетсво строк и столбцов
df.shape
```

Out[ ]:

```
(1715, 25)
```

In [ ]:

```
df.dtypes
```

Out[ ]:

```
PRIMARY_KEY                     object
STATE                           object
YEAR                             int64
ENROLL                         float64
TOTAL_REVENUE                  float64
FEDERAL_REVENUE                float64
STATE_REVENUE                  float64
LOCAL_REVENUE                  float64
TOTAL_EXPENDITURE              float64
INSTRUCTION_EXPENDITURE        float64
SUPPORT_SERVICES_EXPENDITURE   float64
OTHER_EXPENDITURE              float64
CAPITAL_OUTLAY_EXPENDITURE     float64
GRADES_PK_G                    float64
GRADES_KG_G                    float64
GRADES_4_G                     float64
GRADES_8_G                     float64
GRADES_12_G                    float64
GRADES_1_8_G                   float64
GRADES_9_12_G                  float64
GRADES_ALL_G                   float64
AVG_MATH_4_SCORE               float64
AVG_MATH_8_SCORE               float64
AVG_READING_4_SCORE            float64
AVG_READING_8_SCORE            float64
dtype: object
```

In [ ]:

```
#поиск пропусков
for col in df.columns:
    is_missing = np.mean(df[col].isnull())
    print('{} - {}%'.format(col, round(is_missing*100)))
```

```
PRIMARY_KEY - 0%
STATE - 0%
YEAR - 0%
ENROLL - 29%
TOTAL_REVENUE - 26%
FEDERAL_REVENUE - 26%
STATE_REVENUE - 26%
LOCAL_REVENUE - 26%
TOTAL_EXPENDITURE - 26%
INSTRUCTION_EXPENDITURE - 26%
SUPPORT_SERVICES_EXPENDITURE - 26%
OTHER_EXPENDITURE - 29%
CAPITAL_OUTLAY_EXPENDITURE - 26%
GRADES_PK_G - 10%
GRADES_KG_G - 5%
GRADES_4_G - 5%
GRADES_8_G - 5%
GRADES_12_G - 5%
GRADES_1_8_G - 41%
GRADES_9_12_G - 38%
GRADES_ALL_G - 5%
AVG_MATH_4_SCORE - 67%
AVG_MATH_8_SCORE - 65%
AVG_READING_4_SCORE - 62%
AVG_READING_8_SCORE - 67%
```

Целочисленными значениями будем кодировать признак State(пропусков нет). Маштабировать - признак State_revenue (есть пропуски).

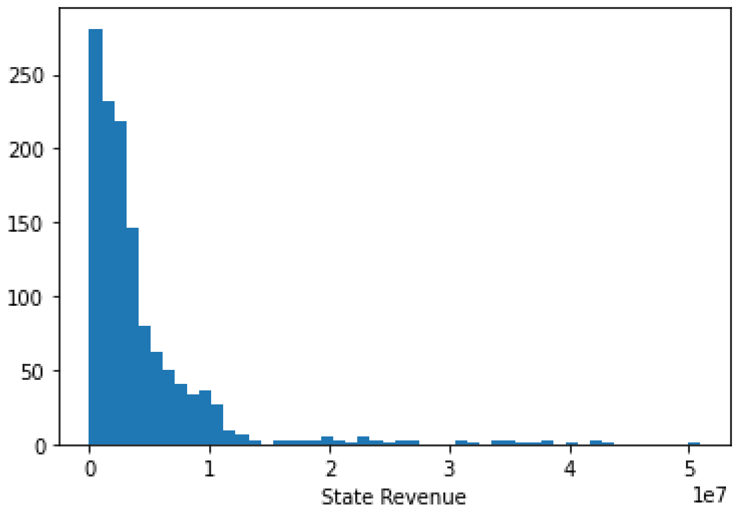
```
In [ ]: df['STATE_REVENUE'].unique()
```

