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"""
Registration : xxxx
Description  : Generating Normal Distributed RV from Uniform RV
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import numpy as np
import matplotlib.pyplot as plt

plotuni, plotnor = 1, 0

# the random data
x1 = np.random.uniform(size=10000)
x2 = np.random.uniform(size=10000)
x1 = x1[x1 != 0]; x2 = x2[x2 != 0]

# Perform Box-Mueller Transform
y1 = np.sqrt(-2*np.log(x1))*np.cos(2*np.pi*x2)
y2 = np.sqrt(-2*np.log(x1))*np.sin(2*np.pi*x2)

left, width = 0.1, 0.65
bottom, height = 0.1, 0.65
spacing = 0.005

rect_scatter = [left, bottom, width, height]
rect_histx = [left, bottom + height + spacing, width, 0.2]
rect_histy = [left + width + spacing, bottom, 0.2, height]

fig = plt.figure(figsize=(8, 8))

ax = fig.add_axes(rect_scatter)
ax_histx = fig.add_axes(rect_histx, sharex=ax)
ax_histy = fig.add_axes(rect_histy, sharey=ax)

ax_histx.tick_params(axis="x", direction='in', labelbottom=False)
ax_histy.tick_params(axis="y", direction='in', labelleft=False)

# Plot Uniform Distro
if(plotuni):
   n,binsx,patches = ax_histx.hist(x1, bins='auto', density=True, color='lightslategrey',
edgecolor='lightsteelblue')
   ax_histx.set_ylabel('$P(x_1)$', size=12)

   n,binsy,patches = ax_histy.hist(x2, bins='auto', density=True,
orientation='horizontal', color='chocolate', edgecolor='firebrick')
   ax_histy.set_xlabel('$P(x_2)$', size=12)

   h = ax.hist2d(x1, x2, bins = (np.size(binsx),np.size(binsy)),cmap='PiYG')
   fig.colorbar(h[3], ax=ax, location='top',shrink=0.75)
   ax.set_title('Uniform Distribution', y=0.0, color='mediumblue', size=16)
   plt.show()

# Plot Gaussian Distro
if(plotnor):
   n,binsx,patches = ax_histx.hist(y1, bins='auto', density=True, color='lightslategrey',
edgecolor='lightsteelblue')
   ax_histx.plot(binsx,1/(np.sqrt(2*np.pi))*np.exp(-(binsx)**2/(2)), linewidth=2,
color='k', label=r'$P(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{(x-\mu)^2/{2\sigma^2}}$')
   ax_histx.set_ylabel('$P(x_1)$', size=14)
   ax_histx.set_title(r'$\mu = 0, \sigma = 1$', size=12)

   n,binsy,patches = ax_histy.hist(y2, bins='auto', density=True,
orientation='horizontal', color='chocolate', edgecolor='firebrick')
   ax_histy.plot(1/(np.sqrt(2*np.pi))*np.exp(-(binsy)**2/(2)), binsy, linewidth=2,
color='k',  label=r'$P(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{(x-\mu)^2/{2\sigma^2}}$')
   ax_histy.set_xlabel('$P(x_2)$', size=14)
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   ax_histy.set_title(r'$\mu = 0, \sigma = 1$', size=12)

   h = ax.hist2d(y1, y2, bins = (np.size(binsx),np.size(binsy)),cmap='PiYG')
   fig.colorbar(h[3], ax=ax, location='top',shrink=0.75)
   ax.set_title('Gaussian Distribution using Box-Mueller Transformation', y=0.0,
color='w', size=12)
   plt.show()
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