CS549 Homework 3

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1 Introduction

So like the last assignment, this one has taken more time than expected. Unlike the last time, I figured that it would be better to get a fully complete assignment a handful of minutes late.

Another point of potential contention, I pre-normalized each image (in the way that is common in most Machine Learning problems), which I think is suggested by the homework assignment, but the statement that was made on piazza made that confusing to me.

2 Eigenface

Subset	error, d = 9	error,d=30
1	1	1
2	1	0.9917
3	0.8167	0.8167
4	0.3214	0.3357
5	0.2263	0.1947

These results make some sense, but I wasn't sure if some of it had to do with the normalization I was conducting. I spent 3 or 4 hours trying to figure out where else it could be going wrong, but I couldn't find it. It may have to do with the fact that I stored the data in the matrices with rows as columns and vice versa, and so I had to remember to transpose in an opposite way than the equations shown.

$$x_i = (x_i - \mu_i)/{\sigma^2}_i \tag{1}$$

$$\mu_{train} = eltwise\ mean\ of\ training\ set\ pixels. \tag{2}$$

$$x_{mod} = x - \mu_{train} \tag{3}$$

$$\Sigma = 1/(num_{img} - 1) * {x_{noMean}}^T (x_{noMean}) \tag{4}$$

$$U = eig(\Sigma) \tag{5}$$

$$V = U(1:d) \tag{6}$$

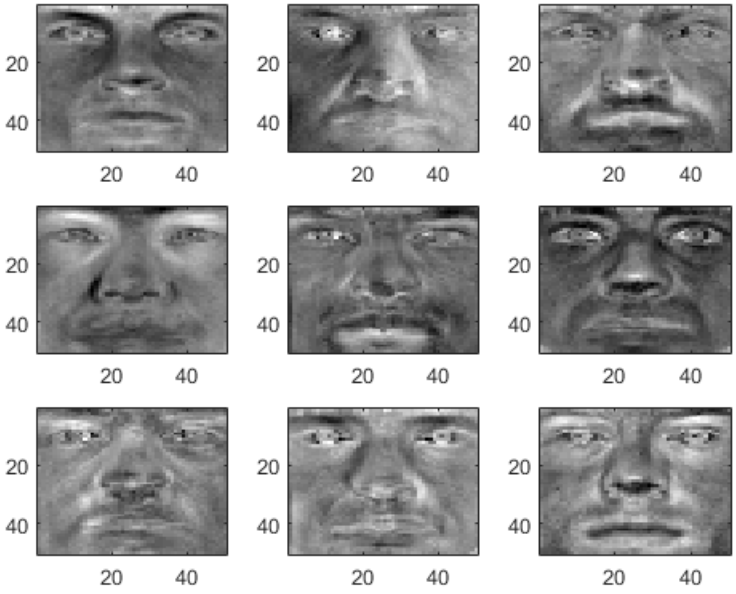
Once the eigenspace is calculated with the equations just presented, data can be converted into the space using the equation:

$$X_{eig} = V * X \tag{7}$$

Below is the figure showing the 9 eigenfaces that had the largest eigenvalues, with strongest in the top left and weakest in the bottom right.

2.1 Fisher Linear Discriminant

Based on what time it is and when I have to wake up, I will finish this tomorrow. Whether or not you will accept it is up to you. I'm pretty disappointed in the state that I'm turning this in right now, but I did not anticipate it taking me 4-5 hours figuring out that one thing in eigenfaces, as I thought I had that pretty much done on Saturday. An updated one will be uploaded tomorrow, regardless of if you accept it.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