Regresao LInear

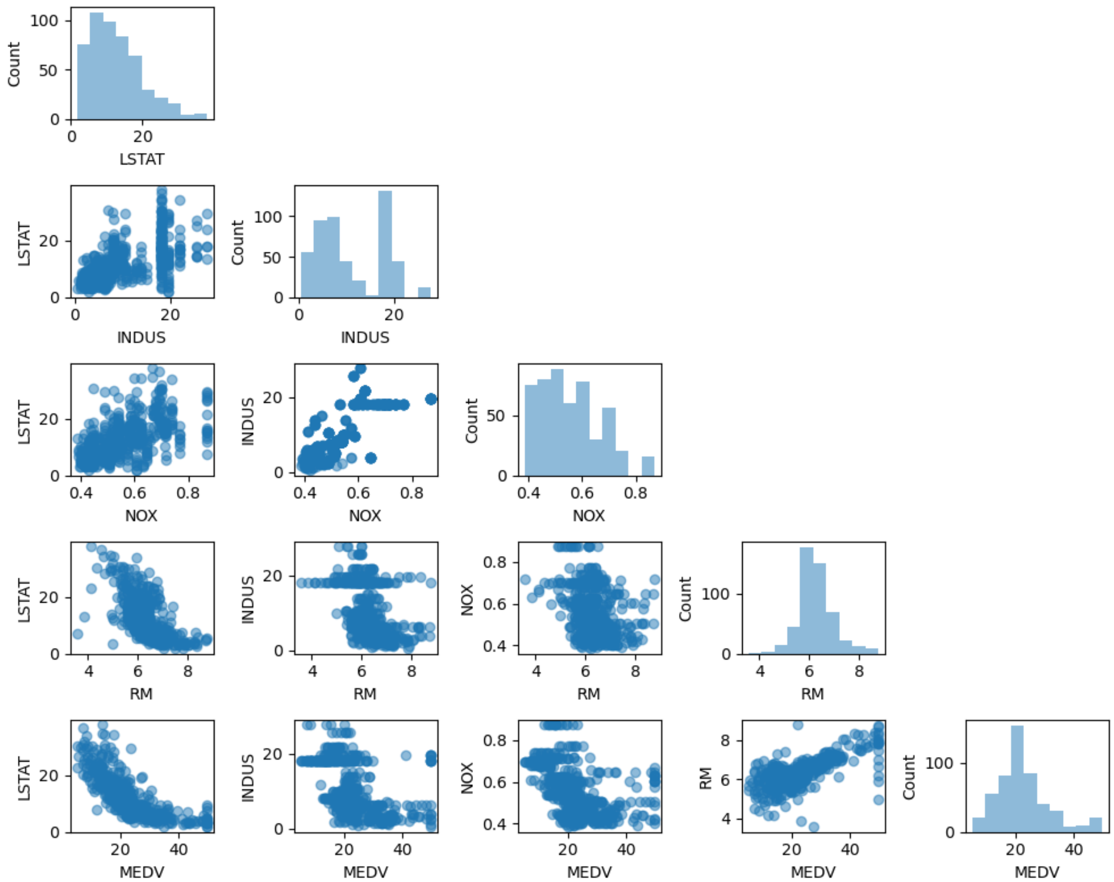
September 28, 2022

[5]:
```python
import pandas as pd

df = pd.read_csv('housing.data.txt',header=None, sep='\s+')

df.columns = ['CRIM', 'ZN', 'INDUS', 'CHAS',
              'NOX', 'RM', 'AGE', 'DIS', 'RAD',
              'TAX', 'PTRATIO', 'B', 'LSTAT', 'MEDV']
df.head()
```

[5]:
```
      CRIM    ZN  INDUS  CHAS    NOX     RM   AGE     DIS  RAD    TAX  \
0  0.00632  18.0   2.31     0  0.538  6.575  65.2  4.0900    1  296.0
1  0.02731   0.0   7.07     0  0.469  6.421  78.9  4.9671    2  242.0
2  0.02729   0.0   7.07     0  0.469  7.185  61.1  4.9671    2  242.0
3  0.03237   0.0   2.18     0  0.458  6.998  45.8  6.0622    3  222.0
4  0.06905   0.0   2.18     0  0.458  7.147  54.2  6.0622    3  222.0

   PTRATIO       B  LSTAT  MEDV
0     15.3  396.90   4.98  24.0
1     17.8  396.90   9.14  21.6
2     17.8  392.83   4.03  34.7
3     18.7  394.63   2.94  33.4
4     18.7  396.90   5.33  36.2
```

