p2

December 16, 2024

[2]:
```python
import numpy as np
import matplotlib.pyplot as plt
from scipy.stats import multivariate_normal

# Parameters
rho = -0.8  # Correlation coefficient
mean = [0, 0]  # Mean of the distribution
cov = [[1, rho], [rho, 1]]  # Covariance matrix

# Generate samples
n_samples = 1000
Z = np.random.normal(0, 1, n_samples)
W = np.random.normal(0, 1, n_samples)
X = Z
Y = rho * Z + np.sqrt(1 - rho**2) * W

# Plot the samples
plt.figure(figsize=(10, 5))
plt.subplot(1, 2, 1)
plt.scatter(X, Y, alpha=0.5)
plt.title('Scatter plot of samples')
plt.xlabel('X')
plt.ylabel('Y')

# Plot the joint PDF and contour
x, y = np.mgrid[-3:3:.01, -3:3:.01]
pos = np.dstack((x, y))
rv = multivariate_normal(mean, cov)

plt.subplot(1, 2, 2)
plt.contourf(x, y, rv.pdf(pos), cmap='viridis')
plt.title('Joint PDF and Contour')
plt.xlabel('X')
plt.ylabel('Y')

rho = -0.4  # Correlation coefficient
mean = [0, 0]  # Mean of the distribution
```

```
cov = [[1, rho], [rho, 1]]  # Covariance matrix

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rho = 0  # Correlation coefficient
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plt.tight_layout()
plt.show()
```
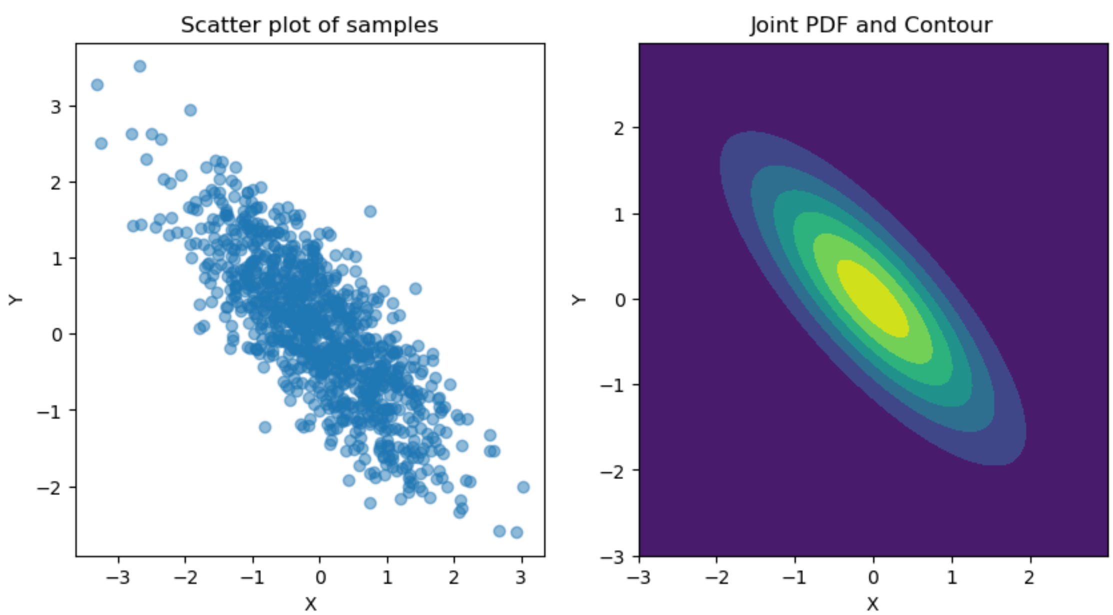
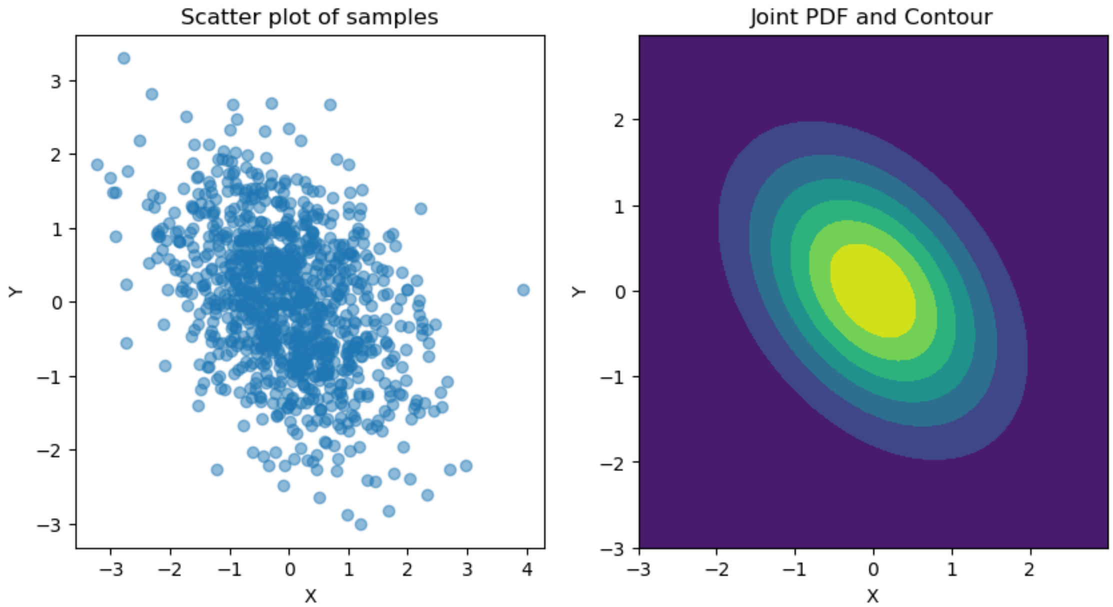
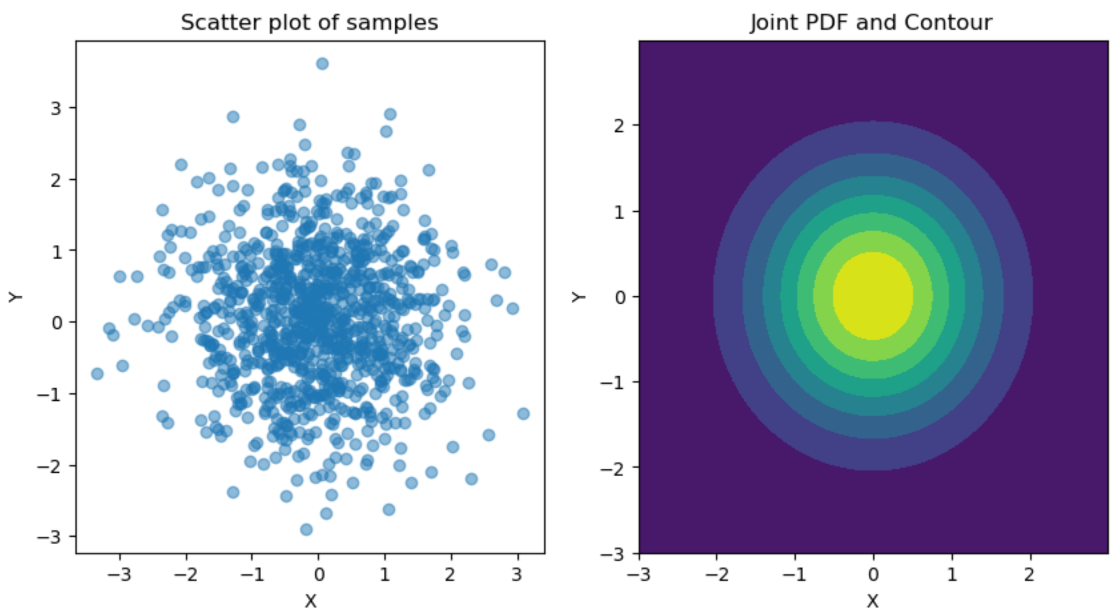




Scatter plot of samples
Joint PDF and Contour
X
Y
−3
−2
−1
0
1
2
3
4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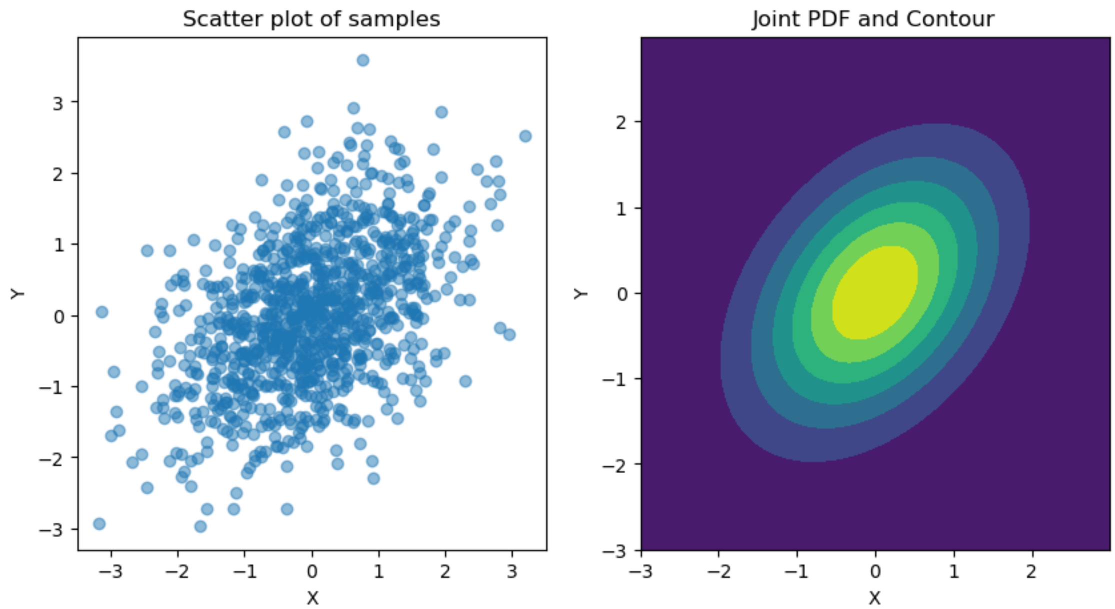
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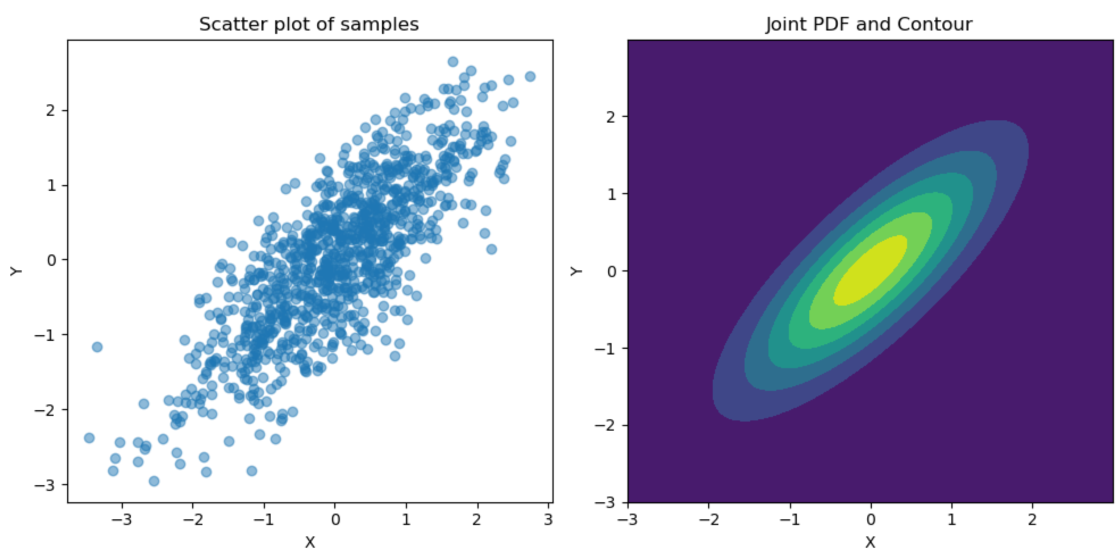
Joint PDF and Contour
X
Y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