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1 Оглавление

2 Задание (к оглавлению)

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.)

Для выбранного датасета (датасетов) на основе материалов лекции решить следующие задачи:

- обработку пропусков в данных;
- кодирование категориальных признаков;
- масштабирование данных.

3 Описание датасета (к оглавлению)

Description

No one can deny that mass shootings are a tragedy. They tear families apart, destroy communities, and leave everyone affected reeling for a long time afterwards. This dataset seeks to catalog every mass shooting in the United States since 1970. It includes information on the location, date, number of fatalities and injuries, as well as other details about the incident. Looking at this data, it's clear that mass shootings are becoming more and more common. In the last decade alone, there have been over 300 mass shootings in the US. That's an average of one mass shooting every two weeks. What's even more sobering is that these numbers are only increasing. In 2017 so far, there have already been 273 mass shootings - that's on track to be the deadliest year on record for mass shootings in America. So what can be done to prevent these tragedies from happening? That's a question that experts have been grappling with for years, and unfortunately there isn't a simple answer. But by understanding more about these events - like where they happen and who is carrying out the attacks - we can hopefully start to make headway in preventing them from happening in the future

Data Manual

- *index*: A unique identifier for each row
- *case*: The name of the mass shooting
- *location*: The location of the mass shooting
- *date*: The date of the mass shooting
- *summary*: A brief summary of the mass shooting
- *fatalities*: The number of people killed in the mass shooting
- *injured*: The number of people injured in the mass shooting
- *total_victims*: The total number of people killed and injured in the mass shooting
- *location.1*: The city and state of the mass shooting
- *ageofshooter*: The age of the shooter
- *priorsignsmentalhealthissues*: Whether or not the shooter showed signs of mental health issues before the shooting
- *mentalhealthdetails*: Details about the shooter's mental health
- *weaponsobtainedlegally*: Whether or not the weapons used in the shooting were obtained legally
- *where_obtained*: Where the weapons used in the shooting were obtained
- *weapon_type*: The type of weapon used in the shooting
- *weapon_details*: Details about the weapon used in the shooting
- *race*: The race of the shooter
- *gender*: The gender of the shooter
- *sources*: The sources used for the information in the dataset
- *mentalhealthsources*: The sources used for the mental health information in the dataset
- *sourcesadditionalage*: The sources used for the shooter's age
- *latitude*: The latitude of the location of the mass shooting
- *longitude*: The longitude of the location of the mass shooting
- *type*: The type of mass shooting
- *year*: The year of the mass shooting

4 Импорт библиотек (к оглавлению)

Ввод [1]:
```
import numpy as np
import pandas as pd

from sklearn.impute import SimpleImputer
from sklearn.preprocessing import OneHotEncoder
from sklearn.preprocessing import StandardScaler

import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
```

5 Загрузка и первичный анализ данных (к оглавлению)

Ввод [2]:
```
df = pd.read_csv("../datasets/mass_shootings.csv", sep=",", index_col="index")
df.head()
```

Out[2]:

index	case	location	date	summary	fatalities	injured	total_victims	location.1	age_of_shooter	prior_signs_mental_health_issue
0	Sacramento County church shooting	Sacramento, California	02/28/22	"A man believed to be meeting his three childr...	4.0	0.0	4.0	Religious	-	
1	Oxford High School shooting	Oxford, Michigan	11/30/21	Ethan Crumbley, a 15-year-old student at Oxfor...	4.0	7.0	11.0	School	15	
2	San Jose VTA shooting	San Jose, California	05/26/21	Samuel Cassidy, 57, a Valley Transportation Au...	9.0	0.0	9.0	Workplace	57	ye
3	FedEx warehouse shooting	Indianapolis, Indiana	04/15/21	Brandon Scott Hole, 19, opened fire around 11 ...	8.0	7.0	15.0	Workplace	19	ye
4	Orange office complex shooting	Orange, California	03/31/21	Aminadab Gaxiola Gonzalez, 44, allegedly opene...	4.0	1.0	5.0	Workplace	-	