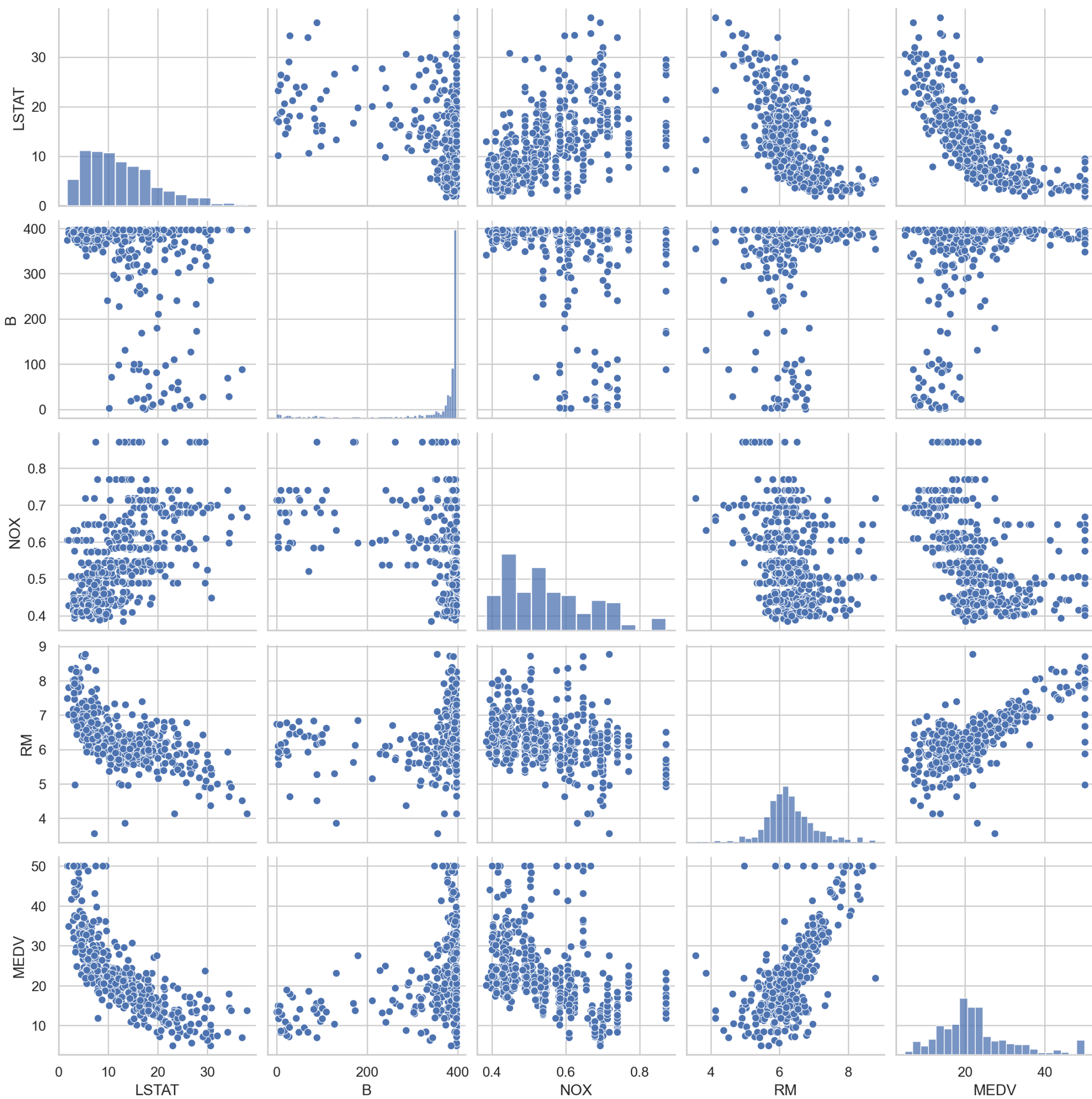
[6]:
```python
import matplotlib.pyplot as plt
from mlxtend.plotting import scatterplotmatrix
```

[7]:
```python
cols = ['LSTAT', 'INDUS', 'NOX', 'RM', 'MEDV']

scatterplotmatrix(df[cols].values, figsize=(10, 8),
                  names=cols, alpha=0.5)
plt.tight_layout()
#plt.savefig('images/10_03.png', dpi=300)
plt.show()
```

