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Tou output must be: 20 15 10 05 10 05 10 15 10 05 10 10	distance function d . $x_{1},x_{2},\cdots,x_{n}\}\sum_{i=1}^{n}d(y,x_{i})$ unction. The matrix directly $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{3},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{3},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{2},\cdots,x_{n}\}$ and x_{2},\cdots	
Vou output must be: 20 15 10 0.05 0.00 0.25 0.50 0.75 10 Problem 2 (10 pts) Let w ₁ , w ₂ ,, w _n , be a set of n points in a space with a computer medical using Euclidean distance as a distance in Policidataset and medical Do not use skleam, supply or any module computing distance. Use numpy functions only 20 20 20 20 20 20 20 20 20 2	distance function d . $x_{1},x_{2},\cdots,x_{n}\}\sum_{i=1}^{n}d(y,x_{i})$ unction. The matrix directly $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{3},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{3},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{2},\cdots,x_{n}\}$ and x_{2},\cdots	
Problem 2 (10 pts) Let x ₁ , x ₂ ,, x _n , be a set of n points in a space with a composition of the set of n points in a space with a composition of the set of n points in a space with a composition of the set of n points in a space with a composition of the set of n points in a space with a composition of the set of n points in a space with a composition of the set of n points in a space with a composition of the set of n points in a space with a composition of n points of n points in a space with a composition of n points	distance function d . $x_{1},x_{2},\cdots,x_{n}\}\sum_{i=1}^{n}d(y,x_{i})$ unction. The matrix directly $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{3},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{3},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{2},\cdots,x_{n}\}$ and x_{2},\cdots	
Problem 2 (10 pts) Let x ₁ , x ₂ ,, x _n be a set of n points in a space with a distance in Meddal is defined as ***** ****************************	distance function d . $x_{1},x_{2},\cdots,x_{n}\}\sum_{i=1}^{n}d(y,x_{i})$ unction. The matrix directly $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{3},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{3},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{2},\cdots,x_{n}\}$ and x_{2},\cdots	
Problem 2 (10 pts) Let x_1, x_2, \cdots, x_n be a set of x_i points in a space with a a_i . Medoid is defined as $x_{modoid} = \operatorname{argmin}_{q_i q_i}$ Compute medoid using Euclidean distance as a distance h . Plot dataset and medoid Do not use sideam, scipy or any module computing distant import mumpy as h point import mumpy as h point h	distance function d . $x_{1},x_{2},\cdots,x_{n}\}\sum_{i=1}^{n}d(y,x_{i})$ unction. The matrix directly $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{3},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{3},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{1},x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{2},\cdots,x_{n}\}$ and $x_{2},\cdots,x_{n}\}$ are $x_{2},\cdots,x_{n}\}$ and x_{2},\cdots	
• Let x_1, x_2, \cdots, x_n be a set of n points in a space with a object of Medoid is defined as $x_{medoid} - \operatorname{arguin}_{per}$ • Compute medoid using Euclidean distance as a distance n . Plot dataset and medoid • Do not use sidean, scipy or any module computing distance. • Use numpy functions only Smatplotlib inline import matplotlib.pyplot as plt import numpy as $n = n + n + n + n + n + n + n + n + n + $	$\{x_1,x_2,\cdots,x_n\}$ $\sum_{i=1}^n d(y,x_i)$ unction. The matrix directly $\{x_i,x_i,\dots,x_n\}$ $\{x_i,x_i,\dots,x_$	
- Compute medoid using Euclidean distance as a distance fit Plot dataset and medoid - Do not use skleam, scipy or any module computing distance. - Use numpy functions only **matplotlib inline import matplotlib.pyplot as plt import numpy as np def plot medoid(data):	color="r")	
import matplotlib.pyplot as plt import numpy as np def plot_medoid(data): u = data[.,np.newaxis] v = ddta.T(np.newaxis]: v = ddta.T(np.newaxis]: v = ddta.T(np.newaxis]: v = ddta.T(np.newaxis]: ax = pl.t.gca() ax.scatter(data[.,0],data[.,1],color="b") ax = pl.t.gca() ax.scatter(medoid[],medoid[],marker = 's', return plr.show() d = np.array([[1,2],[4,3],[5,6],[1,4],[5,2],[1,6]) u = d(:,:,np.newaxis] v = d.T(np.newaxis;:): v = d.	color="r")	