5 rows × 28 columns

Ввод [3]:
```
df = df[df!="-"]
df.head()
```

Out[3]:

index	case	location	date	summary	fatalities	injured	total_victims	location.1	age_of_shooter	prior_signs_mental_health_issue
0	Sacramento County church shooting	Sacramento, California	02/28/22	"A man believed to be meeting his three childr...	4.0	0.0	4.0	Religious	NaN	Na
1	Oxford High School shooting	Oxford, Michigan	11/30/21	Ethan Crumbley, a 15-year-old student at Oxfor...	4.0	7.0	11.0	School	15	Na
2	San Jose VTA shooting	San Jose, California	05/26/21	Samuel Cassidy, 57, a Valley Transportation Au...	9.0	0.0	9.0	Workplace	57	ye
3	FedEx warehouse shooting	Indianapolis, Indiana	04/15/21	Brandon Scott Hole, 19, opened fire around 11 ...	8.0	7.0	15.0	Workplace	19	ye
4	Orange office complex shooting	Orange, California	03/31/21	Aminadab Gaxiola Gonzalez, 44, allegedly opene...	4.0	1.0	5.0	Workplace	NaN	Na

5 rows × 28 columns

Ввод [4]:
```
df.shape
```

Out[4]:
```
(126, 28)
```

Ввод [5]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 126 entries, 0 to 125
Data columns (total 28 columns):
 #   Column                            Non-Null Count  Dtype  
---  ------                            --------------  -----  
 0   case                              126 non-null    object 
 1   location                          126 non-null    object 
 2   date                              126 non-null    object 
 3   summary                           126 non-null    object 
 4   fatalities                        126 non-null    float64
 5   injured                           126 non-null    float64
 6   total_victims                     126 non-null    float64
 7   location.1                        126 non-null    object 
 8   age_of_shooter                    122 non-null    object 
 9   prior_signs_mental_health_issues  109 non-null    object 
 10  mental_health_details             96 non-null     object 
 11  weapons_obtained_legally          115 non-null    object 
 12  where_obtained                    92 non-null     object 
 13  weapon_type                       122 non-null    object 
 14  weapon_details                    108 non-null    object 
 15  race                              115 non-null    object 
 16  gender                            126 non-null    object 
 17  sources                           126 non-null    object 
 18  mental_health_sources             83 non-null     object 
 19  sources_additional_age            100 non-null    object 
 20  latitude                          126 non-null    float64
 21  longitude                         126 non-null    float64
 22  type                              126 non-null    object 
 23  year                              126 non-null    float64
 24  Unnamed: 24                       0 non-null      float64
 25  Unnamed: 25                       0 non-null      float64
 26  Unnamed: 26                       0 non-null      float64
 27  Unnamed: 27                       0 non-null      float64
dtypes: float64(10), object(18)
memory usage: 28.5+ KB
```

Ввод [6]:
```
# Удалим ненужные колонки
df = df.drop([
    "mental_health_sources",
    "sources",
    "sources_additional_age",
    "latitude",
    "longitude",
    "year",
    "summary",
    "mental_health_details",
    "where_obtained",
    "type",
    "gender",
    "weapon_type",
    "weapon_details",
    "prior_signs_mental_health_issues",
    "weapons_obtained_legally"
], axis=1)

df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 126 entries, 0 to 125
Data columns (total 13 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   case            126 non-null    object 
 1   location        126 non-null    object 
 2   date            126 non-null    object 
 3   fatalities      126 non-null    float64
 4   injured         126 non-null    float64
 5   total_victims   126 non-null    float64
 6   location.1      126 non-null    object 
 7   age_of_shooter  122 non-null    object 
 8   race            115 non-null    object 
 9   Unnamed: 24     0 non-null      float64
 10  Unnamed: 25     0 non-null      float64
 11  Unnamed: 26     0 non-null      float64
 12  Unnamed: 27     0 non-null      float64
dtypes: float64(7), object(6)
memory usage: 13.8+ KB
```

Ввод [7]:
```
# обрабатываем строки
df["age_of_shooter"] = pd.to_numeric(df["age_of_shooter"])
df["location.1"] = df["location.1"].str.lower().str.strip()
df["race"] = df["race"].str.lower().str.strip()
```

6 Обработка пропусков в данных (к оглавлению)

Ввод [8]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 126 entries, 0 to 125
Data columns (total 13 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   case            126 non-null    object 
 1   location        126 non-null    object 
 2   date            126 non-null    object 
 3   fatalities      126 non-null    float64
 4   injured         126 non-null    float64
 5   total_victims   126 non-null    float64
 6   location.1      126 non-null    object 
 7   age_of_shooter  122 non-null    float64
 8   race            115 non-null    object 
 9   Unnamed: 24     0 non-null      float64
 10  Unnamed: 25     0 non-null      float64
 11  Unnamed: 26     0 non-null      float64
 12  Unnamed: 27     0 non-null      float64
dtypes: float64(8), object(5)
memory usage: 13.8+ KB
```

