```
#regresiones lineales
"""
The first line of the preceding code enables matplotlib to display the graphical output of the
code in the notebook environment.
The lines of code that follow use the import keyword to load various Python modules into our
programming environment.
The last statement is used to set the aesthetic look of the graphs that matplotlib generates
to the type displayed by the seaborn module.
"""
%matplotlib inline
import matplotlib as mpl
import seaborn as sns
import matplotlib.pyplot as plt
import statsmodels.formula.api as smf
import statsmodels.graphics.api as smg
import pandas as pd
import numpy as np
import patsy
from statsmodels.graphics.correlation import plot_corr
from sklearn.model_selection import train_test_split
plt.style.use('seaborn')
```

```
rawBostonData = pd.read_csv('https://raw.githubusercontent.com/PacktWorkshops/The-Data-
Science-Workshop/master/Chapter02/Dataset/Boston.csv')
```

```
 rawBostonData.head()
```

	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	PTRATIO	LSTAT	MEDV
0	0.00632	18.0	2.31	0	0.538	6.575	65.2	4.0900	1	296	15.3	4.98	24.0
1	0.02731	0.0	7.07	0	0.469	6.421	78.9	4.9671	2	242	17.8	9.14	21.6
2	0.02729	0.0	7.07	0	0.469	7.185	61.1	4.9671	2	242	17.8	4.03	34.7
3	0.03237	0.0	2.18	0	0.458	6.998	45.8	6.0622	3	222	18.7	2.94	33.4
4	0.06905	0.0	2.18	0	0.458	7.147	54.2	6.0622	3	222	18.7	5.33	36.2

```
#limpiamos los valores nulos
rawBostonData = rawBostonData.dropna()
```

```
#limpiamos duplicados
rawBostonData = rawBostonData.dropna()
```

```
list(rawBostonData.columns)
```

```
['CRIM',
 ' ZN ',
 'INDUS ',
 'CHAS',
 'NOX',
 'RM',
 'AGE',
 'DIS',
 'RAD',
 'TAX',
 'PTRATIO',
 'LSTAT',
 'MEDV']
```

```
renamedBostonData = rawBostonData.rename(columns = {'CRIM':'crimeRatePerCapita',
 ' ZN ':'landOver25K_sqft',
 'INDUS ':'non-retailLandProptn',
 'CHAS':'riverDummy',
 'NOX':'nitrixOxide_pp10m',
 'RM':'AvgNo.RoomsPerDwelling',
 'AGE':'ProptnOwnerOccupied',
 'DIS':'weightedDist',
 'RAD':'radialHighwaysAccess',
 'TAX':'propTaxRate_per10K',
 'PTRATIO':'pupilTeacherRatio',
 'LSTAT':'pctLowerStatus',
 'MEDV':'medianValue_Ks'})
renamedBostonData.head()
```

	crimeRatePerCapita	landOver25K_sqft	non-retailLandProptn	riverDummy	nitrixOxide_pp10m	AvgNo.RoomsPerDwelling	ProptnOwnerOcc
0	0.00632	18.0	2.31	0	0.538	6.575	
1	0.02731	0.0	7.07	0	0.469	6.421	
2	0.02729	0.0	7.07	0	0.469	7.185	
3	0.03237	0.0	2.18	0	0.458	6.998	
4	0.06905	0.0	2.18	0	0.458	7.147	

```
renamedBostonData.info()
```

