assignment04

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1 K-means clustering on color image

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In [1]: import matplotlib.pyplot as plt
        import numpy as np
        import random

        file_data                = "mnist_train.csv"
        handle_file        = open(file_data, "r")
        data                        = handle_file.readlines()
        handle_file.close()

        size_row        = 28    # height of the image
        size_col          = 28    # width of the image

        num_image         = len(data)
        count                = 0      # count for the number of images



        #
        # normalize the values of the input data to be [0, 1]
        #
        # def normalize(data):

        #     data_normalized = (data - min(data)) / (max(data) - min(data))

        #     return(data_normalized)

        #
        # example of distance function between two vectors x and y
        #
        def distance(x, y):
```

```
    d = (x - y) ** 2
    s = np.sum(d)
    #r = np.sqrt(s)

    return(s)

#
# calcuate the values of the input data in l2-norm
#
def norm(x):
    r = np.sqrt(x.T * x)

    return(r)


#
# make a matrix each column of which represents an images in a vector form
#
list_image  = np.empty((size_row * size_col, num_image), dtype=float)
list_label  = np.empty(num_image, dtype=int)

k = 10
list_centroid = np.zeros((size_row * size_col, k), dtype=float)
list_count = np.zeros(k)
for line in data:

    line_data   = line.split(',')
    label       = random.randint(0, k - 1)
    im_vector   = np.asfarray(line_data[1:])
#     im_vector   = normalize(im_vector)

    list_label[count]       = label
    list_image[:, count]    = im_vector
    list_centroid[:, label]+= im_vector
    list_count[label]      += 1

    count += 1

for i in range(0, k):
    list_centroid[:, i] /= list_count[i]


while True:
    checkUpdate = 0
    for i in range(0, num_image):
        label = int(list_label[i])
        min = distance(list_centroid[:, label], list_image[:, i])
        for j in range(0, k):
            if j == label:
                continue

            checkDistance = distance(list_centroid[:, j], list_image[:, i])
            if(min > checkDistance):
                list_label[i] = str(j)
                min = checkDistance
                checkUpdate += 1

    if(checkUpdate == 0):
        break

    list_centroid = np.zeros((size_row * size_col, k), dtype=float)
    list_count = np.zeros(k)

    for i in range(0, num_image):
        label = int(list_label[i])
        list_centroid[:, label] += list_image[:, i]
        list_count[label]       += 1

    for i in range(0, k):
        list_centroid[:, i] /= list_count[i]
```

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<Figure size 640x480 with 10 Axes>
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In [2]: #
        # plot 0 ~ 9 mean-images with their labels
        #
        f1 = plt.figure(1)

        for i in range(0, k):

            label       = i
            im_vector   = list_centroid[:, i]
            im_matrix   = im_vector.reshape((size_row, size_col))

            plt.subplot(1, k, i+1)
            plt.title(label)
            plt.imshow(im_matrix, cmap='Greys', interpolation='None')

            frame   = plt.gca()
            frame.axes.get_xaxis().set_visible(False)
            frame.axes.get_yaxis().set_visible(False)

        plt.show()
```

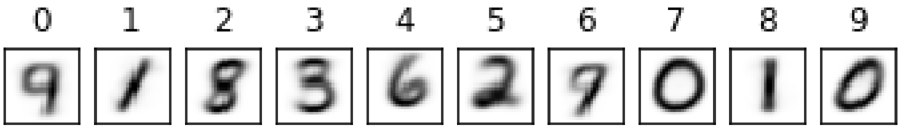
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