Ввод [9]:
```
# Удалим колонки с полностью пустыми значениями
df = df.dropna(how="all", axis=1)
```

Ввод [10]:
```
# Количество пустых значений
total_count = df.shape[0]
result = pd.DataFrame()

num_cols = []
cat_cols = []

for col in df.columns:
    temp_null_count = df[df[col].isnull()].shape[0]
    temp_perc = round((temp_null_count / total_count) * 100.0, 2)
    dt = str(df[col].dtype)

    if temp_null_count > 0:
        if dt=='object':
            cat_cols.append(col)
        if dt=='float64' or dt=='int64':
            num_cols.append(col)

    row = pd.DataFrame({
        "Column": [col],
        "Null Fields Count": [temp_null_count],
        "Null Percentage": [temp_perc],
    })
    result = pd.concat([result, row], ignore_index=True, axis=0)

result
```

Out[10]:

	Column	Null Fields Count	Null Percentage
0	case	0	0.00
1	location	0	0.00
2	date	0	0.00
3	fatalities	0	0.00
4	injured	0	0.00
5	total_victims	0	0.00
6	location.1	0	0.00
7	age_of_shooter	4	3.17
8	race	11	8.73

6.1 Числовые признаки

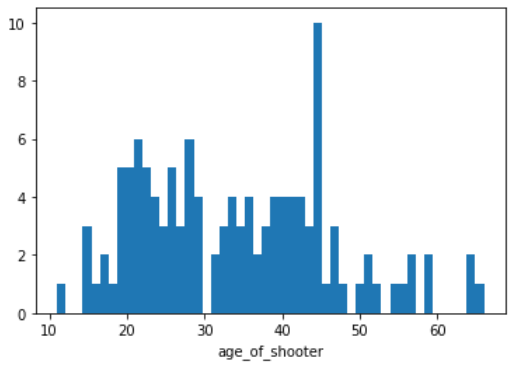
Ввод [11]:
```
df_num = df[num_cols]
df_num
```

Out[11]:

index	age_of_shooter
0	NaN
1	15.0
2	57.0
3	19.0
4	NaN
...	...
121	59.0
122	44.0
123	41.0
124	39.0
125	51.0

126 rows × 1 columns

Ввод [12]:
```
plt.hist(df["age_of_shooter"], 50)
plt.xlabel("age_of_shooter")
plt.show()
```



Ввод [13]:
```
imp_num = SimpleImputer(strategy="median")
data_num_imp = imp_num.fit_transform(df_num)
df["age_of_shooter"] = data_num_imp
df["age_of_shooter"].isnull().sum()
```

Out[13]: 0

6.2 Категориальные признаки

Ввод [14]:
```
df_cat = df[cat_cols]
df_cat["race"].unique()
```

Out[14]:
```
array([nan, 'white', 'black', 'latino', 'asian', 'other',
       'native american', 'unclear'], dtype=object)
```

Ввод [15]:
```
imp_cat = SimpleImputer(missing_values=np.nan, strategy='most_frequent')
data_cat_imp = imp_cat.fit_transform(df_cat)
df["race"] = data_cat_imp
df["race"].isnull().sum()
```

