```matlab
% Class: EE133A
% Date: Oct 3rd 2016
% HW1.16
% Name: Haoran Zhang
% UID: 804586710
%

%Load the file  and declare constants and variables
Num_Clusters = 20;
Img_Size = 784;
Norm_of_Diff = zeros(1,20);
J_Clust = 0;
J_Clust_Prev = 1;
load mnist_train.mat

%change digits from 784x60000 to 784x10000
digits = digits(:,1:10000);

%assign random group to each vector from 1 to 20
group = randi(Num_Clusters,1,10000);

%Z is group representitives 783x20
Z = zeros(Img_Size , Num_Clusters);

%for each iteration when (J_Clust_Prev-J_Clust)/J_Clust>10e-5
%calculate the mean from each group 1 to 20
%for each vector
%calculate the norm to all 20 representitives
%choose the minimum norm and assign group index
%to that digit

while abs((J_Clust_Prev-J_Clust)/J_Clust) > 10e-5
    J_Clust_Prev = J_Clust;
    for ii = (1 : Num_Clusters)
        I = find(group == ii);
        G = digits(:,I);
        Z(:,ii) = mean(G,2);
    end

    for ii = (1 : 10000)
        V = repmat(digits(:,ii),1,20)-Z;
        for kk =(1 : 20)
            Norm_of_Diff(kk) = norm(V(:,kk))^2;
        end
        [Val,group(ii)] = min(Norm_of_Diff);
        J_Clust = J_Clust +Val;
    end
    J_Clust = J_Clust/10000;
end

%display the final 20 representitives
for kk = 1:20
    subplot(4,5,kk)
```
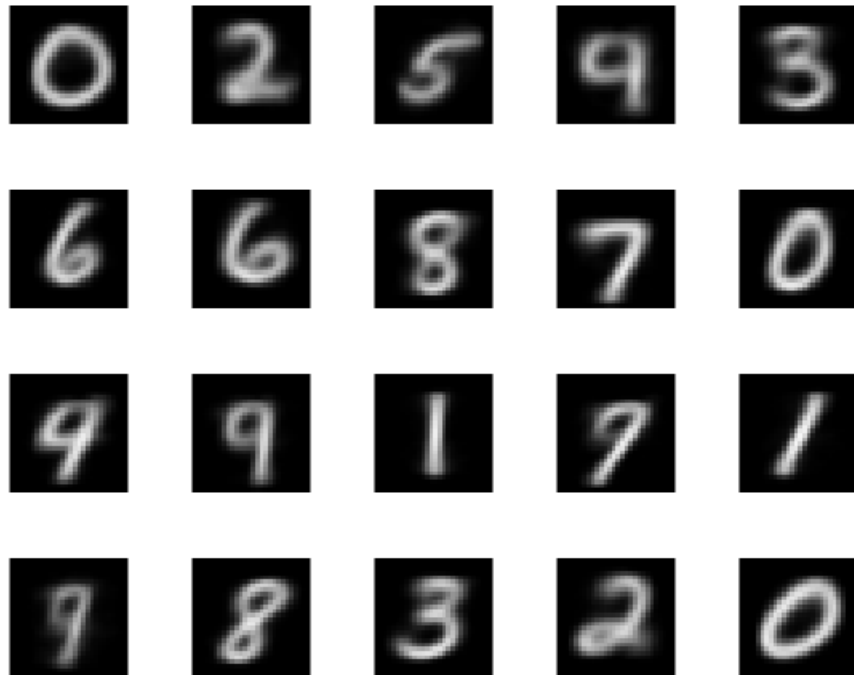
```matlab
        imshow(reshape(Z(:,kk),28,28));
end
```