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**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 |

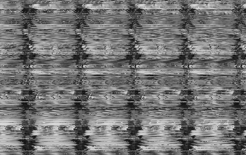
IMAGE OUTPUTS

Ps5-0.png

A close up of a person

Description automatically generated with medium confidence

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



A black and white photo of trees

Description automatically generated with low confidence

Ps6-1-b.png

No image

Description automatically generated

Ps6-1-c-1.png

Background pattern

Description automatically generated

Ps6-1-c-2.png

A collage of a person's face

Description automatically generated with medium confidence

Ps6-1-d.png

Chart

Description automatically generated