Out[15]: 0

Ввод [16]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 126 entries, 0 to 125
Data columns (total 9 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   case            126 non-null    object 
 1   location        126 non-null    object 
 2   date            126 non-null    object 
 3   fatalities      126 non-null    float64
 4   injured         126 non-null    float64
 5   total_victims   126 non-null    float64
 6   location.1      126 non-null    object 
 7   age_of_shooter  126 non-null    float64
 8   race            126 non-null    object 
dtypes: float64(4), object(5)
memory usage: 9.8+ KB
```

7 Кодирование категориальных признаков (к оглавлению)

Ввод [17]:
```
df.head()
```

Out[17]:

index	case	location	date	fatalities	injured	total_victims	location.1	age_of_shooter	race
0	Sacramento County church shooting	Sacramento, California	02/28/22	4.0	0.0	4.0	religious	34.0	white
1	Oxford High School shooting	Oxford, Michigan	11/30/21	4.0	7.0	11.0	school	15.0	white
2	San Jose VTA shooting	San Jose, California	05/26/21	9.0	0.0	9.0	workplace	57.0	white
3	FedEx warehouse shooting	Indianapolis, Indiana	04/15/21	8.0	7.0	15.0	workplace	19.0	white
4	Orange office complex shooting	Orange, California	03/31/21	4.0	1.0	5.0	workplace	34.0	white

Ввод [18]:
```
cat_enc = df[["location.1", "race"]]
```

Ввод [19]:
```
ohe = OneHotEncoder()
cat_enc_ohe = ohe.fit_transform(cat_enc)
ohe.categories_
```

Out[19]:
```
[array(['airport', 'military', 'other', 'religious', 'school', 'workplace'],
       dtype=object),
 array(['asian', 'black', 'latino', 'native american', 'other', 'unclear',
        'white'], dtype=object)]
```

Ввод [20]:
```
ohe.inverse_transform(cat_enc_ohe.todense()[0:10])
```

```
/usr/local/anaconda3/lib/python3.9/site-packages/sklearn/utils/validation.py:727: FutureWarning: np.matrix usage is deprecated in 1.0 and will raise a TypeError in 1.2. Please convert to a numpy array with np.asarray. For more information see: https://numpy.org/doc/stable/reference/generated/numpy.matrix.html (https://numpy.org/doc/stable/reference/generated/numpy.matrix.html)
  warnings.warn(
```

Out[20]:
```
array([['religious', 'white'],
       ['school', 'white'],
       ['workplace', 'white'],
       ['workplace', 'white'],
       ['workplace', 'white'],
       ['workplace', 'white'],
       ['workplace', 'white'],
       ['workplace', 'white'],
       ['workplace', 'black'],
       ['other', 'black']], dtype=object)
```

8 Масштабирование данных (к оглавлению)

Ввод [21]:
```
df.head()
```

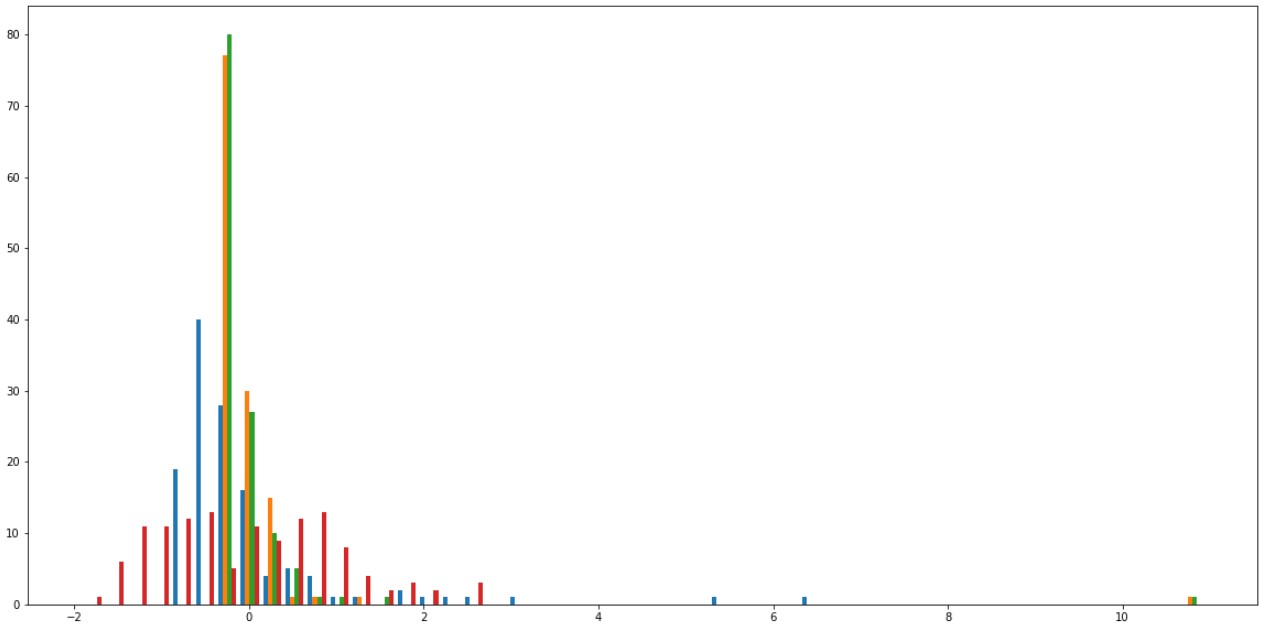
Out[21]:

index	case	location	date	fatalities	injured	total_victims	location.1	age_of_shooter	race
0	Sacramento County church shooting	Sacramento, California	02/28/22	4.0	0.0	4.0	religious	34.0	white
1	Oxford High School shooting	Oxford, Michigan	11/30/21	4.0	7.0	11.0	school	15.0	white
2	San Jose VTA shooting	San Jose, California	05/26/21	9.0	0.0	9.0	workplace	57.0	white
3	FedEx warehouse shooting	Indianapolis, Indiana	04/15/21	8.0	7.0	15.0	workplace	19.0	white
4	Orange office complex shooting	Orange, California	03/31/21	4.0	1.0	5.0	workplace	34.0	white

Ввод [22]:
```
scale_features = [
    "fatalities",
    "injured",
    "total_victims",
    "age_of_shooter"
]