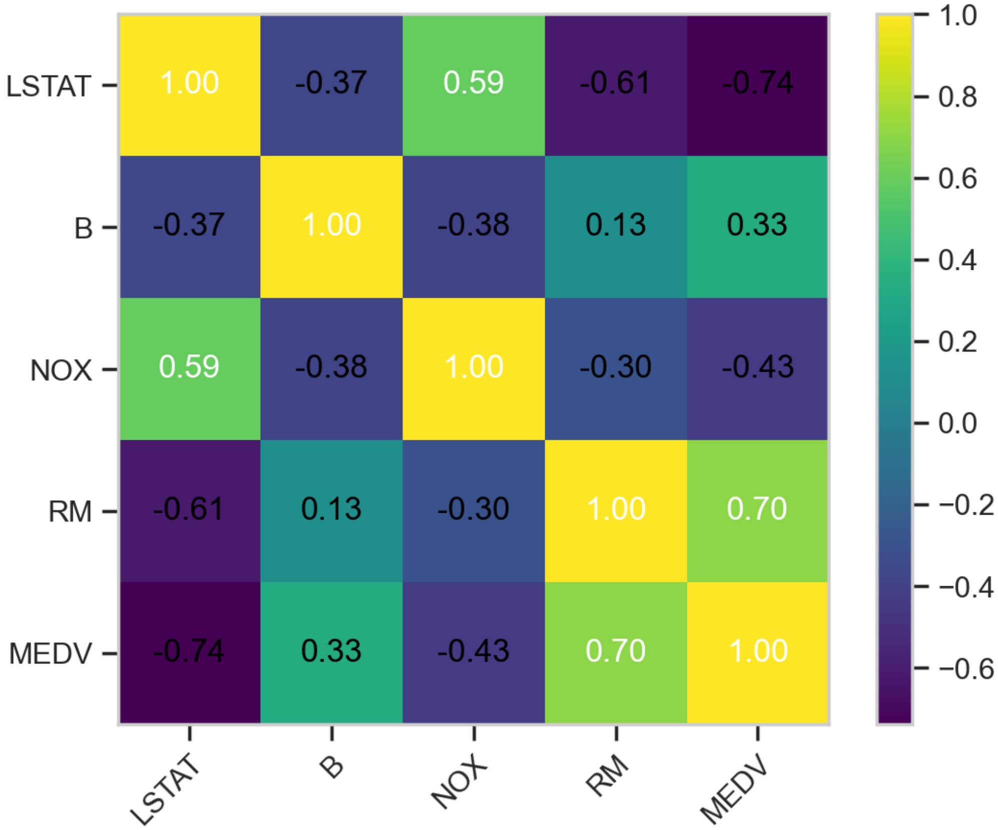


[8]:
```
import matplotlib.pyplot as plt
import seaborn as sns

%matplotlib inline
%config InlineBackend.figure_format = 'retina'

sns.set(style='whitegrid', context='notebook')

cols = ['LSTAT', 'B', 'NOX', 'RM', 'MEDV']
sns.pairplot(df[cols], size=2.5)
plt.savefig('scatter.png', dpi=300)

plt.show()
```

```
/usr/lib/python3/dist-packages/seaborn/axisgrid.py:2089: UserWarning: The `size`
parameter has been renamed to `height`; please update your code.
  warnings.warn(msg, UserWarning)
```



