Load Data

```
clear
load("mnist.mat");
```

PCA for each digit

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%Iterate through each digit
for d=0:9
   digits = digits_train(:, :, labels_train==d); %get images corresponding to the image
   digits = reshape(im2double(digits), [784 size(digits, 3)]); %reshape the images. Eac

   mean_vector = sum(digits, 2)/size(digits, 2); %calculate mean for each of the 784 co
   digits = digits - mean_vector; % subtract mean from data

   cov = digits*digits'/size(digits, 2); % calculate the co-variance matrix for the dat
   [V, D] = eig(cov); % Eigen value decomposition for the co variance matrix

   [~, i] = sort(diag(D), 'descend'); % get the index permutation correspoding to decre
   V = V(:, i); %sort the eigen vectors
   D = D(i, i); %sort the eigen values

   v1 = V(:, 1); %eigen vector with maximum eigen vector
   lambda1 = D(1, 1); %maxximum eigen value

   figure;
   plot(diag(D)); %plot the eigen values
   title(["Eigenvalues for Digit " num2str(d)]);

   %show the three images mu, mu-sqrt(l*v), mu + sqrt(l*v)
   figure;
   subplot(1,3,1); imagesc(reshape(mean_vector - sqrt(lambda1)*v1,[28 28]));
   title("\mu - sqrt(\lambda_1)*v_1 for " + string(d))
   subplot(1,3,2); imagesc(reshape(mean_vector,[28 28]));
   title("\mu for " + string(d))
   subplot(1,3,3); imagesc(reshape(mean_vector + sqrt(lambda1)*v1,[28 28]));
   title("\mu + sqrt(\lambda_1)*v_1 for " + string(d))
%      disp("Number of eigen values greater than 1 are "+num2str(sum(diag(D)>=1)))
end
```