In [1]:
```
import numpy as np
import matplotlib.pyplot as plt

import pandas as pd
import seaborn as sns

%matplotlib inline
```

In [2]:
```
from sklearn.datasets import load_boston
boston_dataset = load_boston()
```

```
/home/ubuntu/.local/lib/python3.10/site-packages/sklearn/utils/deprecation.py:87: FutureWarning: Function load_boston is deprecated; `load_boston` is deprecated in 1.0 and will be removed in 1.2.

    The Boston housing prices dataset has an ethical problem. You can refer to
    the documentation of this function for further details.

    The scikit-learn maintainers therefore strongly discourage the use of this
    dataset unless the purpose of the code is to study and educate about
    ethical issues in data science and machine learning.

    In this special case, you can fetch the dataset from the original
    source::

        import pandas as pd
        import numpy as np


        data_url = "http://lib.stat.cmu.edu/datasets/boston"
        raw_df = pd.read_csv(data_url, sep="\s+", skiprows=22, header=None)
        data = np.hstack([raw_df.values[::2, :], raw_df.values[1::2, :2]])
        target = raw_df.values[1::2, 2]

    Alternative datasets include the California housing dataset (i.e.
    :func:`sklearn.datasets.fetch_california_housing`) and the Ames housing
    dataset. You can load the datasets as follows::

        from sklearn.datasets import fetch_california_housing
        housing = fetch_california_housing()

    for the California housing dataset and::

        from sklearn.datasets import fetch_openml
        housing = fetch_openml(name="house_prices", as_frame=True)

    for the Ames housing dataset.
    warnings.warn(msg, category=FutureWarning)
```

In [3]:
```
print(boston_dataset.keys())
```

```
dict_keys(['data', 'target', 'feature_names', 'DESCR', 'filename', 'data_module'])
```

In [4]:
```
boston_dataset.DESCR
```

Out[4]:
```
".. _boston_dataset:\n\nBoston house prices dataset\n---------------------------\n\n**Data Set Characteristics:**  \n\n    :Number of Instances: 506 \n\n    :Number of Attributes: 13 numeric/categorical predictive. Median Value (attribute 14) is usually the target.\n\n    :Attribute Information (in order):\n        - CRIM     per capita crime rate by town\n        - ZN       proportion of residential land zoned for lots over 25,000 sq.ft.\n        - INDUS    proportion of non-retail business acres per town\n        - CHAS     Charles River dummy variable (= 1 if tract bounds river; 0 otherwise)\n        - NOX      nitric oxides concentration (parts per 10 million)\n        - RM       average number of rooms per dwelling\n        - AGE      proportion of owner-occupied units built prior to 1940\n        - DIS      weighted distances to five Boston employment centres\n        - RAD      index of accessibility to radial highways\n        - TAX      full-value property-tax rate per $10,000\n        - PTRATIO  pupil-teacher ratio by town\n        - B        1000(Bk - 0.63)^2 where Bk is the proportion of black people by town\n        - LSTAT    % lower status of the population\n        - MEDV     Median value of owner-occupied homes in $1000's\n\n    :Missing Attribute Values: None\n\n    :Creator: Harrison, D. and Rubinfeld, D.L.\n\nThis is a copy of UCI ML housing dataset.\nhttps://archive.ics.uci.edu/ml/machine-learning-databases/housing/\n\nThis dataset was taken from the StatLib library which is maintained at Carnegie Mellon University.\n\nThe Boston house-price data of Harrison, D. and Rubinfeld, D.L. 'Hedonic\nprices and the demand for clean air', J. Environ. Economics & Management,\nvol.5, 81-102, 1978.  Used in Belsley, Kuh & Welsch, 'Regression diagnostics\n...', Wiley, 1980.  N.B. Various transformations are used in the table on\npages 244-261 of the latter.\n\nThe Boston house-price data has been used in many machine learning papers that address regression\nproblems.  \n\n.. topic:: References\n\n   - Belsley, Kuh & Welsch, 'Regression diagnostics: Identifying Influential Data and Sources of Collinearity', Wiley, 1980. 244-261.\n   - 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.\n"
```

In [5]:
```
boston = pd.DataFrame(boston_dataset.data, columns=boston_dataset.feature_names)
boston.head()
```

Out[5]:

	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

In [6]:
```
boston['MEDV'] = boston_dataset.target
```

In [7]:
```
boston.isnull().sum()
```

Out[7]:
```
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
MEDV       0
dtype: int64
```

In [8]:
```
sns.set(rc={'figure.figsize':(11.7,8.27)})
sns.distplot(boston['MEDV'], bins=30)
plt.show()
```

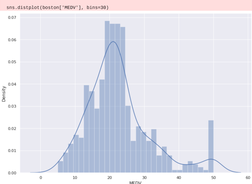
```
/tmp/ipykernel_6673/1962179664.py:2: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(boston['MEDV'], bins=30)
```



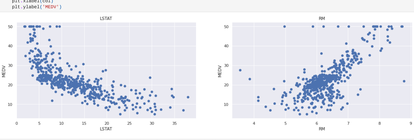
In [9]:
```
correlation_matrix = boston.corr().round(2)
sns.heatmap(data=correlation_matrix, annot=True, cmap='BuPu')
```

Out[9]:
```
<AxesSubplot: >
```

In [10]:
```
plt.figure(figsize=(20, 5))

features = ['LSTAT', 'RM']
target = boston['MEDV']

for i, col in enumerate(features):
    plt.subplot(1, len(features) , i+1)
    x = boston[col]
    y = target
    plt.scatter(x, y, marker='o')
    plt.title(col)
    plt.xlabel(col)
    plt.ylabel('MEDV')
```