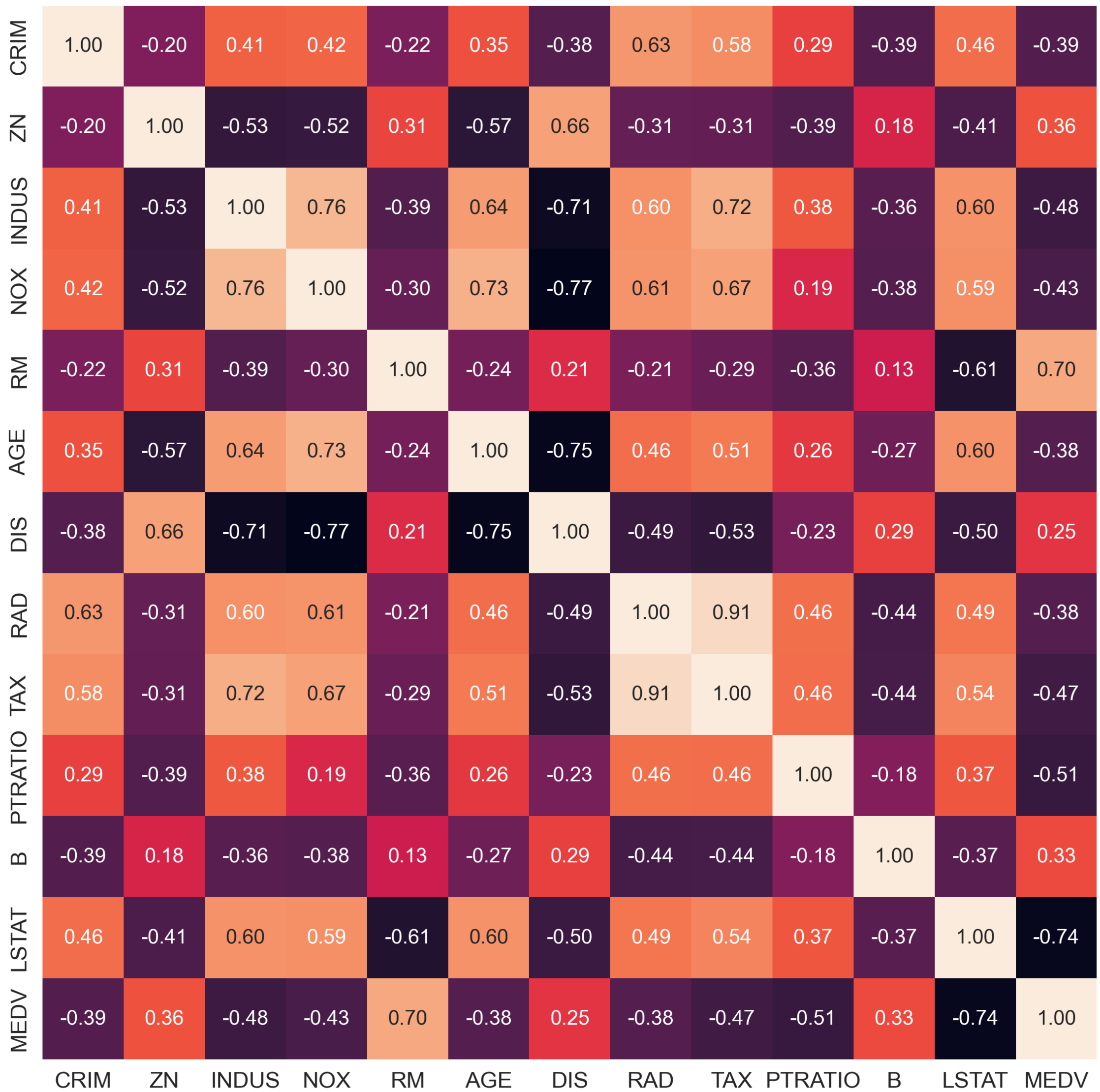
[9]:
```
import numpy as np
from mlxtend.plotting import heatmap


cm = np.corrcoef(df[cols].values.T)
hm = heatmap(cm, row_names=cols, column_names=cols)

# plt.savefig('images/10_04.png', dpi=300)
plt.show()
```



[10]:

```
import numpy as np

corr_cols = ['CRIM', 'ZN', 'INDUS',
             'NOX', 'RM', 'AGE', 'DIS', 'RAD',
             'TAX', 'PTRATIO', 'B', 'LSTAT', 'MEDV']

cm = np.corrcoef(df[corr_cols].values.T)
sns.set(font_scale=1.5)

fig, ax = plt.subplots(figsize=(14, 14))

hm = sns.heatmap(cm,
                 ax=ax,
                 cbar=False,
                 annot=True,
                 square=True,
                 fmt='.2f',
                 annot_kws={'size': 15},
                 yticklabels=corr_cols,
                 xticklabels=corr_cols)
```

```
# plt.savefig('corr_mat.png', dpi=300)

plt.show()
```



