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Курс «Технологии машинного обучения»

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

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Москва, 2022 г.

Описание задания:

1. Выбрать набор данных (датасет), содержащий категориальные признаки и пропуски в данных. Для выполнения следующих пунктов можно использовать несколько различных наборов данных (один для обработки пропусков, другой для категориальных признаков и т.д.)
2. Для выбранного датасета (датасетов) на основе материалов лекции решить следующие задачи: ○ обработку пропусков в данных; ○ кодирование категориальных признаков; ○ масштабирование данных.

Лабораторaня работа №2: Обработка пропусков в данных, кодирование категориальных признаков, масштабирование данных.

```
import pandas as pd
import numpy as np
from matplotlib import pyplot as
plt import seaborn as sns import
math
from sklearn.impute import SimpleImputer
from sklearn.preprocessing import MinMaxScaler, StandardScaler, Normalizer
```

1)Обработка пропусков в данных

In [1]:

```
In [2]: data = pd.read_csv('crimes.csv')
```

```
In [3]: data.head()
```

Out[3]:

	CrimeDate	CrimeTime	CrimeCode	Location	Description	Inside/Outside	Weapon	Post	District	Neighborhood	Location 1	Total Incidents
0	11/12/2016	02:35:00	3B	300 SAINT PAUL PL	ROBBERY - STREET	O	NaN	111.0	CENTRAL	Downtown	(39.2924100000, -76.6140800000)	1
1	11/12/2016	02:56:00	3CF	800 S BROADWAY	ROBBERY - COMMERCIAL	I	FIREARM	213.0	SOUTHEASTERN	Fells Point	(39.2824200000, -76.5928800000)	1
2	11/12/2016	03:00:00	6D	1500 PENTWOOD RD	LARCENY FROM AUTO	O	NaN	413.0	NORTHEASTERN	Stonewood-Pentwood-Winston	(39.3480500000, -76.5883400000)	1
3	11/12/2016	03:00:00	6D	6600 MILTON LN	LARCENY FROM AUTO	O	NaN	424.0	NORTHEASTERN	Westfield	(39.3626300000, -76.5516100000)	1
4	11/12/2016	03:00:00	6E	300 W BALTIMORE ST	LARCENY	O	NaN	111.0	CENTRAL	Downtown	(39.2893800000, -76.6197100000)	1

```
In [4]: data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 285807 entries, 0 to 285806
Data columns (total 12 columns):
 #   Column           Non-Null Count   Dtype
---  ------           --------------   -----
0 CrimeDate        285807 non-null  object
1 CrimeTime        285807 non-null  object
2 CrimeCode        285807 non-null  object
3 Location         284184 non-null  object
4 Description      285807 non-null  object
5 Inside/Outside   281611 non-null  object
6 Weapon           97396 non-null   object
7 Post             285616 non-null  float64
8 District         285749 non-null  object
9 Neighborhood     284106 non-null  object
10          Location 1       284188 non-null  object   11  Total Incidents  285807 non-null  int64
dtypes: float64(1), int64(1), object(10) memory usage: 26.2+ MB
```

```
In [5]:  bad_cols = [] for col in
         data.columns:     if
         data[col].isnull().sum():
                 bad_cols.append(col)     print(f'{col}: {data[col].isnull().sum()}
         ({round(data[col].isnull().sum() / data.shape[0] * 100, 3)}%)') print('\nbad columns:', bad_cols)
```

```
CrimeDate: 0 (0.0%)
CrimeTime: 0 (0.0%)
CrimeCode: 0 (0.0%)
Location: 1623 (0.568%)
Description: 0 (0.0%)
Inside/Outside: 4196 (1.468%)
Weapon: 188411 (65.922%)
Post: 191 (0.067%)
District: 58 (0.02%)
Neighborhood: 1701 (0.595%)
Location 1: 1619 (0.566%) Total Incidents: 0 (0.0%) bad columns: ['Location', 'Inside/Outside',
 'Weapon', 'Post', 'District', 'Neighborhood', 'Location 1']
```

```
In [6]: print("Количество уникальных значений\n") for
          col in data.columns:     print(f'{col}:
          {data[col].unique().size}')
```

```
Количество уникальных значений

CrimeDate: 2143
CrimeTime: 4236
CrimeCode: 81
Location: 25950
Description: 15
Inside/Outside: 5
Weapon: 5
Post: 190
District: 14
Neighborhood: 281
Location 1: 97952
Total Incidents: 1
```

```
In [7]: data.drop(['Total Incidents', 'Weapon'], axis=1, inplace=True) # малоинформативные столбцы
        data.head()
```