```
Out[ ]: array([1659028.,  720711., 1369815., ..., 5986763., 1175899.,      nan])
```

```
In [ ]: #заполним пропуски медианой
        from sklearn.impute import SimpleImputer
        imp1 = SimpleImputer(missing_values=np.nan, strategy='most_frequent')
        data1 = imp1.fit_transform(df[['STATE_REVENUE']])
        pd.isnull(data1).sum()
```

```
Out[ ]: 0
```

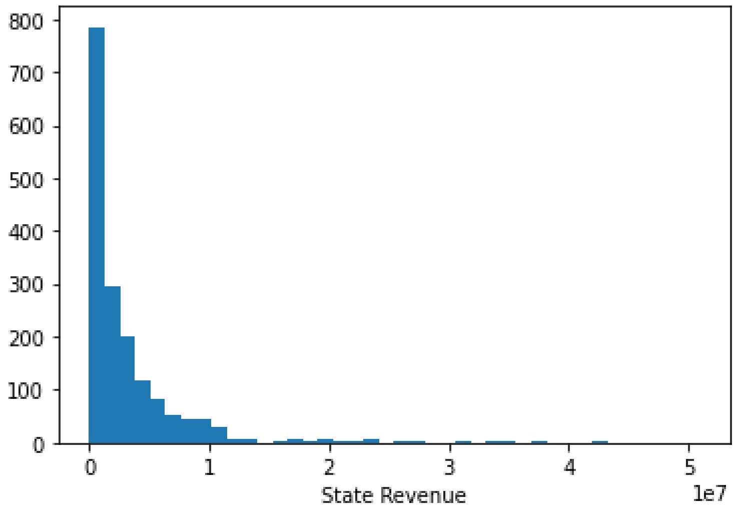
```
In [ ]: plt.hist(df['STATE_REVENUE'], 50)
        plt.xlabel('State Revenue')
        plt.show()
```



Пропусков в столбце STATE_REVENUE не осталось

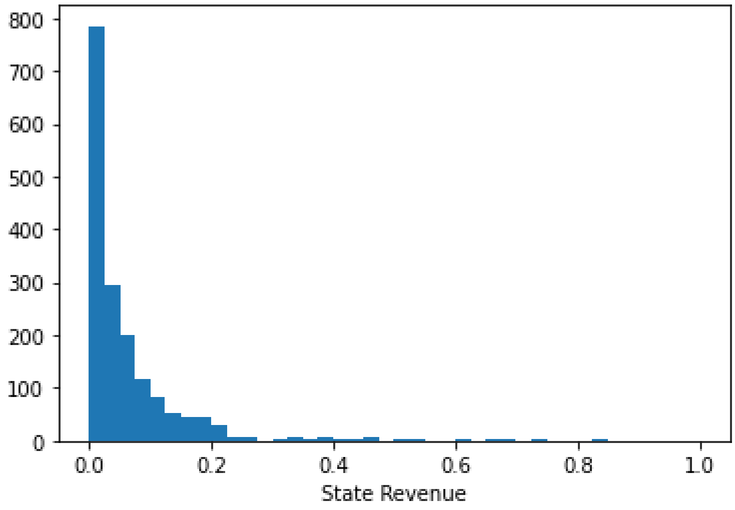
Масштабирование данных

```
In [ ]: plt.hist(data1, 40)
        plt.xlabel('State Revenue')
        plt.show()
```



```
In [ ]: from sklearn.preprocessing import MinMaxScaler
In [ ]: sc1 = MinMaxScaler()
        sc1_data = sc1.fit_transform(data1)
```

```
In [ ]: plt.hist(sc1_data, 40)
        plt.xlabel('State Revenue')
        plt.show()
```



Преобразование категориальных признаков в количественные

