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Кафедра «Системы обработки информации и управления»

Лабораторная работа №4

по дисциплине

«Технологии машинного обучения»

на тему

«Подготовка обучающей и тестовой выборки, кросс-валидация и подбор гиперпараметров на примере метода ближайших соседей.»

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1. Цель

изучение сложных способов подготовки выборки и подбора гиперпараметров на примере метода ближайших соседей.

2. Задание

1. Выберите набор данных (датасет) для решения задачи классификации или регрессии.
2. С использованием метода train_test_split разделите выборку на обучающую и тестовую.
3. Обучите модель ближайших соседей для произвольно заданного гиперпараметра K. Оцените качество модели с помощью подходящих для задачи метрик.
4. Постройте модель и оцените качество модели с использованием кросс-валидации.
5. Произведите подбор гиперпараметра K с использованием GridSearchCV и кросс-валидации.

```
[1]: import numpy as np
     import pandas as pd
     import sklearn
     import warnings
     warnings.filterwarnings('ignore')
```

Для данной задачи выберем датасет с красными винами

```
[2]: data = pd.read_csv('../data/winequality-red.csv')
```

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

```
[3]:    fixed acidity  volatile acidity  citric acid  residual sugar  chlorides  \
     0            7.4              0.70         0.00             1.9      0.076
     1            7.8              0.88         0.00             2.6      0.098
     2            7.8              0.76         0.04             2.3      0.092
     3           11.2              0.28         0.56             1.9      0.075
     4            7.4              0.70         0.00             1.9      0.076

        free sulfur dioxide  total sulfur dioxide  density    pH  sulphates  \
     0                 11.0                  34.0   0.9978  3.51       0.56
     1                 25.0                  67.0   0.9968  3.20       0.68
     2                 15.0                  54.0   0.9970  3.26       0.65
     3                 17.0                  60.0   0.9980  3.16       0.58
     4                 11.0                  34.0   0.9978  3.51       0.56

        alcohol  quality
     0      9.4        5
     1      9.8        5
     2      9.8        5
     3      9.8        6
     4      9.4        5
```

```
[4]: data.dtypes
```

```
[4]: fixed acidity           float64
     volatile acidity        float64
     citric acid             float64
     residual sugar          float64
     chlorides               float64
     free sulfur dioxide     float64
     total sulfur dioxide    float64
     density                 float64
     pH                      float64
     sulphates               float64
     alcohol                 float64
     quality                   int64
     dtype: object
```

```
[5]: data.shape
```

```
[5]: (1599, 12)
```

```
[6]: wine_target = data['quality']
     del data['quality']
```

```
[7]: wine_target[:10]
```

```
[7]: 0    5
     1    5
     2    5
     3    6
     4    5
     5    5
     6    5
     7    7
     8    7
     9    5
     Name: quality, dtype: int64
```

```
[8]: data.head()
```

```
[8]:    fixed acidity  volatile acidity  citric acid  residual sugar  chlorides  \
     0            7.4              0.70         0.00             1.9      0.076
     1            7.8              0.88         0.00             2.6      0.098
     2            7.8              0.76         0.04             2.3      0.092
     3           11.2              0.28         0.56             1.9      0.075
     4            7.4              0.70         0.00             1.9      0.076

        free sulfur dioxide  total sulfur dioxide  density    pH  sulphates  \
     0                 11.0                  34.0   0.9978  3.51       0.56
     1                 25.0                  67.0   0.9968  3.20       0.68
     2                 15.0                  54.0   0.9970  3.26       0.65
     3                 17.0                  60.0   0.9980  3.16       0.58
     4                 11.0                  34.0   0.9978  3.51       0.56
```

```
   alcohol
0      9.4
1      9.8
2      9.8
3      9.8
4      9.4
```

Разделяем выборку на обучающую и тестовую

[9]:
```python
from sklearn.model_selection import train_test_split
wine_X_train, wine_X_test, wine_y_train, wine_y_test = train_test_split(data, wine_target,
  ↪test_size=0.3, random_state=1)
```

Обучаем модель ближайших соседей для произвольно заданного гиперпараметра k=3 Оценим качество модели с помощбю MAE