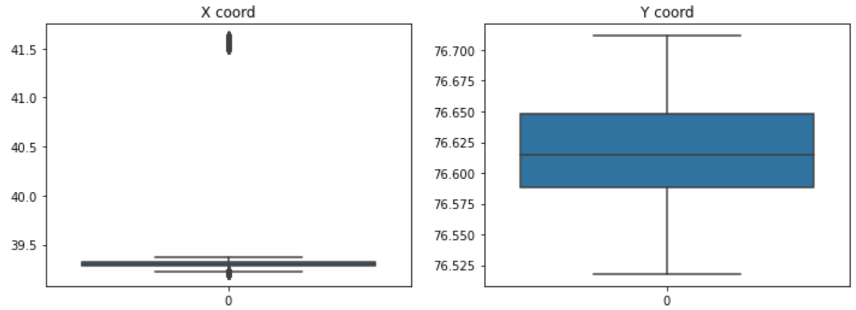
Out[7]:

	CrimeDate	CrimeTime	CrimeCode	Location	Description	Inside/Outside	Post	District	Neighborhood	Location 1
0	11/12/2016	02:35:00	3B	300 SAINT PAUL PL	ROBBERY - STREET	O	111.0	CENTRAL	Downtown	(39.2924100000, -76.6140800000)
1	11/12/2016	02:56:00	3CF	800 S BROADWAY	ROBBERY - COMMERCIAL	I	213.0	SOUTHEASTERN	Fells Point	(39.2824200000, -76.5928800000)
2	11/12/2016	03:00:00	6D	1500 PENTWOOD RD	LARCENY FROM AUTO	O	413.0	NORTHEASTERN	Stonewood-Pentwood-Winston	(39.3480500000, -76.5883400000)
3	11/12/2016	03:00:00	6D	6600 MILTON LN	LARCENY FROM AUTO	O	424.0	NORTHEASTERN	Westfield	(39.3626300000, -76.5516100000)
4	11/12/2016	03:00:00	6E	300 W BALTIMORE ST	LARCENY	O	111.0	CENTRAL	Downtown	(39.2893800000, -76.6197100000)

```
In [8]:

Out[8]:  data['Inside/Outside'].unique()

In [9]:

         array(['O', 'I', 'Outside', 'Inside', nan], dtype=object)

Out[9]:  data['Inside/Outside'].replace('I','Inside', inplace=True)
         data['Inside/Outside'].replace('O','Outside', inplace=True)
         data['Inside/Outside'].unique()
In [10]:
         array(['Outside', 'Inside', nan], dtype=object)

Out[10]:


         data['Inside/Outside'].value_counts()
In [11]:

Out[11]:

         Inside     142531
         Outside    139080
         Name: Inside/Outside, dtype: int64


         data['Post'].value_counts()


         111.0    9776
         212.0    4982
In [12]: 922.0    4655
         211.0    4513
Out[12]: 913.0    4470
         ...
         2.1         1 925.0
         1
         0.7          1
         0.6          1
         1.0          1
         Name: Post, Length: 189, dtype: int64

         data['District'].value_counts()


         NORTHEASTERN    44832
         SOUTHEASTERN    39245
In [13]: CENTRAL         33782
         SOUTHERN        33031
Out[13]: NORTHERN        32005
         NORTHWESTERN    28690
         SOUTHWESTERN    26242
         EASTERN         24168
         WESTERN         23266
         NORTHESTERN       280
         SOUTHESTERN       205
         Central             2
         Gay Street          1
         Name: District, dtype: int64

         data['Neighborhood'].value_counts()


         Downtown                  9666
         Frankford                 6791
         Belair-Edison             6133
         Brooklyn                  4528
         Cherry Hill               4273
         ...
         Mt Pleasant Park            12
         Blythewood                   5
         EASTERN                      1
         Dundalk Marine Terminal      1
         NORTHEASTERN                 1
         Name: Neighborhood, Length: 280, dtype: int64

In [14]: data = data.dropna(subset=['Location 1'], axis=0)


         x = [float(elem[1:14]) for elem in data['Location 1']] y =
         [float(elem[17:30]) for elem in data['Location 1']]
         data['X'] = pd.Series(x).reindex(data.index,
         method='ffill') data['Y'] =
         pd.Series(y).reindex(data.index, method='ffill')
          data.drop(['Location 1'], axis=1, inplace=True)
```

