Assignment 4

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Lab Assignment 4

After having a brief conversation with Joshua Tenenbaum, the primary creator of the isometric feature mapping algorithm, it only seems right that we make your first lab assignment be replicating his canonical, dimensionality reduction research experiment for visual perception! In fact, you will also be using his original dataset from December 2000. It consists of 698 samples of 4096-dimensional vectors. These vectors are the coded brightness values of 64x64-pixel heads that have been rendered facing various directions and lighted from many angles. Replicate Dr. Tenenbaum's experiment by:

1. Applying both PCA and Isomap to the 698 raw images to derive 2D principal components and a 2D embedding of the data's intrinsic geometric structure.
2. Project both onto a 2D scatter plot, with a few superimposed face images on the associated samples.
3. Extra: If you're feeling fancy, increase n_components to three, and plot your scatter plot on a 3D chart.

NOTE: If you encounter issues with loading .mat files using SciPy, you might want to see this Stack Overflow post and check the version of SciPy you're using.

Lab Questions

4 points possible (graded)

Between linear PCA and the non-linear Isomap, which algorithm is better able to capture the true nature of the faces dataset when reduced to two component?

- PCA
- IsoMap

Each coordinate axis of your 3D manifold should correlate highly with one degree of freedom from the original, underlying data. In the isomap plot of the first two components (0 and 1), which 'degree of freedom' do you think was encoded onto first component (the X-axis) encoded? In other words, what varies as you move horizontally in your manifold rendering?

Select an option ▾

Alter your code to graph the second and third components (index=1 and 2) instead of the 0th and 1st, for both PCA and Isomap. Look *closely* at the Isomap plot. Can you tell what 'degree of freedom' the X axis represents?

Select an option ▾

In his experiment, Dr. Tenenbaum set his K-parameter (n_neighbors is SciKit-Learn) to 8. Try reducing that figure down to 3 and re-running your code. Does the X-Axis still represent the same degree of freedom?

Select an option ▾

Submit You have used 0 of 2 attempts