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Лабораторна робота №6

1. Для даних по титаніку titanic.csv побудувати модель, в якій можна визначити, чи виживе пасажир, заповнивши решту параметрів.
2. Використати декілька методів.
3. Порівняти результати.

Встановлюємо потрібні бібліотеки

In [181…
```
!pip install numpy pandas matplotlib seaborn scikit-learn -q
```

```
WARNING: You are using pip version 21.3.1; however, version 23.1.2 is available.
You should consider upgrading via the 'D:\DA\LAB_6\venv\Scripts\python.exe -m pip install --upgrade pip' comm
and.
```

In [182…
```
import pandas as pd
import matplotlib.pyplot as plt
import matplotlib.patches as mpatches
import seaborn as sns
from sklearn.model_selection import train_test_split
```

Зчитуємо файл

In [183…
```
path = 'data/titanic.csv'
dataset = pd.read_csv(path, sep=',', decimal='.')
```

Аналізуємо дані

In [184…
```
dataset.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 891 entries, 0 to 890
Data columns (total 12 columns):
 #   Column       Non-Null Count  Dtype  
---  ------       --------------  -----  
 0   PassengerId  891 non-null    int64  
 1   Survived     891 non-null    int64  
 2   Pclass       891 non-null    int64  
 3   Name         891 non-null    object 
 4   Sex          891 non-null    object 
 5   Age          714 non-null    float64
 6   SibSp        891 non-null    int64  
 7   Parch        891 non-null    int64  
 8   Ticket       891 non-null    object 
 9   Fare         891 non-null    float64
 10  Cabin        204 non-null    object 
 11  Embarked     889 non-null    object 
dtypes: float64(2), int64(5), object(5)
memory usage: 83.7+ KB
```

In [185…
```
dataset.head()
```

Out[185]:

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin	Embarked
0	1	0	3	Braund, Mr. Owen Harris	male	22.0	1	0	A/5 21171	7.2500	NaN	S
1	2	1	1	Cumings, Mrs. John Bradley (Florence Briggs Th...	female	38.0	1	0	PC 17599	71.2833	C85	C
2	3	1	3	Heikkinen, Miss. Laina	female	26.0	0	0	STON/O2. 3101282	7.9250	NaN	S
3	4	1	1	Futrelle, Mrs. Jacques Heath (Lily May Peel)	female	35.0	1	0	113803	53.1000	C123	S
4	5	0	3	Allen, Mr. William Henry	male	35.0	0	0	373450	8.0500	NaN	S

In [186…
```
dataset.describe()
```

Out[186]:

	PassengerId	Survived	Pclass	Age	SibSp	Parch	Fare
count	891.000000	891.000000	891.000000	714.000000	891.000000	891.000000	891.000000
mean	446.000000	0.383838	2.308642	29.699118	0.523008	0.381594	32.204208
std	257.353842	0.486592	0.836071	14.526497	1.102743	0.806057	49.693429
min	1.000000	0.000000	1.000000	0.420000	0.000000	0.000000	0.000000
25%	223.500000	0.000000	2.000000	20.125000	0.000000	0.000000	7.910400
50%	446.000000	0.000000	3.000000	28.000000	0.000000	0.000000	14.454200
75%	668.500000	1.000000	3.000000	38.000000	1.000000	0.000000	31.000000
max	891.000000	1.000000	3.000000	80.000000	8.000000	6.000000	512.329200

Перетворюємо Pclass на категоріальну змінну

In [187…
```
dataset['Pclass'] = dataset['Pclass'].astype(str)
```

In [188…
```
dataset.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 891 entries, 0 to 890
Data columns (total 12 columns):
 #   Column       Non-Null Count  Dtype  
---  ------       --------------  -----  
 0   PassengerId  891 non-null    int64  
 1   Survived     891 non-null    int64  
 2   Pclass       891 non-null    object 
 3   Name         891 non-null    object 
 4   Sex          891 non-null    object 
 5   Age          714 non-null    float64
 6   SibSp        891 non-null    int64  
 7   Parch        891 non-null    int64  
 8   Ticket       891 non-null    object 
 9   Fare         891 non-null    float64
 10  Cabin        204 non-null    object 
 11  Embarked     889 non-null    object 
dtypes: float64(2), int64(4), object(6)
memory usage: 83.7+ KB
```

