Московский государственный технический университет им. Н.Э. Баумана
Кафедра «Системы обработки информации и управления»

Лабораторная работа №6
по дисциплине
«Технологии машинного обучения»
на тему
«Ансамбли моделей машинного обучения»

Выполнил:
студент группы ИУ5-63Б
Кривцов Н. А.

Москва — 2020 г.

1. Лабораторная работа №6. Ансамбли моделей машинного обучения.

[0]:
```
import numpy as np
import pandas as pd
from sklearn.datasets import load_wine
from sklearn.model_selection import train_test_split
```

1.1. Загрузка набора данных. Разбиение на тестовую и обучающую выборки

[0]:
```
X, y = load_wine(return_X_y=True)
X_train, X_test, y_train, y_test = train_test_split(X, y, random_state=42)
```

[3]:
```
print(X_train.shape)
print(X_test.shape)
print(y_train.shape)
print(y_test.shape)
```

```
(133, 13)
(45, 13)
(133,)
(45,)
```

[0]:
```
from sklearn.ensemble import RandomForestClassifier, ExtraTreesClassifier
from sklearn.metrics import classification_report

# Отчёт о метриках модели
def test_model(model, x, y):
  results = model.predict(x)
  return classification_report(y, results)
```

1.2. Случайный лес

[14]:
```
for n_trees in range(5, 35, 5):
  print("{} деревьев.\n".format(n_trees))
  rfc = RandomForestClassifier(n_estimators=n_trees, max_depth=None)
  rfc.fit(X_train, y_train)
  print(test_model(rfc, X_test, y_test))
```

```
5 деревьев.

              precision    recall  f1-score   support
```

0	0.88	1.00	0.94	15
1	0.94	0.89	0.91	18
2	1.00	0.92	0.96	12
accuracy			0.93	45
macro avg	0.94	0.94	0.94	45
weighted avg	0.94	0.93	0.93	45

10 деревьев.

	precision	recall	f1-score	support
0	1.00	1.00	1.00	15
1	1.00	1.00	1.00	18
2	1.00	1.00	1.00	12
accuracy			1.00	45
macro avg	1.00	1.00	1.00	45
weighted avg	1.00	1.00	1.00	45

15 деревьев.

	precision	recall	f1-score	support
0	1.00	1.00	1.00	15
1	1.00	1.00	1.00	18
2	1.00	1.00	1.00	12
accuracy			1.00	45
macro avg	1.00	1.00	1.00	45
weighted avg	1.00	1.00	1.00	45

20 деревьев.

	precision	recall	f1-score	support
0	1.00	1.00	1.00	15
1	1.00	0.94	0.97	18
2	0.92	1.00	0.96	12
accuracy			0.98	45
macro avg	0.97	0.98	0.98	45
weighted avg	0.98	0.98	0.98	45

25 деревьев.

	precision	recall	f1-score	support
0	1.00	0.93	0.97	15
1	0.94	0.94	0.94	18

```
           2       0.92      1.00      0.96        12

    accuracy                           0.96        45
   macro avg       0.96      0.96      0.96        45
weighted avg       0.96      0.96      0.96        45
```

```
30 деревьев.

              precision    recall  f1-score   support

           0       1.00      1.00      1.00        15
           1       1.00      1.00      1.00        18
           2       1.00      1.00      1.00        12

    accuracy                           1.00        45
   macro avg       1.00      1.00      1.00        45
weighted avg       1.00      1.00      1.00        45
```

[0]:
```
from matplotlib import pyplot as plt
from sklearn.tree import plot_tree
```

1.3. Сверхслучайный лес

[16]:
```
for n_trees in range(5, 35, 5):
  print("{} деревьев.\n".format(n_trees))
  etc = RandomForestClassifier(n_estimators=n_trees, max_depth=None)
  etc.fit(X_train, y_train)
  print(test_model(etc, X_test, y_test))
```

```
5 деревьев.

              precision    recall  f1-score   support

           0       0.88      0.93      0.90        15
           1       0.84      0.89      0.86        18
           2       1.00      0.83      0.91        12

    accuracy                           0.89        45
   macro avg       0.91      0.89      0.89        45
weighted avg       0.90      0.89      0.89        45
```

```
10 деревьев.

              precision    recall  f1-score   support

           0       0.94      1.00      0.97        15
           1       0.94      0.89      0.91        18
           2       0.92      0.92      0.92        12
```

```
    accuracy                           0.93        45
   macro avg       0.93      0.94      0.93        45
weighted avg       0.93      0.93      0.93        45
```