disall = np.linalq.norm(u-v,axis = 1) medoid data[np.argmin(disall.sum(axis = 1))] plt.scatter(data[:,0],data[:,1],color="b") ax = plt.gca() ax.scatter(medoid[0],medoid[1],marker = 's', return plt.show() d = np.array([[1,2],[4,3],[5,6],[1,4],[5,2],[1,6] u = d[:,:,np.newaxis], v = d.T[np.newaxis,:,:] disall = np.linalq.norm(u-v,axis = 1) print(d[np.argmin(disall.sum(axis = 1))]) [4 3] # DO NOT EDIT THIS CELL np.random.seed(0) data = np.random.randn(10, 2) plot_medoid(data) 20 15 10 05 00 025 050 075 100 125 150 175 You output must be: 20 15 10 05 06 07 07 08 Sample code Mmatplotlib inline import matplotlib.pyplot as plt import numpy as np def sample_code(): x = np.arange(10) y = n	color="r")	
u = d[;;,pp.newaxis] v = dT[pn.newaxis;;] disall = np.linalg.norm(u-v,axis = 1) print(d[np.argmin(disall.sum(axis = 1))])		
np.random.seed(0) data = np.random.randn(10,2) plot_medoid(data) 20 15 10 05 -05 -10 000 025 050 075 100 125 150 175 You output must be: 20 15 10 0.5 -1.0 0.00 0.25 0.50 0.75 100 0.5 -1.0 Sample code **Mmatplotlib inline import matplotlib.pyplot as plt import numpy as np def sample_code(): x = np.arange(10) y = np.arange(10) y = np.arange(10) radius = 10 plt.scatter(x, y) ax = plt.gca() ax.ad(patch(plt.circle(center, radius, color plt.axis('equal') plt.show() sample_code() 10.0 7.5 5.0 -2.5 -5.0 -7.5 -10.0	1.25 1.50 1.75	
10	1.25 1.50 1.75	
You output must be: 20 -1.0 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0.5 -0	1.25 1.50 1.75	
15 10 0.5 0.0 -0.5 -1.0 0.00 0.25 0.50 0.75 100 Sample code **matplotlib inline import matplotlib.pyplot as plt import numpy as np def sample_code(): x = np.arange(10) y = np.arange(10) center = (0, 0) radius = 10 plt.scatter(x, y) ax = plt.gca() ax.add_patch(plt.circle(center, radius, color plt.axis('equal') plt.show() sample_code() 10.0 7.5 5.0 2.5 0.0 -2.5 -5.0 -7.5 -10.0	1.25 1.50 1.75	
Code Sample code Matplotlib inline import matplotlib.pyplot as plt import numpy as np def sample_code(): x = np.arange(10) y = np.arange(10) center = (0, 0) radius = 10 plt.scatter(x, y) ax = plt.gca() ax.add_patch(plt.Circle(center, radius, color plt.axis('equal') plt.show() sample_code()	1.25 1.50 1.75	
Sample code *matplotlib inline import matplotlib.pyplot as plt import numpy as np def sample_code(): x = np.arange(10) y = np.arange(10) center = (0, 0) radius = 10 plt.scatter(x, y) ax = plt.gca() ax.add_patch(plt.Circle(center, radius, color plt.axis('equal') plt.show() sample_code()	1.25 1.50 1.75	
<pre>%matplotlib inline import matplotlib.pyplot as plt import numpy as np def sample_code(): x = np.arange(10) y = np.arange(10) center = (0, 0) radius = 10 plt.scatter(x, y) ax = plt.gca() ax.add_patch(plt.Circle(center, radius, color plt.axis('equal') plt.show() sample_code() 10.0 7.5 5.0 -7.5 -10.0</pre>		
<pre>x = np.arange(10) y = np.arange(10) center = (0, 0) radius = 10 plt.scatter(x, y) ax = plt.gca() ax.add_patch(plt.Circle(center, radius, color plt.axis('equal') plt.show() sample_code()</pre> 10.0 7.5 5.0 2.5 -0.0 -7.5 -10.0		
sample_code() 10.0 7.5 5.0 2.5 0.0 -2.5 -5.0 -7.5 -10.0	-='r', alpha=0.2))	
2.5 - 0.0 - -2.5 - -5.0 - -7.5 - -10.0 -		
-15 -10 -5 -		
Problem 3 (5 pts) • We want to draw a scatter plot using data • Plot the center using a green square symbol		
 Plot points inside radius from center using red dots Plot points out of the radius from center using 'CO' colored Draw a filled circle centered at center using red color and a mature import matplotlib.pyplot as plt import numpy as np 		
<pre>def points_within_radius(data, center, radius): plt.scatter(center[0],center[1],marker = 's', ax = plt.gca() ax.add_patch(plt.Circle(center, radius, color v = center[np.newaxis,:] v = np.repeat(v,len(data),0) disall = np.linalg.norm(data-v,axis=1) bd = data[np.where(disall>radius)] rd = data[np.where(disall<=radius)]</pre>		
<pre>plt.scatter(bd[:,0],bd[:,1], color="C0") plt.scatter(rd[:,0],rd[:,1], color="r") plt.axis('equal') plt.show() d = np.array([[1,2],[4,3],[5,6],[1,4],[5,2],[1,6]) radius = 4.0</pre>	13)	
<pre>center = np.random.randn(2) v = np.repeat(center[np.newaxis,:],len(d),0) print(v) disall = np.linalg.norm(d-v,axis=1) print(disall) t=np.where(disall <radius) pre="" print(d[t])<=""></radius)></pre>		
