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Кафедра «Системы обработки информации и управления»



Лабораторная работа №3  
по дисциплине  
«Методы машинного обучения»

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Дин Но

Москва — 2021 г.

# 1. Цель лабораторной работы

изучение продвинутых способов предварительной обработки данных для дальнейшего формирования моделей.

## 2. Основная часть

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

```
data=pd.read_csv("drive/MyDrive/healthcare-dataset-stroke-data.csv",encoding='utf-8')
data.head()
```

	id	gender	age	hypertension	heart_disease	ever_married	work_type	Residence_type	avg_glucose_level	bmi	smoking_status	stroke
0	9046	Male	67.0	0	1	Yes	Private	Urban	228.69	36.6	formerly smoked	1
1	51676	Female	61.0	0	0	Yes	Self-employed	Rural	202.21	NaN	never smoked	1
2	31112	Male	80.0	0	1	Yes	Private	Rural	105.92	32.5	never smoked	1
3	60182	Female	49.0	0	0	Yes	Private	Urban	171.23	34.4	smokes	1
4	1665	Female	79.0	1	0	Yes	Self-employed	Rural	174.12	24.0	never smoked	1

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
```

```
RangeIndex: 5110 entries, 0 to 5109
```

```
Data columns (total 12 columns):
```

#	Column	Non-Null Count	Dtype
---	-----	-----	----
0	id	5110 non-null	int64
1	gender	5110 non-null	object
2	age	5110 non-null	float64
3	hypertension	5110 non-null	int64
4	heart_disease	5110 non-null	int64
5	ever_married	5110 non-null	object
6	work_type	5110 non-null	object
7	Residence_type	5110 non-null	object
8	avg_glucose_level	5110 non-null	float64
9	bmi	4909 non-null	float64
10	smoking_status	5110 non-null	object
11	stroke	5110 non-null	int64

```
dtypes: float64(3), int64(4), object(5)
```

```
memory usage: 479.2+ KB
```

```
data.describe()
```

	id	age	hypertension	heart_disease	avg_glucose_level	bmi	stroke
count	5110.000000	5110.000000	5110.000000	5110.000000	5110.000000	4909.000000	5110.000000
mean	36517.829354	43.226614	0.097456	0.054012	106.147677	28.893237	0.048728
std	21161.721625	22.612647	0.296607	0.226063	45.283560	7.854067	0.215320
min	67.000000	0.080000	0.000000	0.000000	55.120000	10.300000	0.000000
25%	17741.250000	25.000000	0.000000	0.000000	77.245000	23.500000	0.000000
50%	36932.000000	45.000000	0.000000	0.000000	91.885000	28.100000	0.000000
75%	54682.000000	61.000000	0.000000	0.000000	114.090000	33.100000	0.000000
max	72940.000000	82.000000	1.000000	1.000000	271.740000	97.600000	1.000000

### 3. масштабирование признаков (не менее чем тремя способами)

```
import sklearn.preprocessing as preproc

data['standardized_n'] = preproc.StandardScaler().fit_transform(data[['avg_glucose_level']])
data['minmax_n'] = preproc.minmax_scale(data[['avg_glucose_level']])
data['l2_normalized_n'] = preproc.normalize(data[['avg_glucose_level']], axis = 0)

fig,(ax1, ax2, ax3, ax4) = plt.subplots(4, 1, figsize = (7, 12))
plt.subplots_adjust(wspace =0, hspace =0.5)

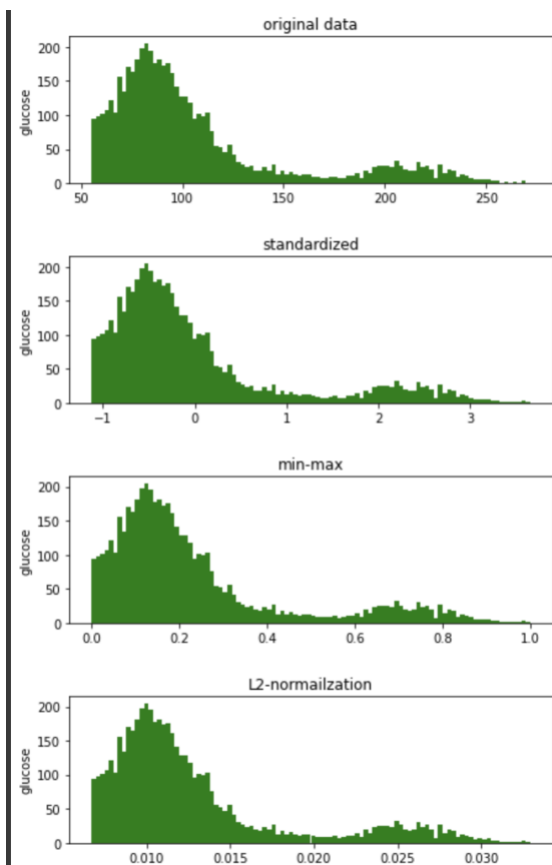
ax1.hist(data['avg_glucose_level'], bins = 100, color = 'g')
ax1.set_xlabel('')
ax1.set_ylabel('glucose')
ax1.set_title('original data')

ax2.hist(data['standardized_n'], bins = 100, color = 'g')
ax2.set_xlabel('')
ax2.set_ylabel('glucose')
ax2.set_title('standardized')

ax3.hist(data['minmax_n'], bins = 100, color = 'g')
ax3.set_xlabel('')
ax3.set_ylabel('glucose')
ax3.set_title('min-max')

ax4.hist(data['l2_normalized_n'], bins = 100, color = 'g')
ax4.set_xlabel('')
ax4.set_ylabel('glucose')
ax4.set_title('L2-normalization')

plt.show()
```



#### 4. обработку выбросов для числовых признаков (по одному способу для удаления выбросов и для замены выбросов);