```
In [ ]: from sklearn.preprocessing import LabelEncoder, OneHotEncoder
```

```
In [ ]: df['STATE']
```

```
Out[ ]: 0              ALABAMA
        1               ALASKA
        2              ARIZONA
        3             ARKANSAS
        4           CALIFORNIA
                      ...
        1710          VIRGINIA
        1711        WASHINGTON
        1712     WEST_VIRGINIA
        1713         WISCONSIN
        1714           WYOMING
        Name: STATE, Length: 1715, dtype: object
```

```
In [ ]: df['STATE'].unique()
```

```
Out[ ]: array(['ALABAMA', 'ALASKA', 'ARIZONA', 'ARKANSAS', 'CALIFORNIA',
               'COLORADO', 'CONNECTICUT', 'DELAWARE', 'DISTRICT_OF_COLUMBIA',
               'FLORIDA', 'GEORGIA', 'HAWAII', 'IDAHO', 'ILLINOIS', 'INDIANA',
               'IOWA', 'KANSAS', 'KENTUCKY', 'LOUISIANA', 'MAINE', 'MARYLAND',
               'MASSACHUSETTS', 'MICHIGAN', 'MINNESOTA', 'MISSISSIPPI',
               'MISSOURI', 'MONTANA', 'NEBRASKA', 'NEVADA', 'NEW_HAMPSHIRE',
               'NEW_JERSEY', 'NEW_MEXICO', 'NEW_YORK', 'NORTH_CAROLINA',
               'NORTH_DAKOTA', 'OHIO', 'OKLAHOMA', 'OREGON', 'PENNSYLVANIA',
               'RHODE_ISLAND', 'SOUTH_CAROLINA', 'SOUTH_DAKOTA', 'TENNESSEE',
               'TEXAS', 'UTAH', 'VERMONT', 'VIRGINIA', 'WASHINGTON',
               'WEST_VIRGINIA', 'WISCONSIN', 'WYOMING', 'DODEA', 'NATIONAL'],
              dtype=object)
```

In [ ]:

```
#преобразование
le1 = LabelEncoder()
le1.fit_transform(df['STATE'])
```

Out[ ]:

```
array([ 0,  1,  2, ..., 50, 51, 52])
```

In [ ]:

```
list(le1.classes_)
```

Out[ ]:

```
['ALABAMA',
 'ALASKA',
 'ARIZONA',
 'ARKANSAS',
 'CALIFORNIA',
 'COLORADO',
 'CONNECTICUT',
 'DELAWARE',
 'DISTRICT_OF_COLUMBIA',
 'DODEA',
 'FLORIDA',
 'GEORGIA',
 'HAWAII',
 'IDAHO',
 'ILLINOIS',
 'INDIANA',
 'IOWA',
 'KANSAS',
 'KENTUCKY',
 'LOUISIANA',
 'MAINE',
 'MARYLAND',
 'MASSACHUSETTS',
 'MICHIGAN',
 'MINNESOTA',
 'MISSISSIPPI',
 'MISSOURI',
 'MONTANA',
 'NATIONAL',
 'NEBRASKA',
 'NEVADA',
 'NEW_HAMPSHIRE',
 'NEW_JERSEY',
 'NEW_MEXICO',
 'NEW_YORK',
 'NORTH_CAROLINA',
 'NORTH_DAKOTA',
 'OHIO',
 'OKLAHOMA',
 'OREGON',
 'PENNSYLVANIA',
 'RHODE_ISLAND',
 'SOUTH_CAROLINA',
 'SOUTH_DAKOTA',
 'TENNESSEE',
 'TEXAS',
 'UTAH',
 'VERMONT',
 'VIRGINIA',
 'WASHINGTON',
 'WEST_VIRGINIA',
 'WISCONSIN',
 'WYOMING']
```

Закодировали признак State целочисленными значениями методом label encoding

```
In [ ]: enc1 = OneHotEncoder(handle_unknown='ignore')
        state_enc = enc1.fit_transform(df[['STATE']])
        state_enc.toarray()[0:7]
```

```
Out[ ]: array([[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.,
                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., 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., 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., 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., 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., 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., 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., 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.,
                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., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.,
                0., 0., 0., 0., 0.]])
```

