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COEN 281
11/23/2015

HW #2

1) (50 pts) Use PCA to convert the images to the PC space. How much variance is captured by 20, 40, 60, 80 and 100 PC's?

Number of PC's	Cumulative Variance Captured
20	87.45%
40	93.57%
60	96.19%
80	97.75%
100	98.76%

2) (50 pts) Select three images (out of the 165). Reconstruct them in the original space using 20, 40, 60, 80, and 100 PC's. Display the images, and compare them (visually) with the originals. How many PC's seem sufficient to reconstruct the images with reasonable quality (based on visual inspection)?

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PC_20

PC_40

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PC_60

PC_80

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PC_100

Image 2

Original

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PC_20

PC_40

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PC_60

PC_80

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PC_100

Image 3

Original

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PC_20

PC_40

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PC_60

PC_80

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PC_100

After carefully observing all the three images, it looks like 80 principal components are needed to see rough indication of the image and sometimes 60 is also enough. When you use 100 principal components then you get even better reconstruction of the original image.

3) (extra credit) (50 pts) Find out what fraction of data points (images) retain their nearest neighbors on transformation to 2-dimensional space (top two PC's).

46 of the nearest images match between original and 2-dimensional space image. Thus, the fraction that retains their nearest neighbors is 46/165 = .2788, 27.8%.