scaler = StandardScaler()
scaler_data = scaler.fit_transform(df[scale_features])

data = pd.DataFrame(scaler_data, columns=scale_features)
plt.figure(figsize=(20, 10))
plt.hist(data, 50)
plt.show()
```



Ввод [23]:
```
df[scale_features] = data
df
```

Out[23]:

index	case	location	date	fatalities	injured	total_victims	location.1	age_of_shooter	race
0	Sacramento County church shooting	Sacramento, California	02/28/22	-0.516003	-0.236776	-0.286341	religious	0.000000	white
1	Oxford High School shooting	Oxford, Michigan	11/30/21	-0.516003	-0.093639	-0.157422	school	-1.584994	white
2	San Jose VTA shooting	San Jose, California	05/26/21	0.134161	-0.236776	-0.194256	workplace	1.918677	white
3	FedEx warehouse shooting	Indianapolis, Indiana	04/15/21	0.004128	-0.093639	-0.083754	workplace	-1.251311	white
4	Orange office complex shooting	Orange, California	03/31/21	-0.516003	-0.216327	-0.267924	workplace	0.000000	white
...	...	...	...	...	...	...	...	...	...
121	Shopping centers spree killings	Palm Bay, Florida	04-23-87	-0.255937	0.049497	0.008332	other	2.085518	white
122	United States Postal Service shooting	Edmond, Oklahoma	08-20-86	0.914357	-0.114087	0.026749	workplace	0.834207	white
123	San Ysidro McDonald's massacre	San Ysidro, California	07-18-84	1.824586	0.151738	0.395090	other	0.583945	white
124	Dallas nightclub shooting	Dallas, Texas	06-29-84	-0.255937	-0.216327	-0.231090	other	0.417104	white
125	Welding shop shooting	Miami, Florida	08-20-82	0.004128	-0.175431	-0.157422	other	1.418153	white

126 rows × 9 columns