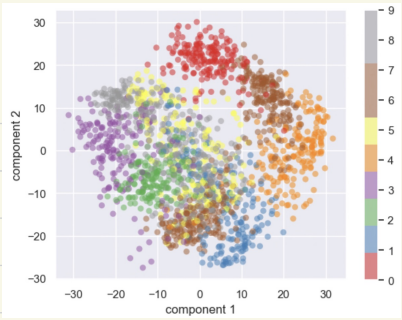


Exercises for PCA

Digits 0-9

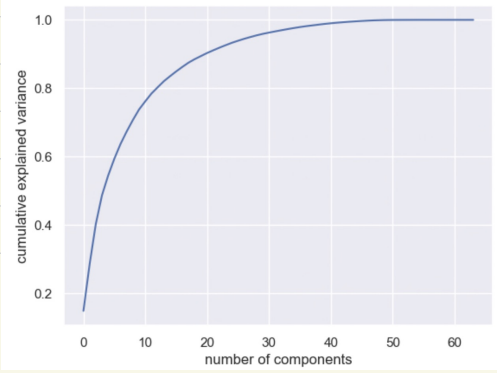
1. (i) From the course GitHub page, download and run the jupyter notebook
05.09-Principal-Component-Analysis.ipynb

(ii) For the digits 0-9 example, edit the code to not only plot PCA basis vectors 1 vs 2, but to also plot PCA basis vectors 1 vs 3. Do some classes now appear closer together? Do other classes now appear further apart?

(iii) For the digits 0-9 example, edit the code to plot PCA basis vectors 19 vs 20. What changes?

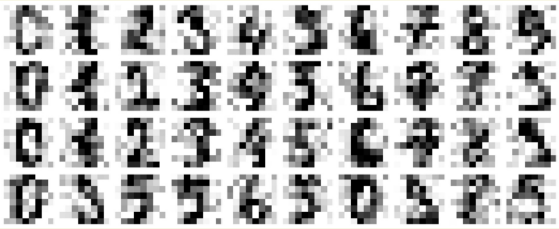
(Extra Credit) Make a 3D plot showing PCA basis vectors 1 vs 2 vs 3. Can you make this plot rotate in 3D? Do you gain extra insight about the data?

(iv) See the explained variance curve. Why is it concave down ⌒ and not concave up ⌣? On what datasets would it be close to linear ／?



Exercises for PCA

Noisy digits 0-9



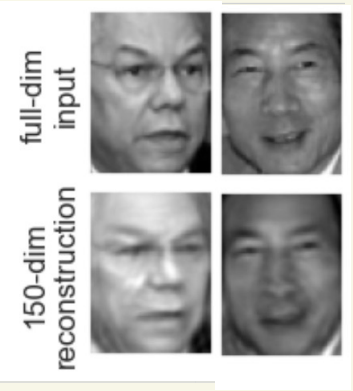
2. (i) You have already plotted the 2-dimensional PCA embedding of the digits 0-9. Do the same for the noisy digits. What changes?

(ii) Plot the 2-dimensional PCA embedding of the filtered digits. What do you notice?

(iii) There is an apparent contradiction. The filtered digit images look more like the original digit images. But the 2D PCA embedding of the filtered digits look more like the 2D PCA embedding of the noisy digit images. Explain this!

Exercises for PCA

Eigenfaces



3. (i) With n=150 PCA dimensions, you can still identify a person from the reconstructed image. How much must you decrease n until that changes?

(ii) With n=150 PCA dimensions, you can still see differences between the reconstructed image and the original. How much must you increase n until that changes?