In [11]:
```
X= pd.DataFrame(np.c_[boston['LSTAT'], boston['RM']], columns = ['LSTAT','RM'])
Y = boston['MEDV']
```

In [12]:
```
from sklearn.model_selection import train_test_split

X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size = 0.2, random_state=5)
print(X_train.shape)
print(X_test.shape)
print(Y_train.shape)
print(Y_test.shape)
```

```
(404, 2)
(102, 2)
(404,)
(102,)
```

In [13]:
```
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error

lin_model = LinearRegression()
lin_model.fit(X_train, Y_train)
```

Out[13]:
```
LinearRegression()
```

In [14]:
```
y_train_predict = lin_model.predict(X_train)
rmse = (np.sqrt(mean_squared_error(Y_train, y_train_predict)))
r2 = r2_score(Y_train, y_train_predict)

print("The model performance for training set")
print("--------------------------------------")
print('RMSE is {}'.format(rmse))
print('R2 score is {}'.format(r2))
print("\n")

y_test_predict = lin_model.predict(X_test)
rmse = (np.sqrt(mean_squared_error(Y_test, y_test_predict)))
r2 = r2_score(Y_test, y_test_predict)

print("The model performance for testing set")
print("--------------------------------------")
print('RMSE is {}'.format(rmse))
print('R2 score is {}'.format(r2))
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
/tmp/ipykernel_6673/1625915512.py in <module>
      2 rmse = (np.sqrt(mean_squared_error(Y_train, y_train_predict)))
      3 r2 = r2_score(Y_train, y_train_predict)
----> 4 r2 = r2_score(Y_train, y_train_predict)
      5
      6 print("The model performance for training set")

NameError: name 'r2_score' is not defined
```

In [15]:
```
y_train_predict = lin_model.predict(X_train)
rmse = (np.sqrt(mean_squared_error(Y_train, y_train_predict)))
r2 = r2_score(Y_train, y_train_predict)

print("The model performance for training set")
print("--------------------------------------")
print('RMSE is {}'.format(rmse))
print('R2 score is {}'.format(r2))
print("\n")

y_test_predict = lin_model.predict(X_test)
rmse = (np.sqrt(mean_squared_error(Y_test, y_test_predict)))
r2 = r2_score(Y_test, y_test_predict)

print("The model performance for testing set")
print("--------------------------------------")
print('RMSE is {}'.format(rmse))
print('R2 score is {}'.format(r2))
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
/tmp/ipykernel_6673/2569917694.py in <module>
      3 y_train_predict = lin_model.predict(X_train)
      4 rmse = (np.sqrt(mean_squared_error(Y_train, y_train_predict)))
----> 5 r2 = r2_score(Y_train, y_train_predict)
      6
      7 print("The model performance for training set")

NameError: name 'r2_score' is not defined
```

In [16]:
```
plt.scatter(y_train, y_pred)
plt.xlabel("Prices")
plt.ylabel("Predicted prices")
plt.title("Prices vs Predicted prices")
plt.show()
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
/tmp/ipykernel_6673/2465513317.py in <module>
----> 1 plt.scatter(y_train, y_pred)
      2 plt.xlabel("Prices")
      3 plt.ylabel("Predicted prices")
      4 plt.title("Prices vs Predicted prices")
      5 plt.show()

NameError: name 'y_train' is not defined
```

In [17]:
```
plt.scatter(Y_train, Y_test)
plt.xlabel("Prices")
plt.ylabel("Predicted prices")
plt.title("Prices vs Predicted prices")
plt.show()
```

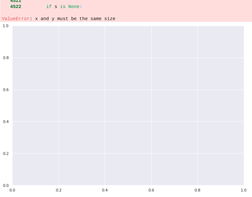
```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
/tmp/ipykernel_6673/3154198348.py in <module>
----> 1 plt.scatter(Y_train, Y_test)
      2 plt.xlabel("Prices")
      3 plt.ylabel("Predicted prices")
      4 plt.title("Prices vs Predicted prices")
      5 plt.show()

~/.local/lib/python3.10/site-packages/matplotlib/pyplot.py in scatter(x, y, s, c, marker, cmap, norm, vmin, vmax, alpha, linewidths, edgecolors, plotnonfinite, data, **kwargs)
   2788         vmin=None, vmax=None, alpha=None, linewidths=None,
   2789         edgecolors=None, plotnonfinite=False, data=None, **kwargs):
-> 2790     __ret = gca().scatter(
   2791         x, y, s=s, c=c, marker=marker, cmap=cmap, norm=norm,
   2792         vmin=vmin, vmax=vmax, alpha=alpha, linewidths=linewidths,

~/.local/lib/python3.10/site-packages/matplotlib/__init__.py in inner(ax, data, *args, **kwargs)
   1421     def inner(ax, *args, data=None, **kwargs):
   1422         if data is None:
-> 1423             return func(ax, *map(sanitize_sequence, args), **kwargs)
   1424
   1425         bound = new_sig.bind(ax, *args, **kwargs)

~/.local/lib/python3.10/site-packages/matplotlib/axes/_axes.py in scatter(self, x, y, s, c, marker, cmap, norm, vmin, vmax, alpha, linewidths, edgecolors, plotnonfinite, **kwargs)
   4518             y = np.ma.ravel(y)
   4519         if x.size != y.size:
-> 4520             raise ValueError("x and y must be the same size")
   4521
   4522         if s is None:

ValueError: x and y must be the same size
```



In [18]:
```
y_pred = lin_model.predict(X_train)
```

In [19]:
```
plt.scatter(Y_train, y_pred)
plt.xlabel("Prices")
plt.ylabel("Predicted prices")
plt.title("Prices vs Predicted prices")
plt.show()
```

In [ ]: