

Avery Peiffer

4042056

ECE 2390 – Fall 2021

Problem Set 6 Report

TEXT RESPONSES

1b. The result looks like a very general outline of a face that represents the average of all the faces in the training directory. It is blurry and has no real distinct features, which makes sense since it is the average of 320 images of faces.

1c. The covariance matrix is a very large expression of the covariance between pixels. The 8 eigenfaces, while horrifying, represent a basis set of faces from which other faces can be generated through a linear combination. They are fairly generic and, again, show no distinct features.

1d. It took 171 eigenvectors to capture 95% of the training data variance. However, it is important to note that this can vary when rerunning the data preprocessing code, because it depends on which images are sorted into the training data.

2b. W_{training} is a 320x171 matrix. W_{testing} is a 80x171 matrix.

3a. The results for the KNN classifiers show that the images in the test set are very distinctive – since the best accuracy is achieved when $K=1$, this means that the single nearest neighbor to the test image is often enough to identify it. As more neighbors are incorporated, the accuracy of the models drop off. This means that the KNN algorithm is starting to take votes from the other classes.

K	Accuracy
1	.95
3	.875
5	.85
7	.775
9	.7375
11	.6625

3b. The SVM seems to generally be more accurate than KNN (except for the RBF kernel – I don't know if this is a mistake or is the genuine result). This does make sense, as the classes being fairly separable should mean that the support vector algorithms have an easier time finding a hyperplane to separate them.

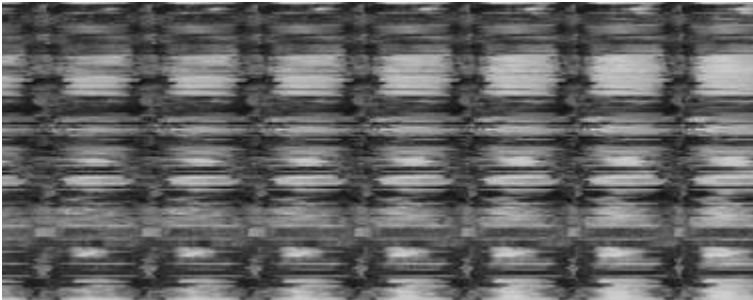
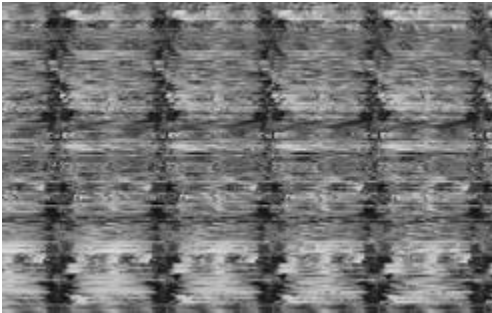
Kernel	Accuracy
Linear	.95
Polynomial	.85
RBF	.025

IMAGE OUTPUTS

Ps5-0.png



Ps6-1-a.png (some screenshots taken throughout the image)



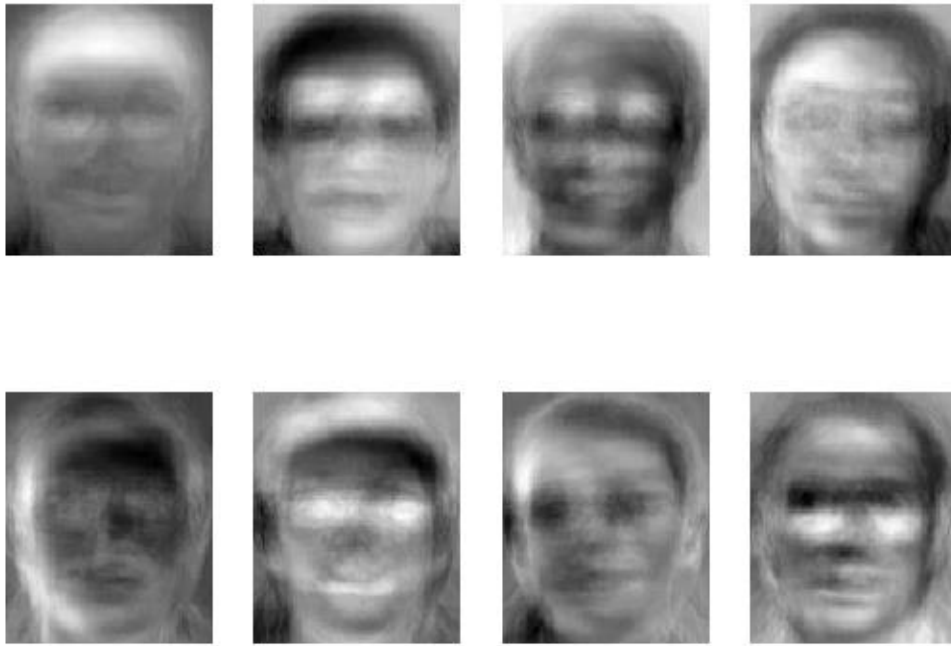
Ps6-1-b.png



Ps6-1-c-1.png



Ps6-1-c-2.png



Ps6-1-d.png