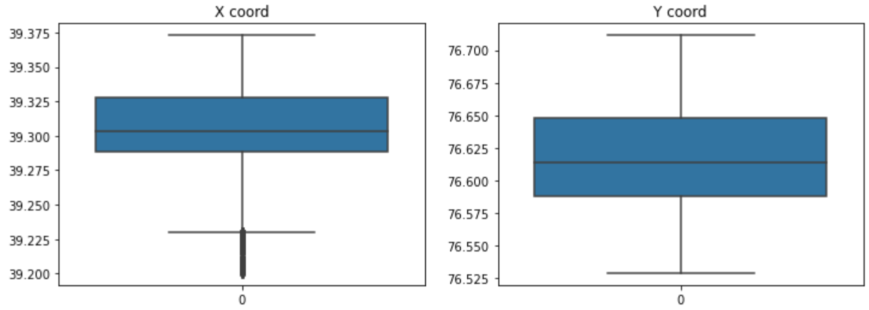
```
In [15]: def show_coords_dist():     fig, (ax1, ax2) =
          plt.subplots(1, 2, figsize=(12, 4))
          sns.boxplot(data=data['X'], ax=ax1);
          sns.boxplot(data=data['Y'], ax=ax2);
          ax1.set_title('X coord')     ax2.set_title('Y coord')
          plt.show()
```

```
In [16]:
  show_coords_dist()
```



```
In [17]:
 data.drop(data[data['X'] > 40].index, inplace=True)
```

```
In [18]:
          show_coords_dist()
```



```
In [19]: SimpleImputer(strategy='constant', fill_value='-', copy=False).fit_transform(data['Location'].values.reshape(-1, 1))
         SimpleImputer(strategy='constant', fill_value='-', copy=False).fit_transform(data['Neighborhood'].values.reshape(-1, 1))
         SimpleImputer(strategy='constant', fill_value='Inside', copy=False).fit_transform(data['Inside/Outside'].values.reshape(-1, 1))


         data = data.dropna(subset=['Post'], axis=0)
         data = data.dropna(subset=['District'],
         axis=0) data = data.dropna(subset=['X'],
         axis=0) data = data.dropna(subset=['Y'],
In [20]: axis=0)
data.isnull().sum()
```

```
Out[20]: CrimeDate         0
         CrimeTime         0
         CrimeCode         0
         Location          0
         Description       0
         Inside/Outside    0
         Post              0
         District          0
         Neighborhood      0
         X                 0
         Y                 0
         dtype: int64
```

2) Кодирование категориальных признаков

```
In [21]: data.head()
```

Out[21]:

	CrimeDate	CrimeTime	CrimeCode	Location	Description	Inside/Outside	Post	District	Neighborhood	X	Y
4	11/12/2016	03:00:00	6E	300 W BALTIMORE ST	LARCENY	Outside	111.0	CENTRAL	Downtown	39.28938	76.61971

```
data['Hours'] = [int(elem[:2]) for elem in data['CrimeTime']]


data['Minutes'] = [int(elem[3:5]) for elem in data['CrimeTime']]
data.head()
```

0	11/12/2016	02:35:00	3B	300 SAINT PAUL PL	ROBBERY - STREET	Outside	111.0	CENTRAL	Downtown	39.29241	76.61408
1	11/12/2016	02:56:00	3CF	800 S BROADWAY	ROBBERY - COMMERCIAL	Inside	213.0	SOUTHEASTERN	Fells Point	39.28242	76.59288
2	11/12/2016	03:00:00	6D	1500 PENTWOOD RD	LARCENY FROM AUTO	Outside	413.0	NORTHEASTERN	Stonewood-Pentwood-Winston	39.34805	76.58834
3	11/12/2016	03:00:00	6D	6600 MILTON LN	LARCENY FROM AUTO	Outside	424.0	NORTHEASTERN	Westfield	39.36263	76.55161

```
In [22]:
```

Out[22]:

	CrimeDate	CrimeTime	CrimeCode	Location	Description	Inside/Outside	Post	District	Neighborhood	X	Y	Hours	Minutes
3	11/12/2016	03:00:00	6D	6600 MILTON LN	LARCENY FROM AUTO	Outside	424.0	NORTHEASTERN	Westfield	39.36263	76.55161	3	0
4	11/12/2016	03:00:00	6E	300 W BALTIMORE ST	LARCENY	Outside	111.0	CENTRAL	Downtown	39.28938	76.61971	3	0

```python
category_cols = ['CrimeCode', 'Location', 'Description', 'Inside/Outside', 'District', 'Neighborhood']
```

```python
print("Количество уникальных значений\n")
for col in category_cols:
    print(f'{col}: {data[col].unique().size}')
```

```
Количество уникальных значений

CrimeCode: 81
Location: 25937
Description: 15
Inside/Outside: 2
District: 12
Neighborhood: 281
```

```python
category_cols.remove('Location')
category_cols.remove('Neighborhood')
```

```python
for col in category_cols:
    data = pd.concat([data, pd.get_dummies(data[col])], axis=1)
```

```python
data.head()
```

	CrimeDate	CrimeTime	CrimeCode	Location	Description	Inside/Outside	Post	District	Neighborhood	X	Gay ...Street	NORTHEASTERN	NORTHERN	NORT
0	11/12/2016	02:35:00	3B	300 SAINT PAUL PL	ROBBERY - STREET	Outside	111.0	CENTRAL	Downtown	39.29241	76.61408	2	35	
1	11/12/2016	02:56:00	3CF	800 S BROADWAY	ROBBERY - COMMERCIAL	Inside	213.0	SOUTHEASTERN	Fells Point	39.28242	76.59288	2	56	
2	11/12/2016	03:00:00	6D	1500 PENTWOOD RD	LARCENY FROM AUTO	Outside	413.0	NORTHEASTERN	Stonewood-Pentwood-Winston	39.34805	76.58834	3	0	

In [23]:

In [24]:

In [25]:

In [26]:

In [27]:

Out[27]:

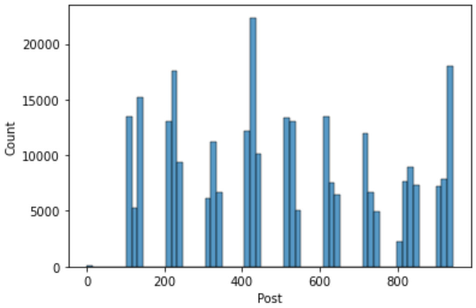
	CrimeDate	CrimeTime	CrimeCode	Location	Description	Inside/Outside	Post	District	Neighborhood	X	...	Gay Street	NORTHEASTERN	NORTHERN	NORT
0	11/12/2016	02:35:00	3B	300 SAINT PAUL PL	ROBBERY - STREET	Outside	111.0	CENTRAL	Downtown	39.29241	...	0	0	0	
1	11/12/2016	02:56:00	3CF	800 S BROADWAY	ROBBERY - COMMERCIAL	Inside	213.0	SOUTHEASTERN	Fells Point	39.28242	...	0	0	0	
2	11/12/2016	03:00:00	6D	1500 PENTWOOD RD	LARCENY FROM AUTO	Outside	413.0	NORTHEASTERN	Stonewood-PentwoodWinston	39.34805	...	0	1	0	
3	11/12/2016	03:00:00	6D	6600 MILTON LN	LARCENY FROM AUTO	Outside	424.0	NORTHEASTERN	Westfield	39.36263	...	0	1	0	
4	11/12/2016	03:00:00	6E	300 W BALTIMORE ST	LARCENY	Outside	111.0	CENTRAL	Downtown	39.28938	...	0	0	0	

5 rows × 123 columns

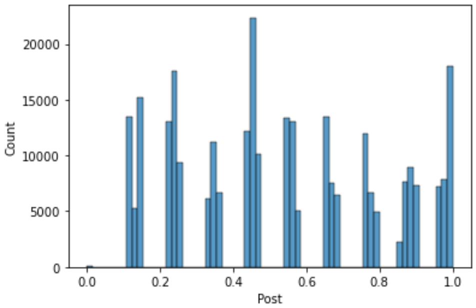
Масштабирование данных

```
In [28]: sns.histplot(data['Post'])
```

```
Out[28]: <AxesSubplot:xlabel='Post', ylabel='Count'>
```

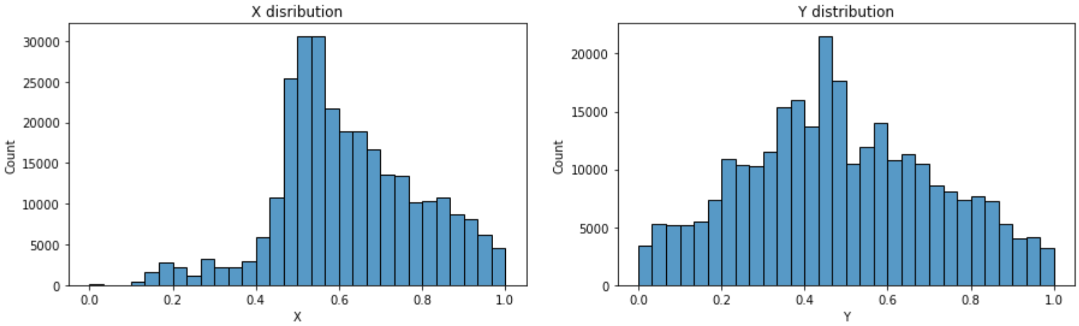


```
In [29]: data['Post'] = MinMaxScaler().fit_transform(data['Post'].values.reshape(-1, 1))
          sns.histplot(data['Post']);
```

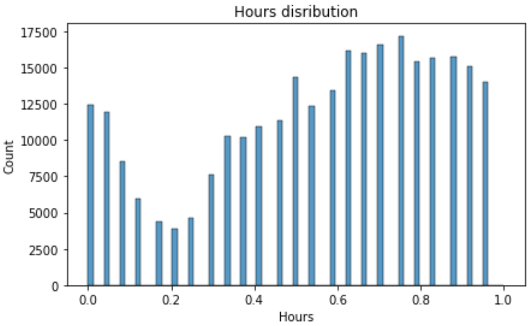


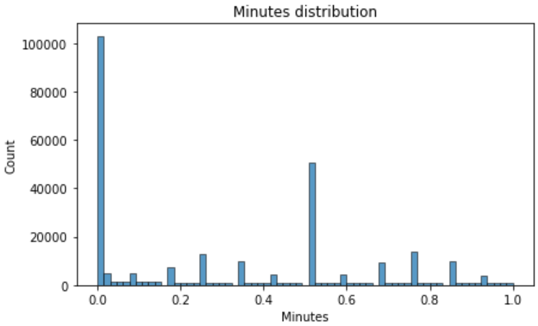
```
In [30]: data['Hours'] = MinMaxScaler().fit_transform(data['Hours'].values.reshape(-1, 1))
          data['Minutes'] = MinMaxScaler().fit_transform(data['Minutes'].values.reshape(-1,
          1)) data['X'] = MinMaxScaler().fit_transform(data['X'].values.reshape(-1, 1))
          data['Y'] = MinMaxScaler().fit_transform(data['Y'].values.reshape(-1, 1))
```

```
In [31]: fig, (ax1, ax2) = plt.subplots(1, 2, figsize=(15, 4))
          sns.histplot(data['X'], ax=ax1, bins=30)
          sns.histplot(data['Y'], ax=ax2, bins=30)
          ax1.set_title('X disribution') ax2.set_title('Y
          distribution') plt.show()
```



```
In [32]: fig, (ax1, ax2) = plt.subplots(1, 2, figsize=(15, 4))
          sns.histplot(data['Hours'], ax=ax1)
          sns.histplot(data['Minutes'], ax=ax2)
          ax1.set_title('Hours disribution')
          ax2.set_title('Minutes distribution') plt.show()
```


Hours disribution
17500
15000
12500
10000
7500
5000
2500
0
Count
0.0
0.2
0.4
0.6
0.8
1.0
Hours


Minutes distribution
100000
80000
60000
40000
20000
0
Count
0.0
0.2
0.4
0.6
0.8
1.0
Minutes