```
u = data['avg_glucose_level'].mean()
std = data['avg_glucose_level'].std()
error = data[np.abs(data['avg_glucose_level'] - u) > 3*std]
data_c = data[np.abs(data['avg_glucose_level'] - u) <= 3*std]
print(data_c.head())
print(error.head())
```

	id	gender	age	...	bmi	smoking_status	stroke
0	9046	1	67.0	...	36.6	1	1
1	51676	0	61.0	...	NaN	2	1
2	31112	1	80.0	...	32.5	2	1
3	60182	0	49.0	...	34.4	3	1
4	1665	0	79.0	...	24.0	2	1

[5 rows x 12 columns]

	id	gender	age	...	bmi	smoking_status	stroke
33	54401	1	80.0	...	30.5	1	1
45	19824	1	76.0	...	33.6	2	1
122	13491	1	80.0	...	31.7	3	1
123	44033	1	56.0	...	35.8	2	1
135	71279	0	71.0	...	38.7	2	1

[5 rows x 12 columns]

#### 5. обработку по крайней мере одного нестандартного признака (который не является числовым или категориальным);

```
from sklearn.preprocessing import LabelEncoder

gle = LabelEncoder()
genre_labels = gle.fit_transform(data['work_type'])
genre_mappings = {index: label for index, label in enumerate(gle.classes_)}
genre_mappings

{0: 'Govt_job',
 1: 'Never_worked',
 2: 'Private',
 3: 'Self-employed',
 4: 'children'}
```

## 6. отбор признаков:

### 6.1 один метод из группы методов фильтрации (filter methods);

```
from sklearn.compose import ColumnTransformer
from sklearn.preprocessing import OneHotEncoder

ct = ColumnTransformer(transformers=[('encoder', OneHotEncoder(), [0, 5, 9]), remainder='passthrough'])
x = np.array(ct.fit_transform(x))

#Filter
from sklearn.feature_selection import VarianceThreshold

VarianceThreshold(threshold=3).fit_transform(x)

array([[ 67. , 228.69, 36.6 ],
       [ 61. , 202.21,  nan],
       [ 80. , 105.92, 32.5 ],
       ...,
       [ 35. ,  82.99, 30.6 ],
       [ 51. , 166.29, 25.6 ],
       [ 44. ,  85.28, 26.2 ]])
```

### 6.2 один метод из группы методов обертывания (wrapper methods);

```
#Wrapper
features = ['id', 'age',
            'hypertension',
            'heart_disease',
            'ever_married',
            'Residence_type',
            'avg_glucose_level',
            'bmi',
            'gender',
            'work_type',
            'smoking_status']

label = ['stroke']

X_1 = data[features]
y_1 = data[label]
X_1.bmi=(X_1.bmi.fillna(28.74))
X_1.gender=(X_1.gender.fillna(1))
```

```

from imblearn.over_sampling import SMOTE

smote = SMOTE()
x_smote, y_smote = smote.fit_resample(X_1, y_1)

from sklearn.model_selection import train_test_split
X_train,X_test, y_train,y_test=train_test_split(x_smote,y_smote,test_size=0.33,random_state=42)

from sklearn.feature_selection import RFE
from sklearn.linear_model import LogisticRegression

RFE(estimator=LogisticRegression(), n_features_to_select=2).fit_transform(X_train, y_train)

```

```

array([[0.          , 1.          ],
       [0.25230092, 0.74769908],
       [0.          , 1.          ],
       ...,
       [0.          , 1.          ],
       [0.          , 1.          ],
       [0.          , 1.          ]])

```

## 6.3 Один метод из группы методов вложений (embedded methods).

```

#Embedded
from sklearn.feature_selection import SelectFromModel
from sklearn.linear_model import LogisticRegression

SelectFromModel(LogisticRegression(C=0.1)).fit_transform(X_train, y_train)

array([[0.          , 2.          , 3.          ],
       [0.          , 2.24309724, 0.          ],
       [0.          , 2.          , 2.          ],
       ...,
       [0.          , 2.63624944, 2.75749963],
       [0.          , 2.          , 3.          ],
       [0.          , 2.          , 0.50776673]])

```

## Список литературы

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- [2] Team The IPython Development. IPython 7.3.0 Documentation [Electronic resource] // Read the Docs. — 2019. — Access mode: <https://ipython.readthedocs.io/en/stable/> (online; accessed: 20.02.2019).
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