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

Отчет по РК №1
по курсу «Технологии машинного обучения»

Вариант №1

ИСПОЛНИТЕЛЬ:
Аушева Л.И.
Группа ИУ5-61Б

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"__"___________2020 г.

ПРЕПОДАВАТЕЛЬ:
Гапанюк Ю.Е.

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"__"___________2020 г.

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Аушева Л.И. ИУ5-61Б, В-1

Задача №1.

Для заданного набора данных проведите корреляционный анализ. В случае наличия пропусков в данных удалите строки или колонки, содержащие пропуски. Сделайте выводы о возможности построения моделей машинного обучения и о возможном вкладе признаков в модель.

In [1]:
```
import pandas as pd
import numpy as np
from sklearn.datasets import load_boston
```

Признаки

In [23]:
```
data = load_boston()
print(data.DESCR)
```

```
.. _boston_dataset:

Boston house prices dataset
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**Data Set Characteristics:**

    :Number of Instances: 506

    :Number of Attributes: 13 numeric/categorical predictive. Median Value (attribute 14) is usually the target.
```

```
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```

```
    :Attribute Information (in order):
        - CRIM     per capita crime rate by town
        - ZN       proportion of residential land zoned for lots over 25,000 sq.ft.
        - INDUS    proportion of non-retail business acres per town
        - CHAS     Charles River dummy variable (= 1 if tract bounds river; 0 otherwise)
        - NOX      nitric oxides concentration (parts per 10 million)
        - RM       average number of rooms per dwelling
        - AGE      proportion of owner-occupied units built prior to 1940
        - DIS      weighted distances to five Boston employment centres
        - RAD      index of accessibility to radial highways
        - TAX      full-value property-tax rate per $10,000
        - PTRATIO  pupil-teacher ratio by town
        - B        1000(Bk - 0.63)^2 where Bk is the proportion of blacks by town
        - LSTAT    % lower status of the population
        - MEDV     Median value of owner-occupied homes in $1000's

    :Missing Attribute Values: None

    :Creator: Harrison, D. and Rubinfeld, D.L.

This is a copy of UCI ML housing dataset.
https://archive.ics.uci.edu/ml/machine-learning-databases/housing/


This dataset was taken from the StatLib library which is maintained at Carnegie Mellon University.

The Boston house-price data of Harrison, D. and Rubinfeld, D.L. 'Hedonic
prices and the demand for clean air', J. Environ. Economics & Management,
vol.5, 81-102, 1978.   Used in Belsley, Kuh & Welsch, 'Regression diagnostics
...', Wiley, 1980.   N.B. Various transformations are used in the table on
 pages 244-261 of the latter.

 The Boston house-price data has been used in many machine learning papers that address regression
 problems.

 .. topic:: References

    - Belsley, Kuh & Welsch, 'Regression diagnostics: Identifying Influential Data and Sources of Collinearity', Wiley
 , 1980. 244-261.
    - Quinlan,R. (1993). Combining Instance-Based and Model-Based Learning. In Proceedings on the Tenth International
 Conference of Machine Learning, 236-243, University of Massachusetts, Amherst. Morgan Kaufmann.
```

In [24]:
```
X = data['data']
df_X = pd.DataFrame(X, columns=data.feature_names)
df_X
```

Out[24]:

	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	PTRATIO	B	LSTAT
0	0.00632	18.0	2.31	0.0	0.538	6.575	65.2	4.0900	1.0	296.0	15.3	396.90	4.98
1	0.02731	0.0	7.07	0.0	0.469	6.421	78.9	4.9671	2.0	242.0	17.8	396.90	9.14
2	0.02729	0.0	7.07	0.0	0.469	7.185	61.1	4.9671	2.0	242.0	17.8	392.83	4.03
3	0.03237	0.0	2.18	0.0	0.458	6.998	45.8	6.0622	3.0	222.0	18.7	394.63	2.94
4	0.06905	0.0	2.18	0.0	0.458	7.147	54.2	6.0622	3.0	222.0	18.7	396.90	5.33
...	...	...	...	...	...	...	...	...	...	...	...	...	...
501	0.06263	0.0	11.93	0.0	0.573	6.593	69.1	2.4786	1.0	273.0	21.0	391.99	9.67
502	0.04527	0.0	11.93	0.0	0.573	6.120	76.7	2.2875	1.0	273.0	21.0	396.90	9.08

503	0.06076	0.0	11.93	0.0	0.573	6.976	91.0	2.1675	1.0	273.0	21.0	396.90	5.64
504	0.10959	0.0	11.93	0.0	0.573	6.794	89.3	2.3889	1.0	273.0	21.0	393.45	6.48
505	0.04741	0.0	11.93	0.0	0.573	6.030	80.8	2.5050	1.0	273.0	21.0	396.90	7.88

506 rows × 13 columns

Целевой признак

In [28]:

```
y = data['target']
df_y = pd.DataFrame(y, columns=['MEDV'])
df_y
```

Out[28]:

	MEDV
0	24.0
1	21.6
2	34.7
3	33.4
4	36.2
...	...
501	22.4
502	20.6
503	23.9
504	22.0
505	11.9

503 23.9
504 22.0
505 11.9

506 rows × 1 columns

Пропущенные (нулевые) значения отсутствуют

In [17]:

```
df_X.isnull().sum()
```

Out[17]:

```
CRIM       0
ZN         0
INDUS      0
CHAS       0
NOX        0
RM         0
AGE        0
DIS        0
RAD        0
TAX        0
PTRATIO    0
B          0
LSTAT      0
dtype: int64
```

Коэффициент корелляции Пирсона

по уровню криминала

In [18]:

```
corr_matrix = df_X.corr()
```

In [29]:

```
corr_matrix['CRIM'].sort_values(ascending=False)
```

Out[29]:

```
CRIM       1.000000
RAD        0.625505
TAX        0.582764
LSTAT      0.455621
NOX        0.420972
INDUS      0.406583
AGE        0.352734
PTRATIO    0.289946
CHAS      -0.055892
ZN        -0.200469
RM        -0.219247
DIS       -0.379670
B         -0.385064
Name: CRIM, dtype: float64
```

Связан с 'ставка налога на полную стоимость имущества за 10 000 долл. США' и 'индекс доступности к радиальным магистралям'

Построим модель KNeighborsRegressor

```
In [31]: from sklearn.model_selection import cross_val_score
         from sklearn.model_selection import KFold
         from sklearn.neighbors import KNeighborsRegressor
```

```
In [89]: from sklearn.model_selection import GridSearchCV
         from sklearn.metrics import accuracy_score
```

```
In [63]: kf = KFold(n_splits=5, shuffle=True, random_state=42)
         params = [{'n_neighbors': [3, 5, 7, 9, 11], 'weights': ['distance', 'uniform'], 'p': [1, 2]}]
         grid_search = GridSearchCV(KNeighborsRegressor(), param_grid=params, cv=kf, n_jobs=-1)
         grid_search.fit(X, y)
```

```
Out[63]: GridSearchCV(cv=KFold(n_splits=5, random_state=42, shuffle=True),
                      error_score=nan,
                      estimator=KNeighborsRegressor(algorithm='auto', leaf_size=30,
                                                    metric='minkowski',
                                                    metric_params=None, n_jobs=None,
                                                    n_neighbors=5, p=2,
                                                    weights='uniform'),
                      iid='deprecated', n_jobs=-1,
                      param_grid=[{'n_neighbors': [3, 5, 7, 9, 11], 'p': [1, 2],
                                   'weights': ['distance', 'uniform']}],
                      pre_dispatch='2*n_jobs', refit=True, return_train_score=False,
                      scoring=None, verbose=0)
```

Лучшая модель

```
In [104]: clf = grid_search.best_estimator_
          clf
```

```
Out[104]: KNeighborsRegressor(algorithm='auto', leaf_size=30, metric='minkowski',
                              metric_params=None, n_jobs=None, n_neighbors=5, p=1,
                              weights='distance')
```

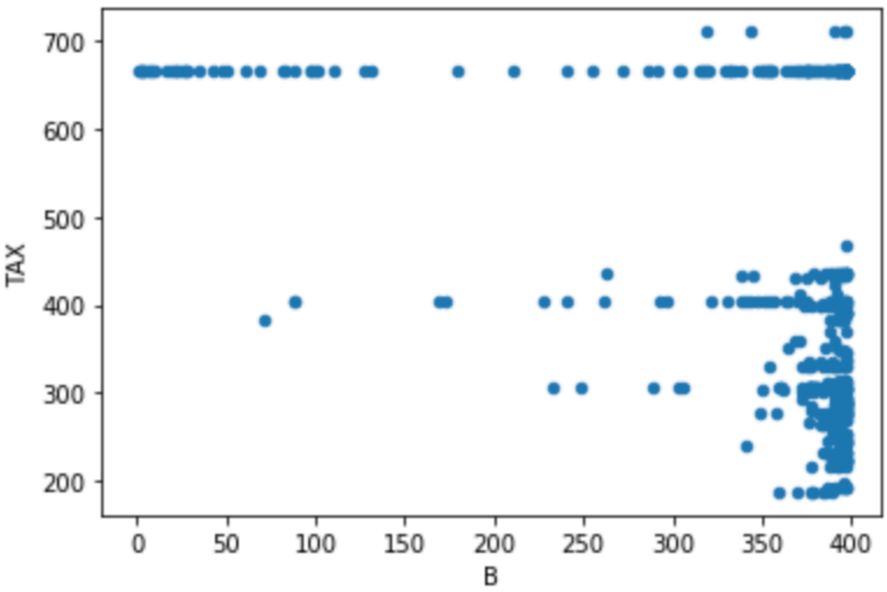
```
In [105]: cvs = cross_val_score(clf, X, y, cv=kf, scoring='neg_mean_squared_error')
          cvs.mean()
```

```
Out[105]: -29.7872280754304
```

Диаграмма рассеяния

```
In [113]: %matplotlib inline
          import matplotlib as mpl
          import matplotlib.pyplot as plt
          from matplotlib.colors import ListedColormap
```

```
In [132]: df_X.plot(kind='scatter', x='B', y='TAX')
          plt.show()
```


TAX
B