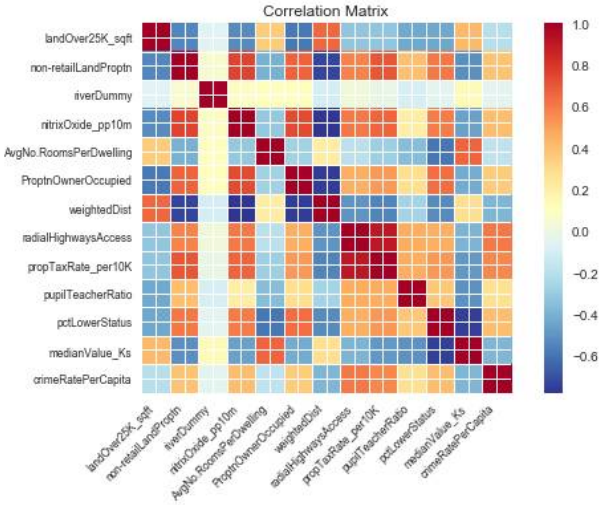
```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 506 entries, 0 to 505
Data columns (total 13 columns):
 #   Column                  Non-Null Count  Dtype  
---  ------                  --------------  -----  
 0   crimeRatePerCapita      506 non-null    float64
 1   landOver25K_sqft        506 non-null    float64
 2   non-retailLandProptn    506 non-null    float64
 3   riverDummy              506 non-null    int64  
 4   nitrixOxide_pp10m       506 non-null    float64
 5   AvgNo.RoomsPerDwelling  506 non-null    float64
 6   ProptnOwnerOccupied     506 non-null    float64
 7   weightedDist            506 non-null    float64
 8   radialHighwaysAccess    506 non-null    int64  
 9   propTaxRate_per10K      506 non-null    int64  
 10  pupilTeacherRatio       506 non-null    float64
 11  pctLowerStatus          506 non-null    float64
 12  medianValue_Ks          506 non-null    float64
dtypes: float64(10), int64(3)
memory usage: 55.3 KB
```

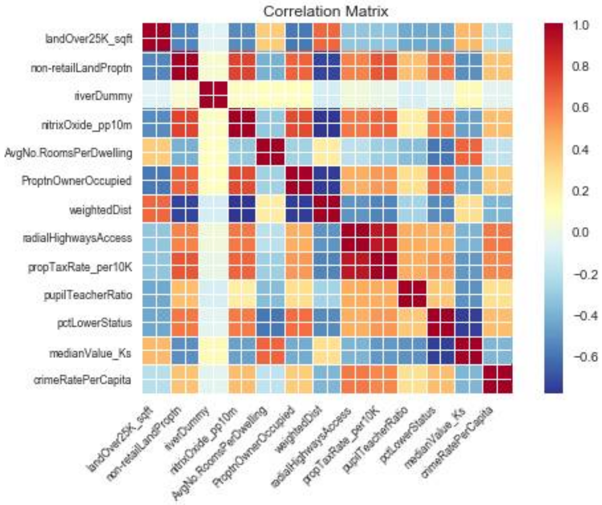
```
#calculamos estadisticas basicas
"""
We used the pandas function, describe, called on the DataFrame to calculate simple statistics
for numeric fields (this includes any field with a numpy number
in the DataFrame. The statistics include the minimum, the maximum, the count of rows in each
column, the average of each column (mean), the 25th percentile,
the 50th percentile, and the 75th percentile.  We transpose (using the .T function) the output
of the describe function to get a better layout.
"""
renamedBostonData.describe(include=[np.number]).T
```

	count	mean	std	min	25%	50%	75%	max
crimeRatePerCapita	506.0	3.613524	8.601545	0.00632	0.082045	0.25651	3.677082	88.9762
landOver25K_sqft	506.0	11.363636	23.322453	0.00000	0.000000	0.00000	12.500000	100.0000
non-retailLandProptn	506.0	11.136779	6.860353	0.46000	5.190000	9.69000	18.100000	27.7400
riverDummy	506.0	0.069170	0.253994	0.00000	0.000000	0.00000	0.000000	1.0000
nitrixOxide_pp10m	506.0	0.554695	0.115878	0.38500	0.449000	0.53800	0.624000	0.8710
AvgNo.RoomsPerDwelling	506.0	6.284634	0.702617	3.56100	5.885500	6.20850	6.623500	8.7800
ProptnOwnerOccupied	506.0	68.574901	28.148861	2.90000	45.025000	77.50000	94.075000	100.0000
weightedDist	506.0	3.795043	2.105710	1.12960	2.100175	3.20745	5.188425	12.1265
radialHighwaysAccess	506.0	9.549407	8.707259	1.00000	4.000000	5.00000	24.000000	24.0000
propTaxRate_per10K	506.0	408.237154	168.537116	187.00000	279.000000	330.00000	666.000000	711.0000
pupilTeacherRatio	506.0	18.455534	2.164946	12.60000	17.400000	19.05000	20.200000	22.0000
pctLowerStatus	506.0	12.653063	7.141062	1.73000	6.950000	11.36000	16.955000	37.9700
medianValue_Ks	506.0	22.532806	9.197104	5.00000	17.025000	21.20000	25.000000	50.0000

```
#Divide the DataFrame into training and test sets,
"""
We choose a test data size of 30%, which is 0.3. The train_test_split function is used to
achieve this. We set the seed of the random number generator
so that we can obtain a reproducible split each time we run this code. An arbitrary value of
10 is used here.
It is good model-building practice to divide a dataset being used to develop a model into at
least two parts.
One part is used to develop the model and it is called a training set (X_train and y_train
combined).
"""
X = renamedBostonData.drop('crimeRatePerCapita', axis = 1)
y = renamedBostonData[['crimeRatePerCapita']]
seed = 10
test_data_size = 0.3
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = test_data_size,
random_state = seed)
train_data = pd.concat([X_train, y_train], axis = 1)
test_data = pd.concat([X_test, y_test], axis = 1)
```

```
#Calculate and plot a correlation matrix for the train_data set
#el backslash es para continuar la linea en el renglon siguiente
corrMatrix = train_data.corr(method = 'pearson')
xnames=list(train_data.columns)
ynames=list(train_data.columns)
plot_corr(corrMatrix, xnames=xnames, ynames=ynames,\
          title=None, normcolor=False, cmap='RdYlBu_r')
```





```
"""
In the preceding heatmap, we can see that there is a strong positive correlation (an increase
in one causes an increase in the other)
between variables that have orange or red squares.
There is a strong negative correlation (an increase in one causes a decrease in the other)
between variables with blue squares.
There is little or no correlation between variables with pale-colored squares.
"""
```

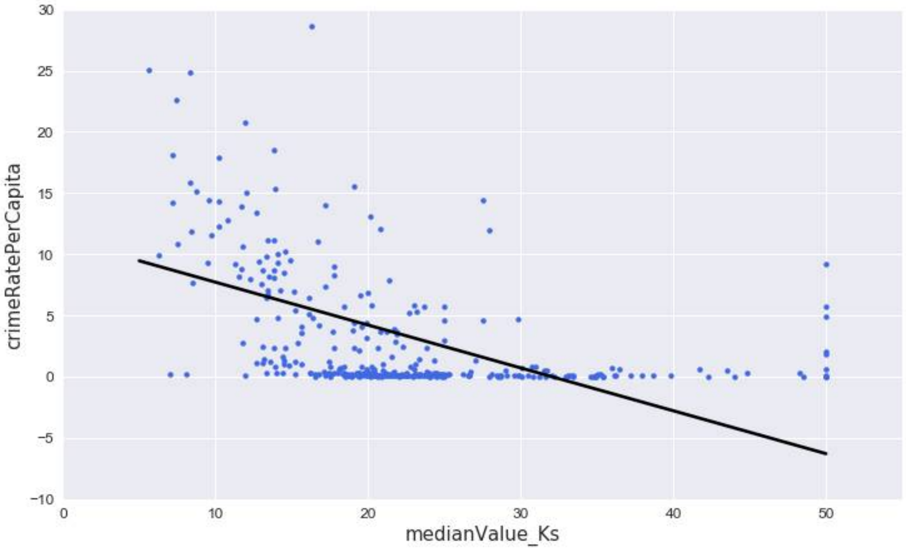
```
'\nIn the preceding heatmap, we can see that there is a strong positive correlation (an
increase in one causes an increase in the other) \nbetween variables that have orange or red
squares. \nThere is a strong negative correlation (an increase in one causes a decrease in
the other) between variables with blue squares. \nThere is little or no correlation between
variables with pale-colored squares.\n'
```

```
train_data.corr (method = 'pearson')
```