0.1 Implementando um modelo de regressão linear de mínimos quadrados comum

…

0.1.1 Resolvendo a regressão para parâmetros de regressão com gradiente descendente

[11]:
```python
import numpy as np
```

[12]:
```python
class LinearRegressionGD(object):

    def __init__(self, eta=0.001, n_iter=20):
        self.eta = eta
        self.n_iter = n_iter

    def fit(self, X, y):
        self.w_ = np.zeros(1 + X.shape[1])
        self.cost_ = []

        for i in range(self.n_iter):
            output = self.net_input(X)
            errors = (y - output)
            self.w_[1:] += self.eta * X.T.dot(errors)
            self.w_[0] += self.eta * errors.sum()
            cost = (errors**2).sum() / 2.0
            self.cost_.append(cost)
        return self

    def net_input(self, X):
        return np.dot(X, self.w_[1:]) + self.w_[0]

    def predict(self, X):
        return self.net_input(X)
```

[13]:
```python
X = df[['RM']].values
y = df['MEDV'].values
```

[14]:
```python
X
```

[14]:
```
array([[6.575],
       [6.421],
       [7.185],
       [6.998],
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```

```
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       [6.027],
       [6.593],
       [6.12 ],
       [6.976],
       [6.794],
       [6.03 ]])
```
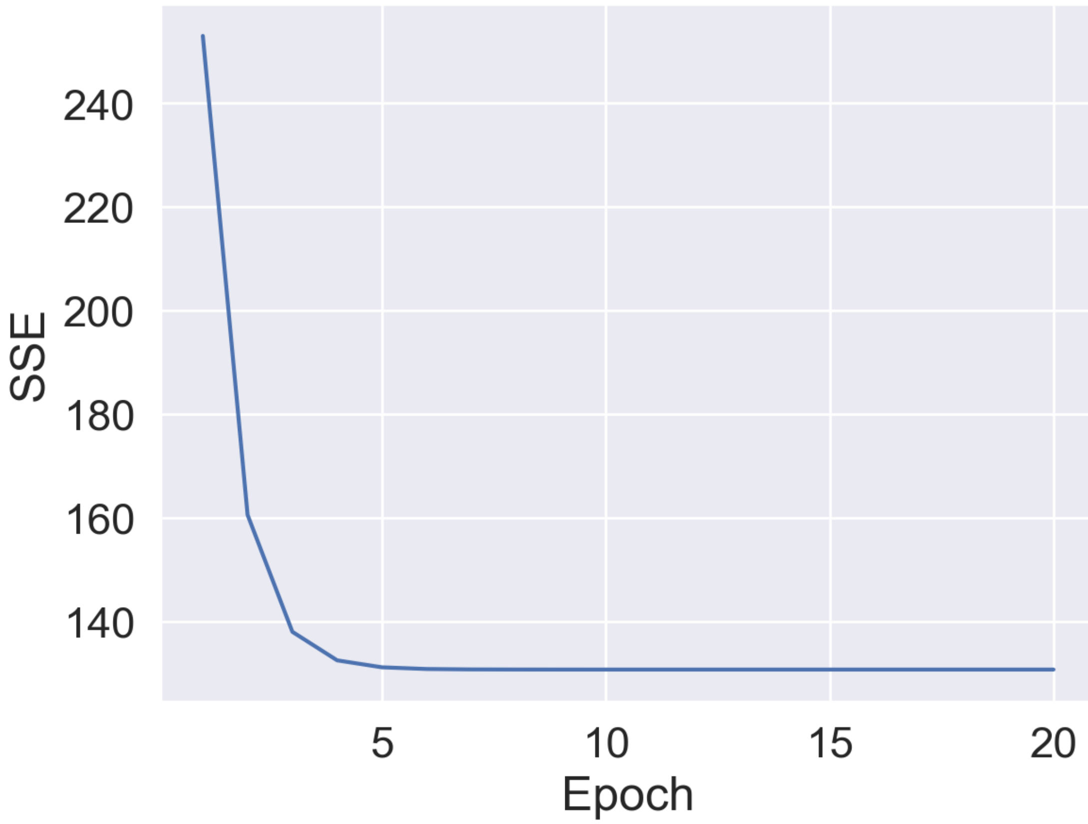

[15]:
```
from sklearn.preprocessing import StandardScaler