[[-2.55298982 0.6536186] [-2.55298982 0.6536186] [-2.55298982 0.6536186] [-2.55298982 0.6536186] [-2.55298982 0.6536186] [-2.55298982 0.6536186]] [3.79953675 6.96040094 9.25372624 4.88077915 7.672	205305 6.41930921]	
<pre># DO NOT EDIT THIS CELL np.random.seed(1) data = np.random.randn(10,2) radius = 3.0 center = np.random.randn(2) points_within_radius(data, center, radius)</pre>		
4 - 3 - 2 - 1 - 0 - 1		
You output must be:		
3 -		
1 - 0 -		
-1 -2 -6 -4 -2 0	2 4	
 Problem 4 (10 pts) We want to find k nearest points from the center Plot the center using a green square symbol Plot k-nearest points from center using red dots Plot other points using 'C0' colored dots 		
 Draw a filled circle centered at center using red color and a Do not use sklearn, scipy or any module computing k-neare Use numpy functions only *matplotlib inline import matplotlib.pyplot as plt		
<pre>import numpy as np def points_k_nearest(data, center, k=1): plt.scatter(center[0], center[1], marker = 's', v = center[np.newaxis,:] v = np.repeat(v,len(data),0) disall = np.linalg.norm(data-v,axis=1) sortdist=np.argsort(disall) rediverdisall[scartdist[k,1]]</pre>	color="g")	
<pre>radius=disall[sortdist[k-1]] ax = plt.gca() ax.add_patch(plt.Circle(center, radius, color bd = data[np.where(disall>radius)] rd = data[np.where(disall<=radius)] ax.scatter(bd[:,0],bd[:,1], color="C0") ax.scatter(rd[:,0],rd[:,1], color="r") ax.axis('equal') plt.show()</pre>	='r', alpha=0.2))	
<pre># YOUR CODE MUST BE HERE # DO NOT EDIT THIS CELL np.random.seed(1) data = np.random.randn(10,2) k = 5 center = np.random.randn(2) points_k_nearest(data, center, k)</pre>		
3 - 2 - 1 -		
012 - 0 2 4		
You output must be:		
2 - 1 - 0 -		
-1 -2 -		
# DO NOT EDIT THIS CELL np.random.seed(1) data = np.array([[1.,0.],[0.,1.],[-1.,0.],[0.,-1.	.],[1.,1.],[1.,-1.],[-1.,1.],[-1	.,-1.17
<pre>np.random.shuffle(data) k = 1 center = np.array([0.,0.]) points_k_nearest(data, center, k)</pre>	,,, ±,,,±,],[-1	- 11)
0.73 0.50 - 0.25 - 0.00 - -0.25 - -0.50 - -0.75 -		
-1.001.5 -1.0 -0.5 0.0 0.5 1.0 1.5 You output must be:		
1.00 - 0.75 - 0.50 - 0.25 -		
0.00 - -0.25 - -0.50 -		
-0.75 - -1.00 - -1.5 -1.0 -0.5 0.0	0.5 1.0 1.5	
 Problem 5 (15 pts) find_k_nearest_index returns the index of the k-nearest We want to time the execution Do not use sklearn, scipy or any module computing k-neare Use numpy functions only 	est points directly	
 Points: when mean time ≤ 5s: 15 pts when mean time > 5s and ≤ 10s: 10 pts when mean time > 10s: 5 pts import numpy as np		
<pre>def find_k_nearest_index(data, center, k=1): v = np.repeat(center[np.newaxis,:],len(data), disall = np.linalg.norm(data-v,axis=1) radius=disall[np.argsort(disall)[k-1]] return np.where(disall<=radius)[0] # YOUR CODE MUST BE HERE</pre>	0)	
<pre># DO NOT EDIT THIS CELL np.random.seed(0) data = np.array([[1.,0.],[0.,1.],[-1.,0.],[0.,-1. np.random.shuffle(data) k = 1 center = np.array([0.,0.]) print(find k nearest index(data, center, k))</pre>],[1.,1.],[1.,-1.],[-1.,1.],[-1	.,-1.]])
<pre>print(find_k_nearest_index(data, center, k)) [1 2 4 5] You output must be: [1 2 4 5]</pre>		
<pre># DO NOT EDIT THIS CELL np.random.seed(100) data = np.random.randn(10000000,20) # 10 million k = 5 center = np.random.randn(20) print(find_k_nearest_index(data, center, k)) %timeit find_k_nearest_index(data, center, k)</pre>	on data	
[1664998 3042821 3307688 3848441 5351099] 4.27 s ± 11.5 ms per loop (mean ± std. dev. of 7 m You output must be: [1664998 3042821 3307688 3848441 5351099]	runs, 1 loop each)	
Your time must be around: 1.99 s ± 113 ms per loop (mean ± std. dev. of the std. dev. dev. dev. dev. dev. dev. dev. de		
1 loop, best of 5: 1.2 s per loop Ethics: If you cheat, you will get negatgive of the total points. If the hom		et -22.
 What to submit Run all cells after restarting the kernel Goto "File -> Print Preview" Print the page as pdf 		
 Pdf file name must be in a form of: homework_2_홍길동_2 Submit the pdf file in google classroom No late homeworks will be accepted Your homework will be graded on the basis of correctness and accepted 		

Homework 2. Numpy and matplotlib

Double Click here to edit this cell

• Student ID: 201803430

• Name: 조성현