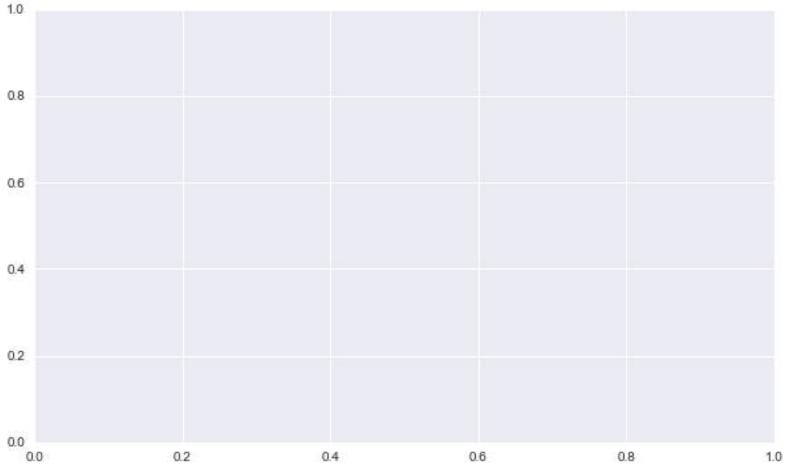
	landOver25K_sqft	non-retailLandProptn	riverDummy	nitrixOxide_pp10m	AvgNo.RoomsPerDwelling	ProptnOwnerC
landOver25K_sqft	1.000000	-0.540095	-0.059189	-0.520305	0.355346	-0.
non-retailLandProptn	-0.540095	1.000000	0.065271	0.758178	-0.399166	0.
riverDummy	-0.059189	0.065271	1.000000	0.091469	0.107996	0.
nitrixOxide_pp10m	-0.520305	0.758178	0.091469	1.000000	-0.306510	0.
AvgNo.RoomsPerDwelling	0.355346	-0.399166	0.107996	-0.306510	1.000000	-0.
ProptnOwnerOccupied	-0.577457	0.667887	0.106329	0.742016	-0.263085	1.
weightedDist	0.659340	-0.728968	-0.098551	-0.776311	0.215439	-0.
radialHighwaysAccess	-0.311920	0.580813	0.022731	0.606721	-0.183000	0.
propTaxRate_per10K	-0.324172	0.702973	-0.007864	0.662164	-0.280341	0.
pupilTeacherRatio	-0.424612	0.398513	-0.094255	0.206809	-0.350828	0.
pctLowerStatus	-0.435827	0.607457	-0.041110	0.603656	-0.586573	0.
medianValue_Ks	0.422574	-0.508338	0.136831	-0.453424	0.666761	-0.
crimeRatePerCapita	-0.198455	0.387471	-0.044587	0.405813	-0.167258	0.

```
#usando Scatter graphs
"""
Use the subplots function in matplotlib to define a canvas (assigned the variable name fig in
the following code) and a graph object (assigned the variable
name ax in the following code) in Python.
You can set the size of the graph by setting the figsize (width = 10, height = 6) argument of
the function

Use the seaborn function regplot to create the scatter plot

The function accepts arguments for the independent variable (x), the dependent variable (y),
the confidence interval of the regression parameters (ci),
which takes values from 0 to 100, the DataFrame that has x and y (data), a matplotlib graph
object (ax), and others to control the aesthetics of the
points on the graph.  (In this case, the confidence interval is set to None
"""
fig, ax = plt.subplots(figsize=(10, 6))
fig.tight_layout()
ax.set_ylabel('Crime rate per Capita', fontsize=15, fontname='DejaVu Sans')
ax.set_xlabel("Median value of owner-occupied homes in $1000's", fontsize=15, fontname='DejaVu
Sans')
ax.set_xlim(left=None, right=55)
ax.set_ylim(bottom=-10, top=30)
ax.tick_params(axis='both', which='major', labelsize=12)

sns.regplot(x='medianValue_Ks', y='crimeRatePerCapita', ci=None, data=train_data, ax=ax,
color='k', scatter_kws={"s": 20,"color": "royalblue", "alpha":1})
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x20459c4d208>
```



```
fig, ax = plt.subplots(figsize=(10, 6))
```



By The Jupyter Book community