# 一、实验内容

1) 使用numpy进行生成数组、数组运算、数组元素访问、矩阵转置、矩阵不同维度上元素的均值计算、矩阵不同维度上元素的排序、计算数据的标准差和方差、产生正态分布随机数的二维数组等操作。

2) 使用matplotlib绘制正余弦曲线、绘制散点图、绘制饼状图、绘制柱状图、绘制多个图形在一起显示、绘制多个图形单独显示、绘制三维图形等操作。

# 二、详细实现

1.

import numpy as np

import numpy.matlib

# create empty array 3X3 (int)

emptyArray = np.empty([3, 3], dtype=int)

print(emptyArray)

# create a 3X3 array contain all 0(int)

zerosArray = np.zeros([3, 3], dtype=int)

print(zerosArray)

# create a 3X3 eye

eyeArray = np.eye(3, dtype=int)

print(eyeArray)

# create a 3X3 array contain all 1(int)

onesArray = np.ones([3, 3], dtype=int)

print(onesArray)

# create a array by a list

byListArray1 = np.array([[1, 2, 3], [4, 5, 6], [7, 8, 9]])

print(byListArray1)

l = [1, 2, 3]

byListArray2 = np.asarray(l)

print(byListArray2)

# create array by range

rangeArray = np.arange(5, 15, 2, dtype=float)

print(rangeArray)

#linspace, and the logspace is equality so emit it

linspaceArray = np.linspace(5, 15, 10, dtype=float)

print(linspaceArray)

# and reshape the array

linspaceArray = np.linspace(5, 15, 10, dtype=float).reshape([10,1])

print(linspaceArray)

#slice in rangeArray

s = slice(2, 7, 2)

print(rangeArray[s])

#is equal to this

print(rangeArray[2:7:2])

#index in Ndarray

print(rangeArray[4])

print(byListArray1[2])

print(byListArray1[2][2])

#using ... to index

print(byListArray1[...,2])

print(byListArray1[2,...])

# example of the broadcast in Array add

print(byListArray1+byListArray2)

# create a 3X3 matrix in random element

Matrix = numpy.matlib.rand(3, 3)

print(Matrix)

# calculate the matrix's inv

print(np.linalg.inv(Matrix))

# calculate the average and for axis = 0/1 (column/raw)

print(np.mean(Matrix))

print(np.mean(Matrix, axis=0))

print(np.mean(Matrix, axis=1))

# sort the Ndarray by axis = 0/1(column/raw), and I do not use the dtype of align, so order is not used in there.

# kind is default to use 'quicksort'

print(np.sort(Matrix))

print(np.sort(Matrix, axis=0))

print(np.sort(Matrix, axis=1))

# calculate the DX and sqrt(DX) X = Matrix

# equal to mean(x-x.mean()\*\*2)

print(np.std(Matrix))

print(np.var(Matrix))

# using the package function to create a normal

normal1 = np.random.normal(size=100)

print(normal1)

mu = np.array([1, 5])

sigma = np.array([[10, 5], [5, 5]])

normal2 = np.random.multivariate\_normal(mu, sigma, 1000)

print(normal2)

2.

import numpy as np

import matplotlib.pyplot as plt

import pandas as pd

from matplotlib.ticker import MultipleLocator

# plot the sin ans cos

x = np.arange(-3\*np.pi, 3\*np.pi, 0.1)

y = np.sin(x)

plt.plot(x, y)

plt.title('sinx')

plt.show()

y = np.cos(x)

plt.plot(x, y)

plt.title('cosx')

plt.show()

# plot ob

x = np.random.randint(20, size=20)

y = np.random.randint(20, size=20)

plt.scatter(x, y)

plt.show()

# plot histogram

x = np.random.uniform(0, 1, 20)

plt.pie(x)

plt.show()

# plot bar

x = np.random.randint(20, size=20)

y = np.random.randint(20, size=20)

plt.bar(x, y, align='center')

plt.show()

# plot more in single figure

x = np.arange(-3\*np.pi, 3\*np.pi, 0.1)

y\_sinx = np.sin(x)

plt.subplot(2, 1, 1)

plt.plot(x, y\_sinx)

plt.title('sinx')

y\_cosx = np.cos(x)

plt.subplot(2, 1, 2)

plt.plot(x, y\_cosx)

plt.title('cosx')

plt.show()

# plot more figure e.g

x = np.arange(-3\*np.pi, 3\*np.pi, 0.1)

y\_sinx = np.sin(x)

plt.plot(x, y\_sinx)

y\_cosx = np.cos(x)

plt.plot(x, y\_cosx)

plt.show()

# plot 3d

from mpl\_toolkits.mplot3d import axes3d

plt.rcParams['font.sans-serif'] = ['SimHei'] # 步骤一（替换sans-serif字体）

plt.rcParams['axes.unicode\_minus'] = False # 解决坐标轴负号的显示问题

n = 1000

x, y = np.meshgrid(np.linspace(-3, 3, n),

np.linspace(-3, 3, n))

z = (1 - x / 2 + x \*\* 5 + y \*\* 3) \* np.exp(-x \*\* 2 - y \*\* 2)

plt.figure('三维平面图', facecolor='lightgray')

plt.title('三维平面图', fontsize=18)

plt.grid(linestyle=':')

ax = plt.gca(projection='3d')

ax.set\_xlabel('X', fontsize=12)

ax.set\_ylabel('Y', fontsize=12)

ax.set\_zlabel('Z', fontsize=12)

plt.tick\_params(labelsize=8)

# value of v is to set color of figure

v = np.sqrt(x \*\* 2 + y \*\* 2 + z \*\* 2)

ax.plot\_surface(x, y, z, rstride=30, cstride=30, cmap='jet')

plt.show()

# 三、实验结果

调试成功，通过几个简单测试点

# 四、心得体会

熟练使用了numpy.matlib，使用了pyplot和pandas库进行图像与三维图的绘制