sc_x = StandardScaler()
sc_y = StandardScaler()
X_std = sc_x.fit_transform(X)
y_std = sc_y.fit_transform(y[:,np.newaxis]).flatten()
```

[16]:
```
lr = LinearRegressionGD()
lr.fit(X_std, y_std)
```

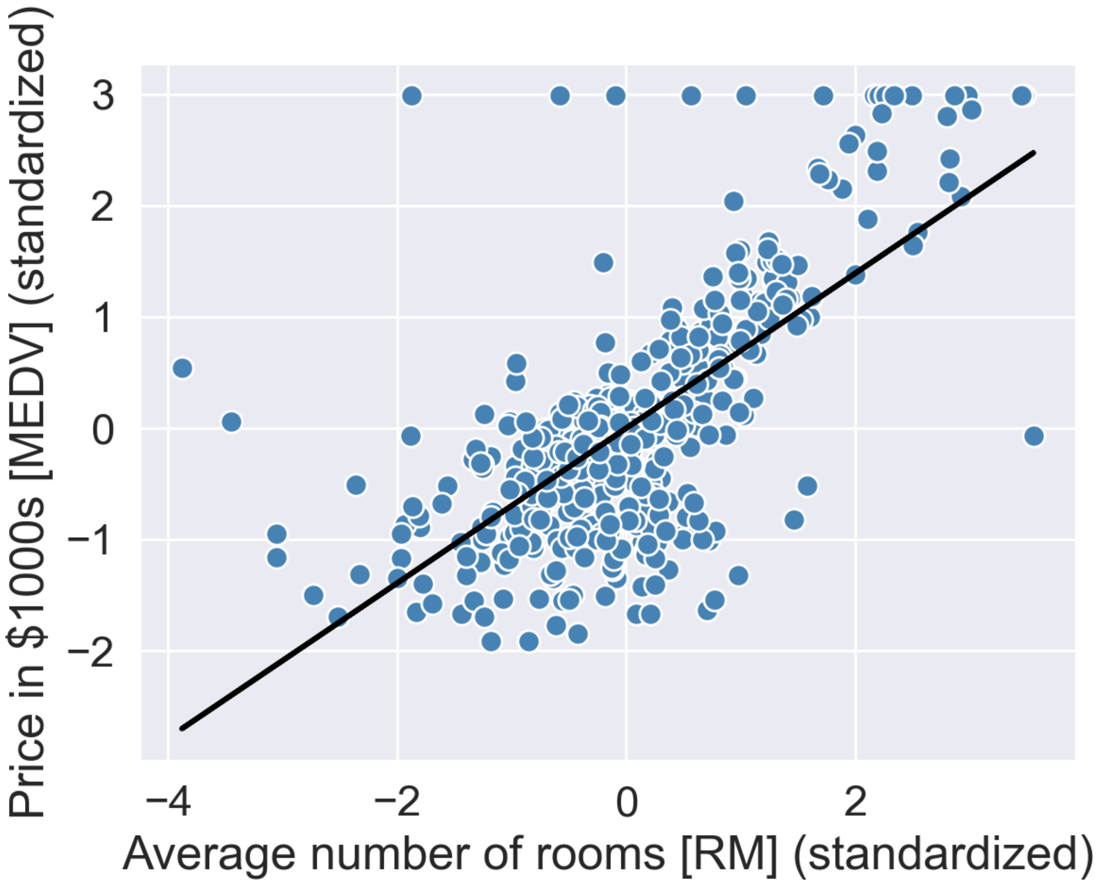
[16]:
```
<__main__.LinearRegressionGD at 0x7fe46acd9ab0>
```

[17]:
```
plt.plot(range(1, lr.n_iter+1), lr.cost_)
plt.ylabel('SSE')
plt.xlabel('Epoch')
#plt.tight_layout()
#plt.savefig('images/10_05.png', dpi=300)
plt.show()
```



[18]:
```
def lin_regplot(X, y, model):
    plt.scatter(X, y, c='steelblue', edgecolor='white', s=70)
    plt.plot(X, model.predict(X), color='black', lw=2)
    return
```

[19]:
```
lin_regplot(X_std, y_std, lr)
plt.xlabel('Average number of rooms [RM] (standardized)')
plt.ylabel('Price in $1000s [MEDV] (standardized)')

#plt.savefig('images/10_06.png', dpi=300)
plt.show()
```



[20]:
```
print('Slope: %.3f' % lr.w_[1])
print('Intercept: %.3f' % lr.w_[0])
```

```
Slope: 0.695
Intercept: -0.000
```

[21]:
```
from distutils.version import LooseVersion
import sklearn


num_rooms_std = sc_x.transform(np.array([[5.0]]))
price_std = lr.predict(num_rooms_std)

if LooseVersion(sklearn.__version__) >= LooseVersion('0.23.0'):
    print("Price in $1000s: %.3f" % sc_y.inverse_transform(price_std[:, np.
 ↪newaxis]).flatten())
else:
    print("Price in $1000s: %.3f" % sc_y.inverse_transform(price_std))
```

