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#Matematyka konkretna
#Wariant 15 Karolina Baron

#Zadanie dotyczy obliczenia środka, osi głównych oraz kątu obrotu
danych dwuwymiarowych z pliku .csv zgodnie z wariantem zadania.

import matplotlib.pyplot as plt
import numpy as np
import pandas as pd
data = pd.read_csv('15.csv', sep=',')
center_and_axes = data.values.flatten()
center = center_and_axes[:1000]
axes = center_and_axes[1000:]
theta = np.pi / 3
R = np.array([[np.cos(theta), -np.sin(theta)],
[np.sin(theta), np.cos(theta)]])
nPoints = 10000
sig = np.array([1.0, 2.0])
xC = np.array([0.0, 0.0])
X = R @ np.diag(sig) @ np.random.randn(2, nPoints) + np.diag(xC) @
np.ones((2, nPoints))
fig = plt.figure()
ax1 = fig.add_subplot(121)
ax1.plot(X[0, :], X[1, :], '.', color='k')
ax1.grid()
plt.xlim((-6, 8))
plt.ylim((-6, 8))
Xavg = np.mean(X, axis=1)
B = X - np.tile(Xavg, (nPoints, 1)).T

U, S, VT = np.linalg.svd(B / np.sqrt(nPoints), full_matrices=0)
ax2 = fig.add_subplot(122)
ax2.plot(X[0, :], X[1, :], '.', color='k')
ax2.grid()
plt.xlim((-6, 8))
plt.ylim((-6, 8))
theta = 2 * np.pi * np.arange(0, 1, 0.01)

Xstd = U @ np.diag(S) @ np.array([np.cos(theta), np.sin(theta)])
ax2.plot(Xavg[0] + Xstd[0, :], Xavg[1] + Xstd[1, :], '-', color='r',
linewidth=3)
ax2.plot(Xavg[0] + 2 * Xstd[0, :], Xavg[1] + 2 * Xstd[1, :], '-',
color='r', linewidth=3)
ax2.plot(Xavg[0] + 3 * Xstd[0, :], Xavg[1] + 3 * Xstd[1, :], '-',
color='r', linewidth=3)

ax2.plot(np.array([Xavg[0], Xavg[0] + U[0, 0] * S[0]]),
np.array([Xavg[1], Xavg[1] + U[1, 0] * S[0]]), '-',
color='cyan', linewidth=5)
ax2.plot(np.array([Xavg[0], Xavg[0] + U[0, 1] * S[1]]),
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np.array([Xavg[1], Xavg[1] + U[1, 1] * S[1]]), '-',
color='cyan', linewidth=5)
plt.show()
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C:\Users\nextn\AppData\Local\Temp\ipykernel_20560\215279659.py:3:
DeprecationWarning:
Pyarrow will become a required dependency of pandas in the next major
release of pandas (pandas 3.0),
(to allow more performant data types, such as the Arrow string type,
and better interoperability with other libraries)
but was not found to be installed on your system.
If this would cause problems for you,
please provide us feedback at
https://github.com/pandas-dev/pandas/issues/54466

  import pandas as pd
```