```
In [ ]: enc1.categories_
```

```
Out[ ]: [array(['ALABAMA', 'ALASKA', 'ARIZONA', 'ARKANSAS', 'CALIFORNIA',
                'COLORADO', 'CONNECTICUT', 'DELAWARE', 'DISTRICT_OF_COLUMBIA',
                'DODEA', 'FLORIDA', 'GEORGIA', 'HAWAII', 'IDAHO', 'ILLINOIS',
                'INDIANA', 'IOWA', 'KANSAS', 'KENTUCKY', 'LOUISIANA', 'MAINE',
                'MARYLAND', 'MASSACHUSETTS', 'MICHIGAN', 'MINNESOTA',
                'MISSISSIPPI', 'MISSOURI', 'MONTANA', 'NATIONAL', 'NEBRASKA',
                'NEVADA', 'NEW_HAMPSHIRE', 'NEW_JERSEY', 'NEW_MEXICO', 'NEW_YORK',
                'NORTH_CAROLINA', 'NORTH_DAKOTA', 'OHIO', 'OKLAHOMA', 'OREGON',
                'PENNSYLVANIA', 'RHODE_ISLAND', 'SOUTH_CAROLINA', 'SOUTH_DAKOTA',
                'TENNESSEE', 'TEXAS', 'UTAH', 'VERMONT', 'VIRGINIA', 'WASHINGTON',
                'WEST_VIRGINIA', 'WISCONSIN', 'WYOMING'], dtype=object)]
```

Закодировали признак State целочисленными значениями методом one hot encoding

В данном случае предпочтительнее метод label encoding, так как в кодируемом столбце много уникальных значений, а значит большой размер матрицы при one hot encoding.

Гистограмма

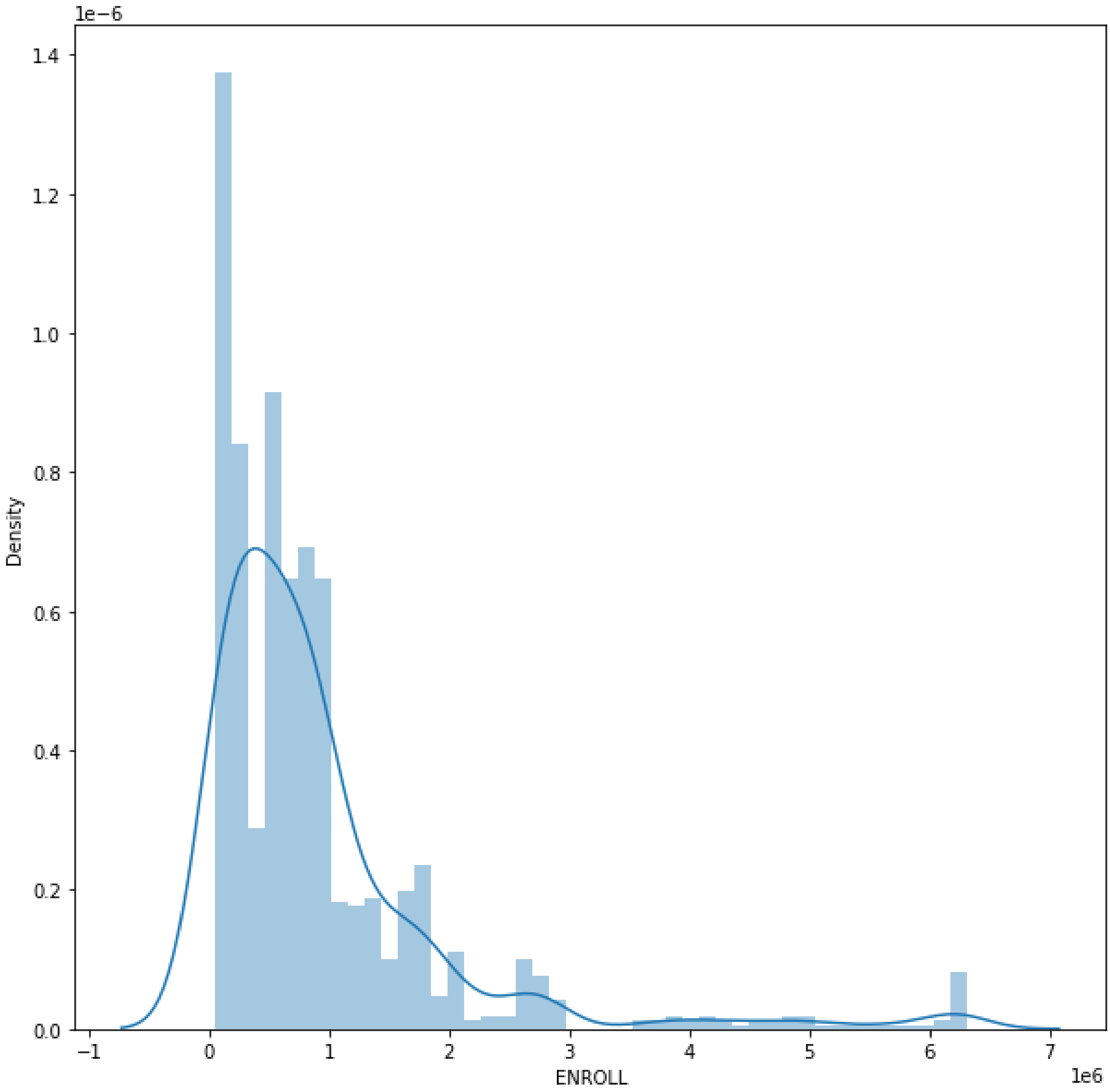
In [ ]:

```
#гистограмма, позволяющаяоценить плотность вероятности распределения
fig, ax = plt.subplots(figsize=(10,10))
sns.distplot(df['ENROLL'])
```

```
/usr/local/lib/python3.7/dist-packages/seaborn/distributions.py:2619: FutureWarning:
`distplot` is a deprecated function and will be removed in a future version. Please
adapt your code to use either `displot` (a figure-level function with similar flexib
ility) or `histplot` (an axes-level function for histograms).
  warnings.warn(msg, FutureWarning)
```

Out[ ]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f5ea58a8150>
```

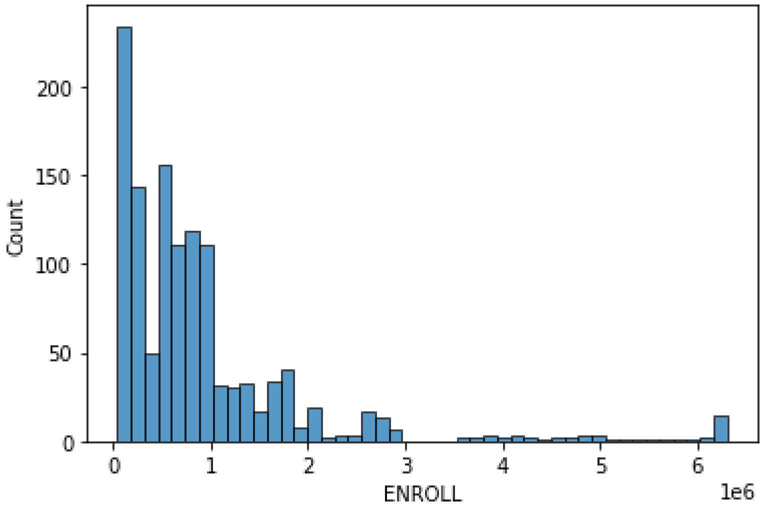


In [ ]:

```
sns.histplot(df['ENROLL'])
```

Out[ ]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x7f5ea39d2ed0>
```


Count
1e6
ENROLL