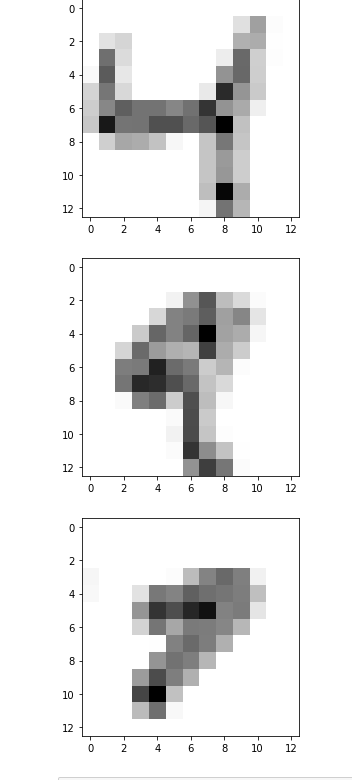
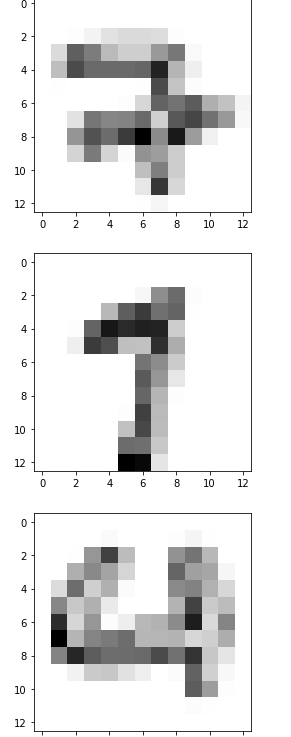
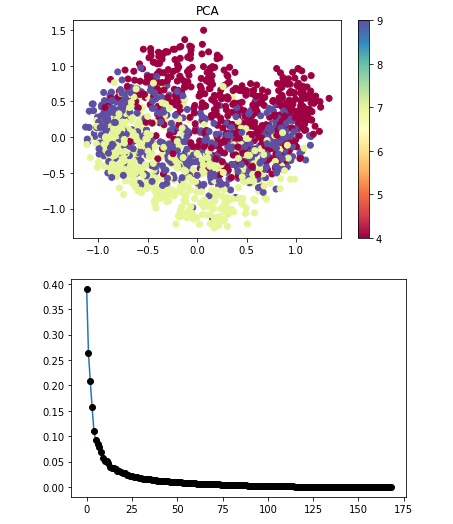
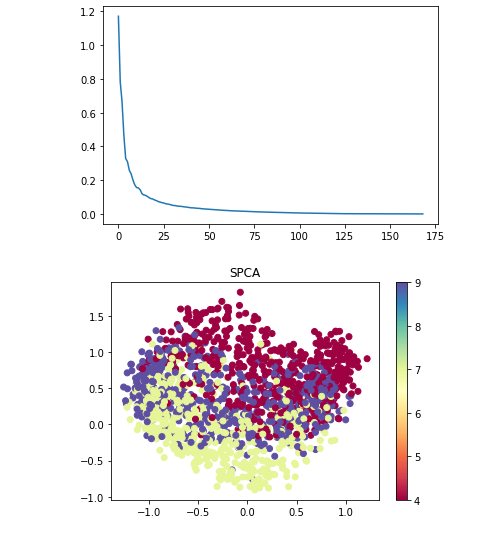
We have a dataset (it is a specially prepared part of MNIST), with 1508 vectors corresponding to 13x13 images of digits 4,7 and 9, so the size of the data matrix is 1508x169. The digits look like this:

The dataset is located at <https://github.com/Mirkes/DAPCA/raw/main/datasets/MNIST_M/MNIST_ex479.mat>

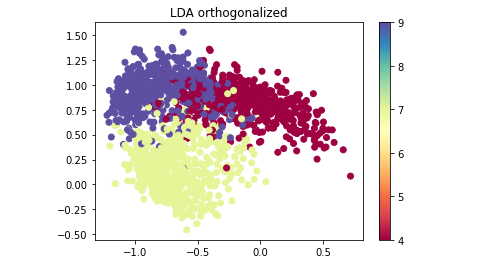
Here is the PCA of this dataset, with the scree plot for the first 10 components:

We apply Supervised PCA (e.g., with alpha=1 meaning points of the same class will be contracted with the same force and the point of different classes will repulse).



The result looks identical to PCA. No other choice of alpha can affect this result: it always looks like PCA.

However, we know that exists a LINEAR orthogonal projection where these three classes are well-separated. It can be obtained by simplest orthogonalization of the 2 vectors connecting two pairs of class centroids:



**Question: why we can not improve the PCA projection in terms of class separation using Supervised PCA?**