15 деревьев.

```
              precision    recall  f1-score   support

           0       0.94      1.00      0.97        15
           1       1.00      0.94      0.97        18
           2       1.00      1.00      1.00        12

    accuracy                           0.98        45
   macro avg       0.98      0.98      0.98        45
weighted avg       0.98      0.98      0.98        45
```

20 деревьев.

```
              precision    recall  f1-score   support

           0       1.00      1.00      1.00        15
           1       1.00      1.00      1.00        18
           2       1.00      1.00      1.00        12

    accuracy                           1.00        45
   macro avg       1.00      1.00      1.00        45
weighted avg       1.00      1.00      1.00        45
```

25 деревьев.

```
              precision    recall  f1-score   support

           0       1.00      1.00      1.00        15
           1       1.00      1.00      1.00        18
           2       1.00      1.00      1.00        12

    accuracy                           1.00        45
   macro avg       1.00      1.00      1.00        45
weighted avg       1.00      1.00      1.00        45
```

30 деревьев.

```
              precision    recall  f1-score   support

           0       1.00      1.00      1.00        15
           1       1.00      1.00      1.00        18
           2       1.00      1.00      1.00        12

    accuracy                           1.00        45
```

macro avg	1.00	1.00	1.00	45
weighted avg	1.00	1.00	1.00	45

1.4. AdaBoost

[0]:
```
from sklearn.ensemble import AdaBoostClassifier
```

[20]:
```
for n in range(5, 35, 5):
  print("{} деревьев.\n".format(n))
  ada = AdaBoostClassifier(n_estimators=n, random_state=42,
 ↪algorithm="SAMME")
  ada.fit(X_train, y_train)
  print(test_model(ada, X_test, y_test))
```

```
5 деревьев.

              precision    recall  f1-score   support

           0       0.93      0.87      0.90        15
           1       0.84      0.89      0.86        18
           2       0.92      0.92      0.92        12

    accuracy                           0.89        45
   macro avg       0.90      0.89      0.89        45
weighted avg       0.89      0.89      0.89        45

10 деревьев.

              precision    recall  f1-score   support

           0       0.88      1.00      0.94        15
           1       0.94      0.89      0.91        18
           2       0.91      0.83      0.87        12

    accuracy                           0.91        45
   macro avg       0.91      0.91      0.91        45
weighted avg       0.91      0.91      0.91        45

15 деревьев.

              precision    recall  f1-score   support

           0       0.88      1.00      0.94        15
           1       0.94      0.94      0.94        18
           2       1.00      0.83      0.91        12

    accuracy                           0.93        45
   macro avg       0.94      0.93      0.93        45
weighted avg       0.94      0.93      0.93        45
```

20 деревьев.

	precision	recall	f1-score	support
0	0.94	1.00	0.97	15
1	0.94	0.89	0.91	18
2	0.92	0.92	0.92	12
accuracy			0.93	45
macro avg	0.93	0.94	0.93	45
weighted avg	0.93	0.93	0.93	45

25 деревьев.

	precision	recall	f1-score	support
0	0.94	1.00	0.97	15
1	0.94	0.89	0.91	18
2	0.92	0.92	0.92	12
accuracy			0.93	45
macro avg	0.93	0.94	0.93	45
weighted avg	0.93	0.93	0.93	45

30 деревьев.

	precision	recall	f1-score	support
0	0.94	1.00	0.97	15
1	0.94	0.83	0.88	18
2	0.85	0.92	0.88	12
accuracy			0.91	45
macro avg	0.91	0.92	0.91	45
weighted avg	0.91	0.91	0.91	45