AMATH 582: HOMEWORK 3

HUNTER LYBBERT

Applied Mathematics Department, University of Washington, Seattle, WA
hlybbert@uw.edu

Abstract. In this report we convey the results of our survey of supervised machine learning algorithms. The MNIST digits dataset was used as a demo task to compare the performance for each of the supervised ML algorithms. We made use of the Ridge Regression Classifier, K-Nearest Neighbors, and Linear Discriminant Analysis. As well as other methods used not discussed in class such as a Random Forest Classifier and a Gradient Boosted Classifier.

1. Introduction and Overview

TODO: update this

2. Theoretical Background

TODO: update this
Let's get into the actual implementation now.

3. Algorithm Implementation and Development

TODO: update this
As more of an exploratory step we performed an analysis of how much information or energy is retained in our data matrix given a certain number of components are retained in the PCA transformation, see Figure 1 for a visualization of the percent of energy preserved by a given number of PCA components.

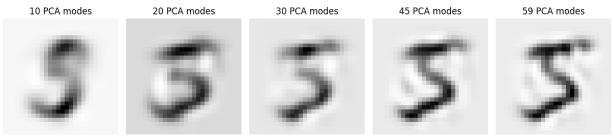

Figure 1. **TODO: update this** An analysis of how much information or energy is retained in our data matrix given a certain number of components are used in the PCA transformation.

See Figure 2 for the visuals described.
sklearn's **ClassifierMixin** and **BaseEstimator** classes. See code for further details.

4. Computational Results

TODO: update this

Date: February 27, 2025.

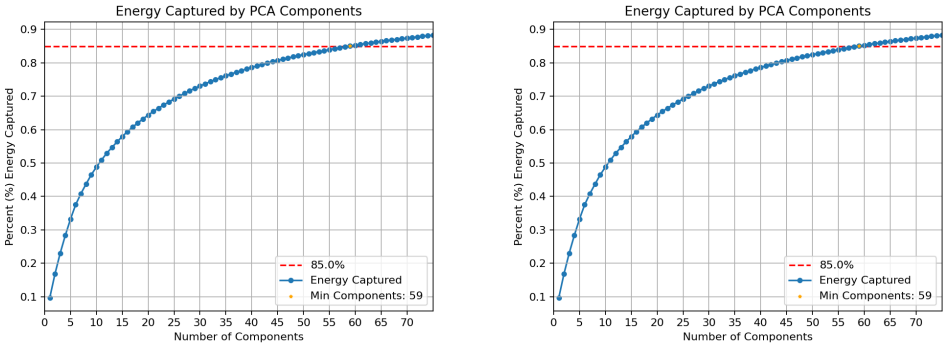

FIGURE 2. **TODO: update this** We have visualized the lower dimensional projection of the robot movement data in both 2 and 3 dimensions. The projected data points (frames from the movement samples) are colored according to movement types.

5. Summary and Conclusions

TODO: update this

Acknowledgements

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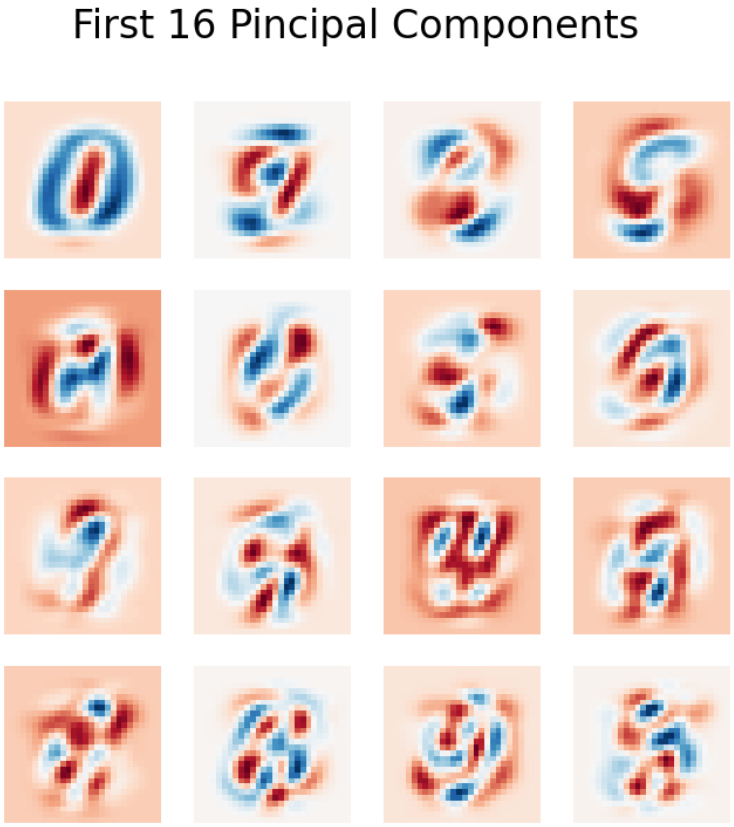

FIGURE 3. **TODO: update this** On the left we are looking at the result of projecting the training set into 2 dimensions. The centroids we calculated have also been plotted as stars. Finally, on the right we have recolored each projected point by which movement type it is classified as using our centroid based classification model.

FIGURE 4. **TODO: update this** This contains the same information as Figure 3 with the exception that this is 3d.