[10]:
```python
from sklearn.neighbors import KNeighborsClassifier
from sklearn.metrics import mean_absolute_error
model_1 = KNeighborsClassifier(n_neighbors=3)
model_1.fit(wine_X_train, wine_y_train)
target = model_1.predict(wine_X_test)
mean_absolute_error(wine_y_test, target)
```

[10]:
```
0.5833333333333337
```

Строим модель и оценивем ее используя кросс-валидацию

[11]:
```python
from sklearn.model_selection import cross_val_score
scores = cross_val_score(KNeighborsClassifier(n_neighbors=3), data, wine_target, cv=5,
  ↪scoring='mean_absolute_error')
scores, np.mean(scores)
```

[11]:
```
(array([-0.63354037, -0.62305296, -0.63862928, -0.8081761 , -0.66561514]),
 -0.6738027716492456 2)
```

произведем подбор гиперпараметров используя GridSearch

[12]:
```python
from sklearn.model_selection import GridSearchCV
n_range = np.arange(1, 50)
turned_parametrs = [{'n_neighbors' : n_range}]
turned_parametrs
```

[12]:
```
[{'n_neighbors': array([ 1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14,
15, 16, 17,
         18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34,
         35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49])}]
```

[13]:
```python
%%time
clf_gs = GridSearchCV(KNeighborsClassifier(), turned_parametrs, cv=5,
  ↪scoring='mean_absolute_error')
clf_gs.fit(wine_X_train, wine_y_train)
```

```
CPU times: user 3.11 s, sys: 0 ns, total: 3.11 s
Wall time: 3.1 s
```

[14]:
```
clf_gs.cv_results_
```

[14]:
```
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        -0.57918552, -0.5520362 , -0.54751131, -0.53393665, -0.53846154,
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 'std_train_score': array([ 0.        ,  0.00407632,  0.00681277,  0.01448732,
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```

[15]:
```
# Лучшая модель
clf_gs.best_estimator_
```

[15]:
```
KNeighborsClassifier(algorithm='auto', leaf_size=30, metric='minkowski',
           metric_params=None, n_jobs=1, n_neighbors=34, p=2,
           weights='uniform')
```

[16]:
```
# Лучшее значение метрики
clf_gs.best_score_
```

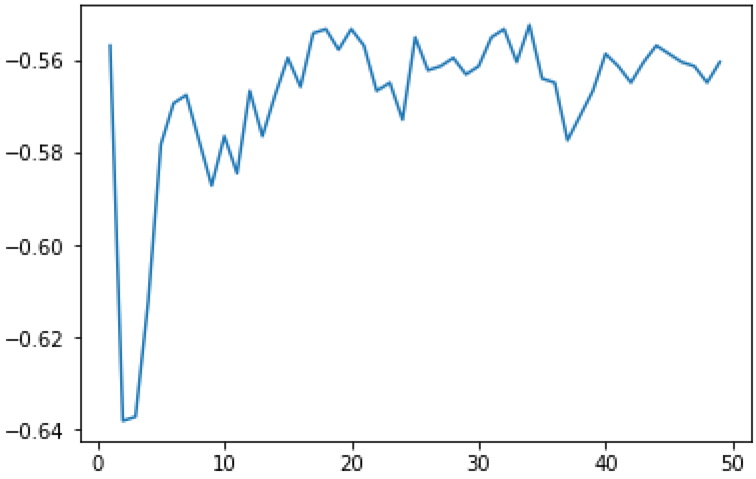
[16]:
```
-0.55227882037533516
```

[17]:
```
# Лучшее значение параметров
clf_gs.best_params_
```

[17]:
```
{'n_neighbors': 34}
```

[18]:
```
%matplotlib inline
import matplotlib.pyplot as plt
# Изменение качества на тестовой выборке в зависимости от K-соседей
plt.plot(n_range, clf_gs.cv_results_['mean_test_score'])
```

[18]:
```
[<matplotlib.lines.Line2D at 0x7f4e39a42c10>]
```


−0.56
−0.58
−0.60
−0.62
−0.64
0
10
20
30
40
50

```
[ ]:
```