```
Price in $1000s: 10.840
```

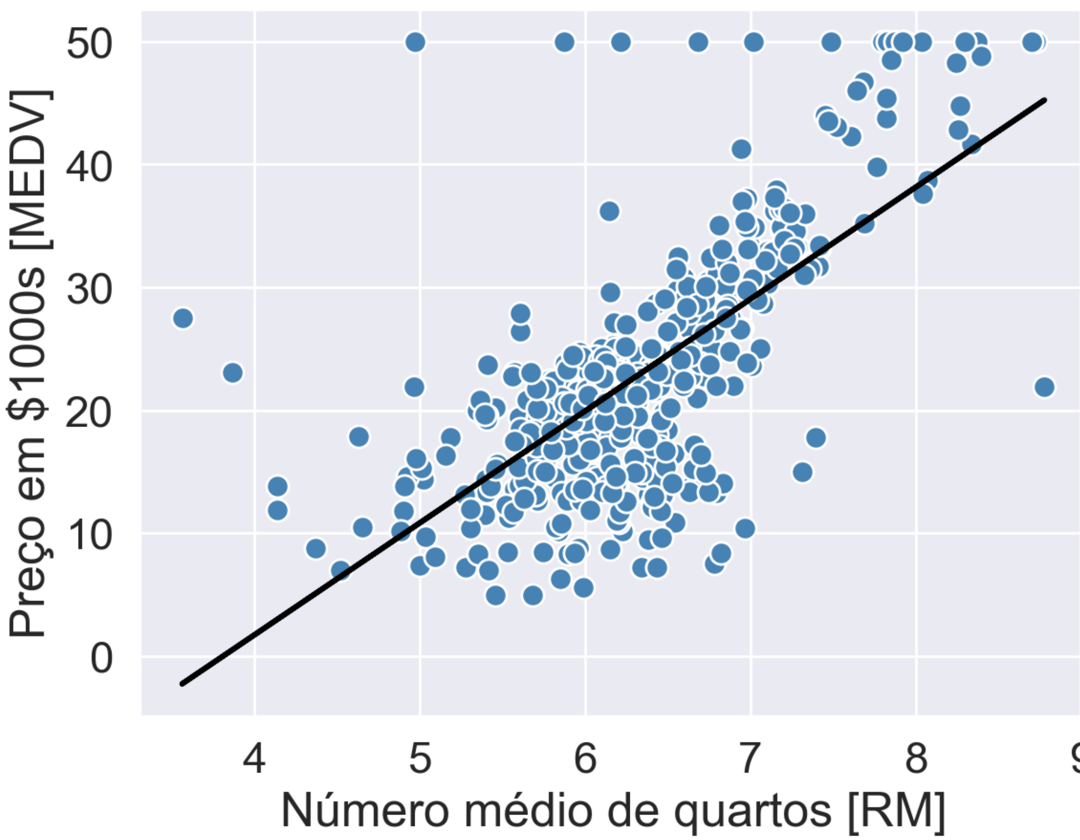
0.2 Estimando o coeficiente de um modelo de regressão via scikit-learn

[22]:
```
from sklearn.linear_model import LinearRegression
```

[23]:
```
slr = LinearRegression()
slr.fit(X, y)
y_pred = slr.predict(X)
print('Slope: %.3f' % slr.coef_[0])
print('Intercept: %.3f' % slr.intercept_)
```

```
Slope: 9.102
Intercept: -34.671
```

[24]:
```
lin_regplot(X, y, slr)
plt.xlabel('Número médio de quartos [RM]')
plt.ylabel('Preço em $1000s [MEDV]')