Видаляємо інформацію, яка нам не треба для аналізу(PassengerId, Name, Ticket) та видаляємо Cabin так як маємо багато пропущених значень

In [189…
```
dataset = dataset.drop(columns=["PassengerId", "Name", "Cabin", "Ticket"])
```

За допомогою функції train_test_split ділимо основні дані на навчальну та тестову

In [190…
```
train_selection, test_selection = train_test_split(dataset, test_size=0.2, random_state=1)
```

In [191…
```
train_selection.head()
```

Out[191]:

	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked
301	1	3	male	NaN	2	0	23.2500	Q
309	1	1	female	30.0	0	0	56.9292	C
516	1	2	female	34.0	0	0	10.5000	S
120	0	2	male	21.0	2	0	73.5000	S
570	1	2	male	62.0	0	0	10.5000	S

Досліджуємо пропущені дані

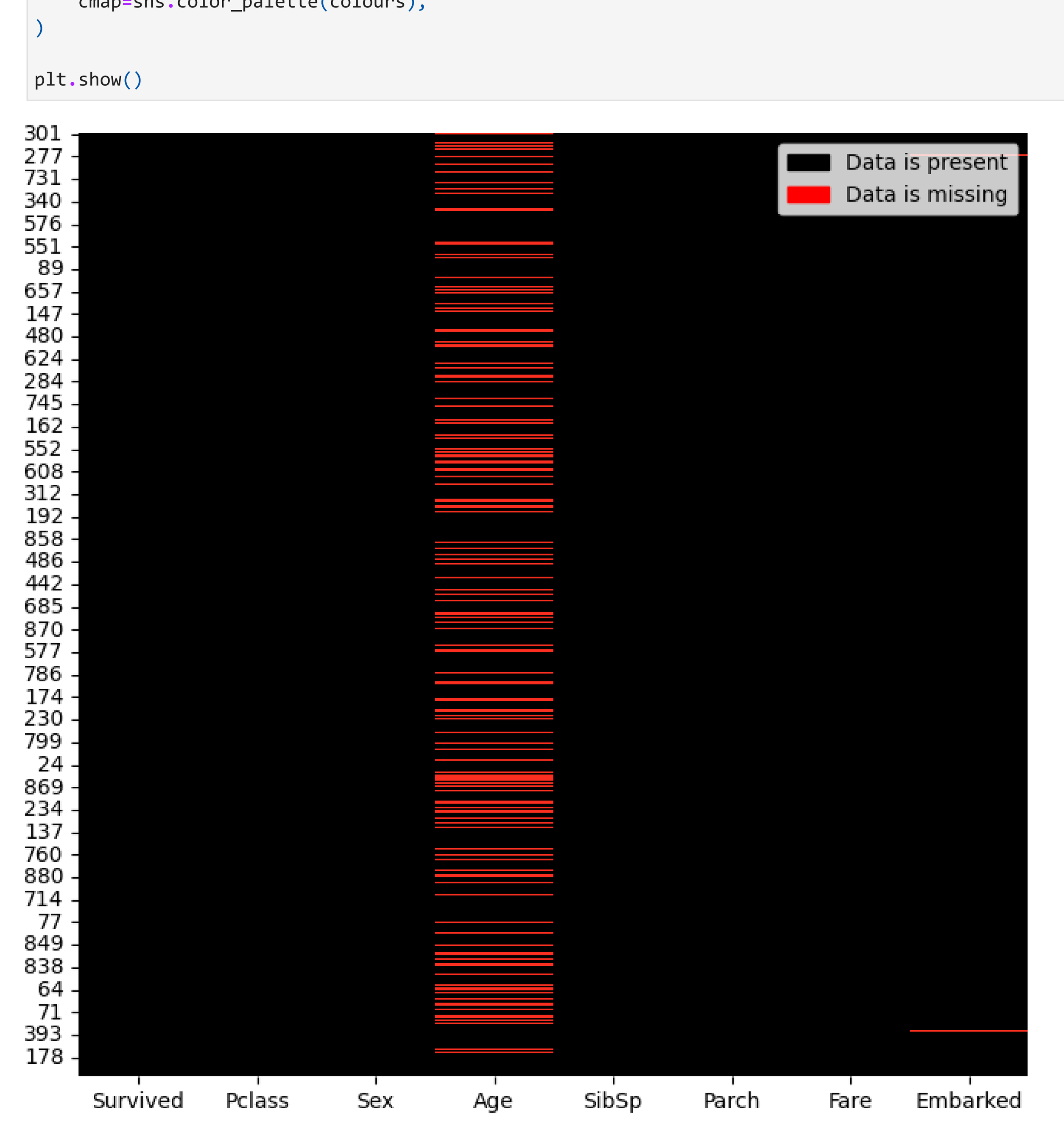
In [192…
```
plt.figure(figsize=(8, 8))

black_patch = mpatches.Patch(color='black', label='Data is present')
red_patch = mpatches.Patch(color='red', label='Data is missing')

plt.legend(handles=[black_patch, red_patch], bbox_to_anchor=(1, 1), loc='best')

colours = ['#000000', '#FC2E20']
sns.heatmap(
    train_selection.isna(), cbar=False,
    cmap=sns.color_palette(colours),
)

plt.show()
```



Заповнюємо пропущені дані в Embarked та Age модами

In [193…
```
train_selection['Embarked'] = train_selection['Embarked'].fillna(train_selection['Embarked'].mode()[0])
train_selection['Age'] = train_selection['Age'].fillna(train_selection['Age'].mode()[0])

test_selection['Embarked'] = test_selection['Embarked'].fillna(test_selection['Embarked'].mode()[0])
test_selection['Age'] = test_selection['Age'].fillna(test_selection['Age'].mode()[0])
```

Кодуємо категоріальні значення в навчальній і тестовій вибірках

In [194…
```
all_features = pd.concat([train_selection, test_selection]).reset_index(drop=True)
all_features = pd.get_dummies(all_features)
```

In [195…
```
train_selection = all_features.iloc[:train_selection.shape[0], :]
test_selection = all_features.iloc[train_selection.shape[0]:, :]
```

In [196…
```
train_selection.head()
```

Out[196]:

	Survived	Age	SibSp	Parch	Fare	Pclass_1	Pclass_2	Pclass_3	Sex_female	Sex_male	Embarked_C	Embarked_
0	1	24.0	2	0	23.2500	False	False	True	False	True	False	Tru
1	1	30.0	0	0	56.9292	True	False	False	True	False	True	Fal
2	1	34.0	0	0	10.5000	False	True	False	True	False	False	Fal
3	0	21.0	2	0	73.5000	False	True	False	False	True	False	Fal
4	1	62.0	0	0	10.5000	False	True	False	False	True	False	Fal

In [197…
```
test_selection.head()
```

Out[197]:

	Survived	Age	SibSp	Parch	Fare	Pclass_1	Pclass_2	Pclass_3	Sex_female	Sex_male	Embarked_C	Embarke
712	1	48.0	0	0	25.9292	True	False	False	True	False	False	
713	0	18.0	0	0	7.8958	False	False	True	False	True	False	
714	1	17.0	0	0	10.5000	False	True	False	True	False	False	
715	0	18.0	0	0	8.1375	False	False	True	True	False	False	
716	1	7.0	0	2	26.2500	False	True	False	True	False	False	

Обрані мною моделі для навчання:

1. Decision Tree
2. Random Forest
3. Gradient Boosting

In [198…
```
from sklearn.tree import DecisionTreeClassifier
from sklearn.ensemble import RandomForestClassifier
from sklearn.ensemble import GradientBoostingClassifier
from sklearn.model_selection import cross_val_score
```

In [199…
```
X_train_selection = train_selection.drop(columns='Survived')
y_train_selection = train_selection['Survived']

X_test_selection = test_selection.drop(columns='Survived')
y_test_selection = test_selection['Survived']
```

In [200…
```
X_train_selection
```

Out[200]:

	Age	SibSp	Parch	Fare	Pclass_1	Pclass_2	Pclass_3	Sex_female	Sex_male	Embarked_C	Embarked_Q	Emb
0	24.0	2	0	23.2500	False	False	True	False	True	False	True	
1	30.0	0	0	56.9292	True	False	False	True	False	True	False	
2	34.0	0	0	10.5000	False	True	False	True	False	False	False	
3	21.0	2	0	73.5000	False	True	False	False	True	False	False	
4	62.0	0	0	10.5000	False	True	False	False	True	False	False	
...	...	...	...	...	...	...	...	...	...	...	...	
707	19.0	0	0	7.6500	False	False	True	False	True	False	False	
708	30.5	0	0	7.7500	False	False	True	True	False	False	True	
709	21.0	0	0	73.5000	False	True	False	False	True	False	False	
710	24.0	0	0	7.5500	False	False	True	True	False	False	False	
711	21.0	0	0	8.0500	False	False	True	False	True	False	False	

712 rows × 12 columns

Decision Tree

In [201…
```
decision_tree = DecisionTreeClassifier(max_depth=3, random_state=1)
tree_scores = cross_val_score(decision_tree, X_train_selection, y_train_selection, cv=5)
tree_scores
```

Out[201]: `array([0.81818182, 0.82517483, 0.85211268, 0.86619718, 0.80985915])`

In [202…
```
tree_scores.mean()
```

Out[202]: `0.83430513148823`

In [203…
```
decision_tree.fit(X_train_selection, y_train_selection)
```

Out[203]:

```
▾ DecisionTreeClassifier
DecisionTreeClassifier(max_depth=3, random_state=1)
```

In [204…
```
decision_tree.score(X_test_selection, y_test_selection)
```

Out[204]: `0.8044692737430168`

Random forest

In [205…
```
random_forest = RandomForestClassifier(max_depth=5)
random_scores = cross_val_score(random_forest, X_train_selection, y_train_selection, cv=5)
random_scores
```

Out[205]: `array([0.7972028 , 0.81818182, 0.86619718, 0.86619718, 0.81690141])`

In [206…
```
random_scores.mean()
```

Out[206]: `0.8329360780065006`

In [207…
```
random_forest.fit(X_train_selection, y_train_selection)
```

Out[207]:

```
▾ RandomForestClassifier
RandomForestClassifier(max_depth=5)
```

In [208…
```
random_forest.score(X_test_selection, y_test_selection)
```

Out[208]: `0.770949720670391`

Gradient Boosting

In [209…
```
gradient_boosting = GradientBoostingClassifier(learning_rate=0.05)
gradient_boosting_scores = cross_val_score(gradient_boosting, X_train_selection, y_train_selection, cv=5)
gradient_boosting_scores
```

Out[209]: `array([0.8041958 , 0.7972028 , 0.85915493, 0.86619718, 0.84507042])`

In [210…
```
gradient_boosting_scores.mean()
```

Out[210]: `0.8343642273219738`

In [211…
```
gradient_boosting.fit(X_train_selection, y_train_selection)
```

Out[211]:
```
GradientBoostingClassifier(learning_rate=0.05)
```

In [212]:
```
gradient_boosting.score(X_test_selection, y_test_selection)
```

Out[212]:
```
0.7821229050279329
```

Отже, за результатом дослідження найкраще себе показала модель Decision Tree Classifier(0.8044692737430168).