Multivariate_Distributions

December 12, 2021

0.1 Multivariate Distributions in Python

Sometimes we can get a lot of information about how two variables (or more) relate if we plot them together. This tutorial aims to show how plotting two variables together can give us information that plotting each one separately may miss.

In [3]:
```
# import the packages we are going to be using
import numpy as np # for getting our distribution
import matplotlib.pyplot as plt # for plotting
import seaborn as sns; sns.set() # For a different plotting theme

# Don't worry so much about what rho is doing here
# Just know if we have a rho of 1 then we will get a perfectly
# upward sloping line, and if we have a rho of -1, we will get
# a perfectly downward slopping line. A rho of 0 will
# get us a 'cloud' of points
r = 1

# Don't worry so much about the following three lines of code for now
# this is just getting the data for us to plot
# Draw random samples from a multivariate normal distribution.
# Syntax : np.multivariate_normal(mean, matrix, size)
# Return : Return the array of multivariate normal values.
# https://www.geeksforgeeks.org/python-numpy-np-multivariate_normal-method/
mean = [15, 5]
cov = [[1, r], [r, 1]]
x, y = x, y = np.random.multivariate_normal(mean, cov, 400).T
x, y
```

Out[3]:
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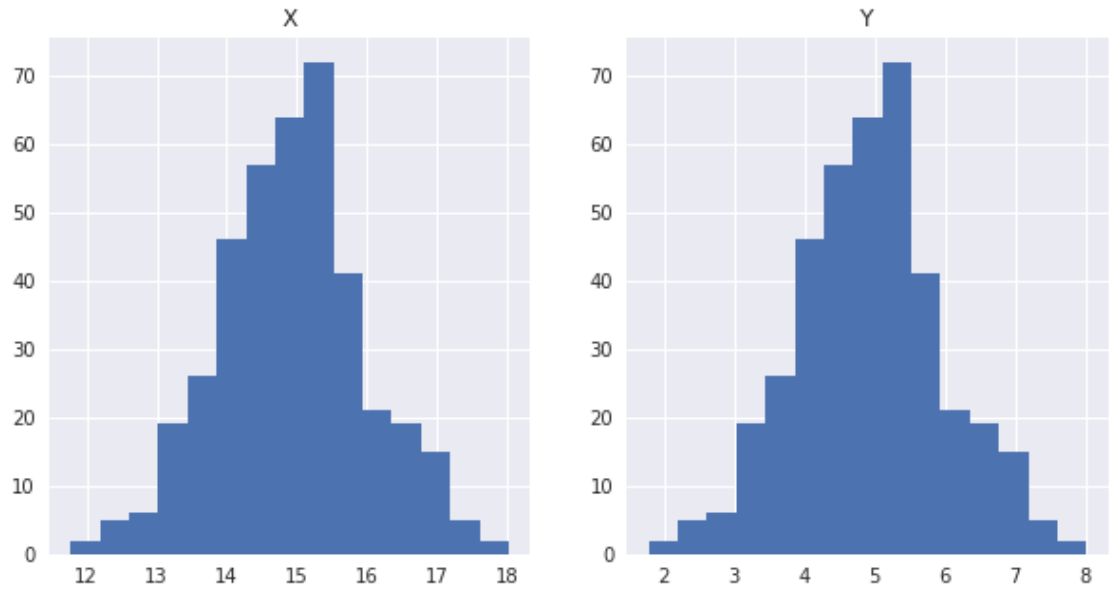
```

In [4]:
```
# Adjust the figure size
plt.figure(figsize=(10,5))

# Plot the histograms of X and Y next to each other
plt.subplot(1,2,1)
plt.hist(x = x, bins = 15)
plt.title("X")

plt.subplot(1,2,2)
plt.hist(x = y, bins = 15)
plt.title("Y")

plt.show()
```



In [5]:
```
# Plot the data
plt.figure(figsize=(10,10))
plt.subplot(2,2,2)
plt.scatter(x = x, y = y)
plt.title("Joint Distribution of X and Y")
```

```
# Plot the Marginal X Distribution
plt.subplot(2,2,4)
plt.hist(x = x, bins = 15)
plt.title("Marginal Distribution of X")


# Plot the Marginal Y Distribution
plt.subplot(2,2,1)
plt.hist(x = y, orientation = "horizontal", bins = 15)
plt.title("Marginal Distribution of Y")

# Show the plots
plt.show()
```