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%=====
%LOAD UCI DATASET
%=====

file_path = '/Users/charlesdavi/Desktop/Datasets/UCI/Ionosphere_full_dataset.txt';
dataset = csvread(file_path);
num_rows = size(dataset,1);
N = size(dataset,2) - 1;

%=====
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%LOAD MNIST DATA
%=====
=====
pkg load image

directory_path = '/Users/charlesdavi/Desktop/MNIST/MNIST - JPG - training/'; %you will
need to adjust this

N = 11^2;

counter = 1;

for k = 0 : 9

    num_images = 100;

    category_number = k;

    directory = [directory_path int2str(k) '/'];

    for i = 1 : num_images

        I = imread([directory '1 (' int2str(i) ').jpg']);

        MNIST_array{counter} = I;
        MNIST_category{counter} = k; %stores the classifier associated with the image
        counter = counter + 1;

    endfor

endfor

%EXTRACTS SHAPE INFORMATION

total_num_images = 10*num_images; %there are 10 categories of images
corresponding to the digits 0 through 9

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counter = 1; %index for the observations
dataset = [];

scramble = randperm(total_num_images,total_num_images); %this is to permute the
dataset, which would otherwise be sorted

%iterates through entire dataset
while(counter <= total_num_images)

I = MNIST_array{scramble(counter)};

[X Z] = read_MNIST(I);

m = size(X,2);

density_matrix = calc_pixel_density(X,Z(1:m));

input_vector = reshape(density_matrix, [1 N]);

input_vector(N+1) = MNIST_category{scramble(counter)}; %this is the hidden classifier

dataset(counter,:) = input_vector;

counter = counter + 1;

endwhile

num_rows = size(dataset,1);
N = size(dataset,2) - 1;

%=====
%CLUSTER DATA
%=====

tic;[cluster_matrix final_delta] = fully_vectorized_delta_clustering(dataset, N);toc

%=====
%TESTS ACCURACY
%=====
cluster_matrix = reshape(cluster_matrix, [num_rows num_rows]); %reshapes for testing
accuracy

total_num_errors = 0;

for i = 1 : num_rows

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num_errors = 0;
x = find(cluster_matrix(i,:) == 1); %all of the rows in the cluster for row i
temp_row = x(1); %this is just one row in the cluster
classifier = dataset(temp_row, N + 1); %this is the classifier for the temp row

cluster_classifiers = dataset(x,N+1); %this is a vector of classes for the cluster

num_errors = num_errors + sum(cluster_classifiers != classifier);

accuracy(i) = 1 - num_errors/num_rows;

total_num_errors = total_num_errors + num_errors;

endfor

mean(accuracy)
```