#plt.savefig('images/10_07.png', dpi=300)
plt.show()
```



[25]:

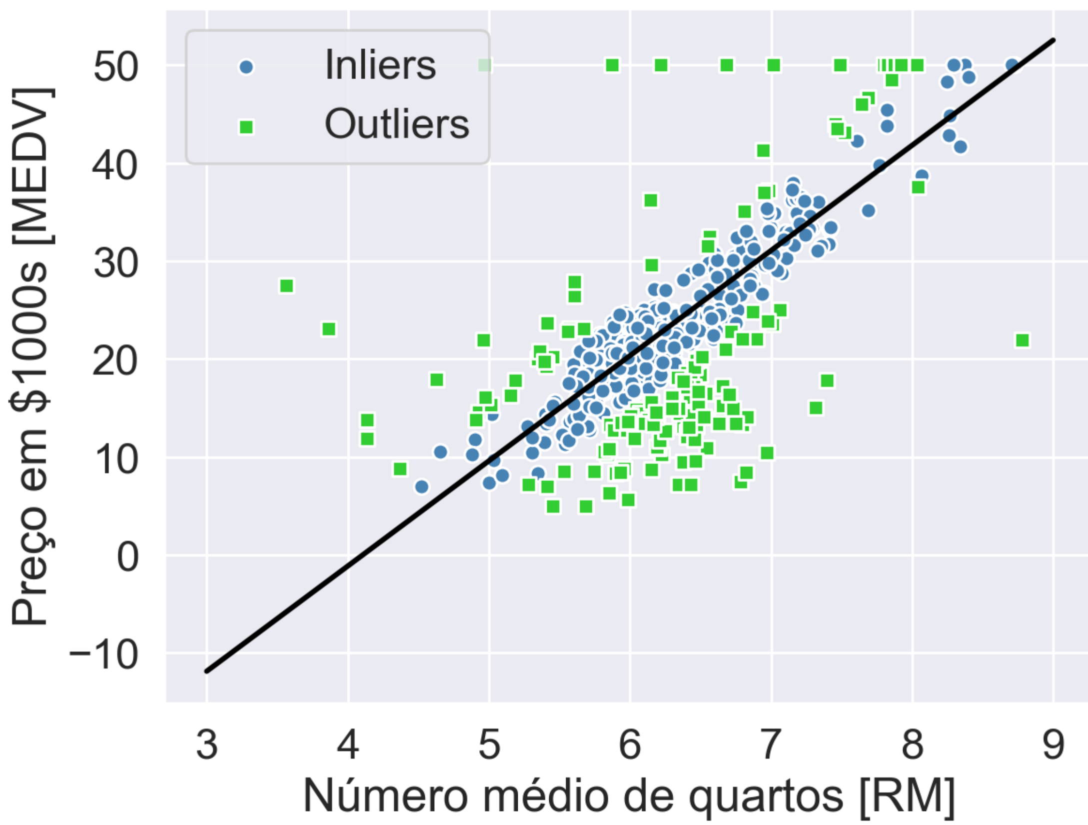
```
# adding a column vector of "ones"
Xb = np.hstack((np.ones((X.shape[0], 1)), X))
w = np.zeros(X.shape[1])
z = np.linalg.inv(np.dot(Xb.T, Xb))
w = np.dot(z, np.dot(Xb.T, y))

print('Slope: %.3f' % w[1])
print('Intercept: %.3f' % w[0])
```

```
Slope: 9.102
Intercept: -34.671
```

[26]:

```
from sklearn.linear_model import RANSACRegressor

ransac = RANSACRegressor(LinearRegression(),
                         max_trials=100,
                         min_samples=50,
                         loss='absolute_loss',
                         residual_threshold=5.0,
                         random_state=0)


ransac.fit(X, y)

inlier_mask = ransac.inlier_mask_
outlier_mask = np.logical_not(inlier_mask)

line_X = np.arange(3, 10, 1)
line_y_ransac = ransac.predict(line_X[:, np.newaxis])
plt.scatter(X[inlier_mask], y[inlier_mask],
            c='steelblue', edgecolor='white',
            marker='o', label='Inliers')
plt.scatter(X[outlier_mask], y[outlier_mask],
            c='limegreen', edgecolor='white',
            marker='s', label='Outliers')
plt.plot(line_X, line_y_ransac, color='black', lw=2)
plt.xlabel('Número médio de quartos [RM]')
plt.ylabel('Preço em $1000s [MEDV]')
plt.legend(loc='upper left')

#plt.savefig('images/10_08.png', dpi=300)
plt.show()
```

```
/usr/lib/python3/dist-packages/sklearn/linear_model/_ransac.py:369:
FutureWarning: The loss 'absolute_loss' was deprecated in v1.0 and will be
removed in version 1.2. Use `loss='absolute_error'` which is equivalent.
  warnings.warn(
```


Inliers
Outliers
Preço em $1000s [MEDV]
Número médio de quartos [RM]
50
40
30
20
10
0
−10
3
4
5
6
7
8
9