Exercise 4

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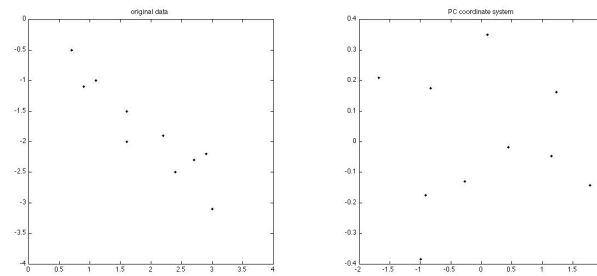
1 Task 1: Toy Data PCA
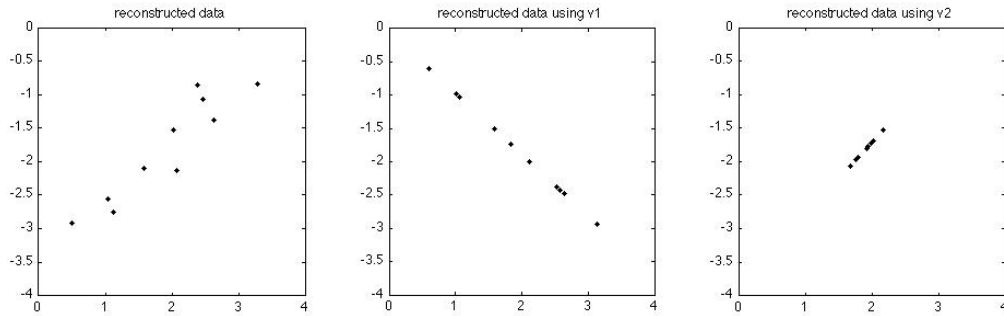

Figure 1: Toy data in PCA Space

Figure 2: Reconstruction of data by using all, one or two PCs

2 Image Data

The principal components of the images of buildings show more rectangular angle orientation. This is because in the images of buildings there are much more straight and perpendicular lines.
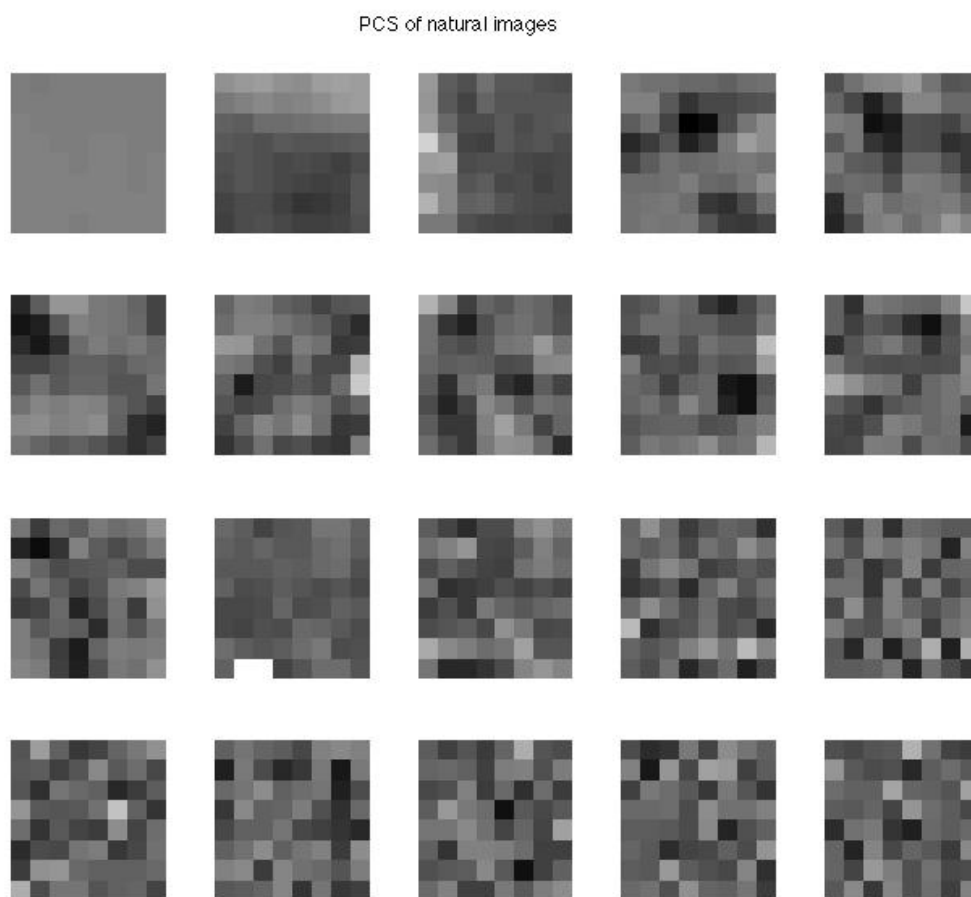
1

PCS of natural images
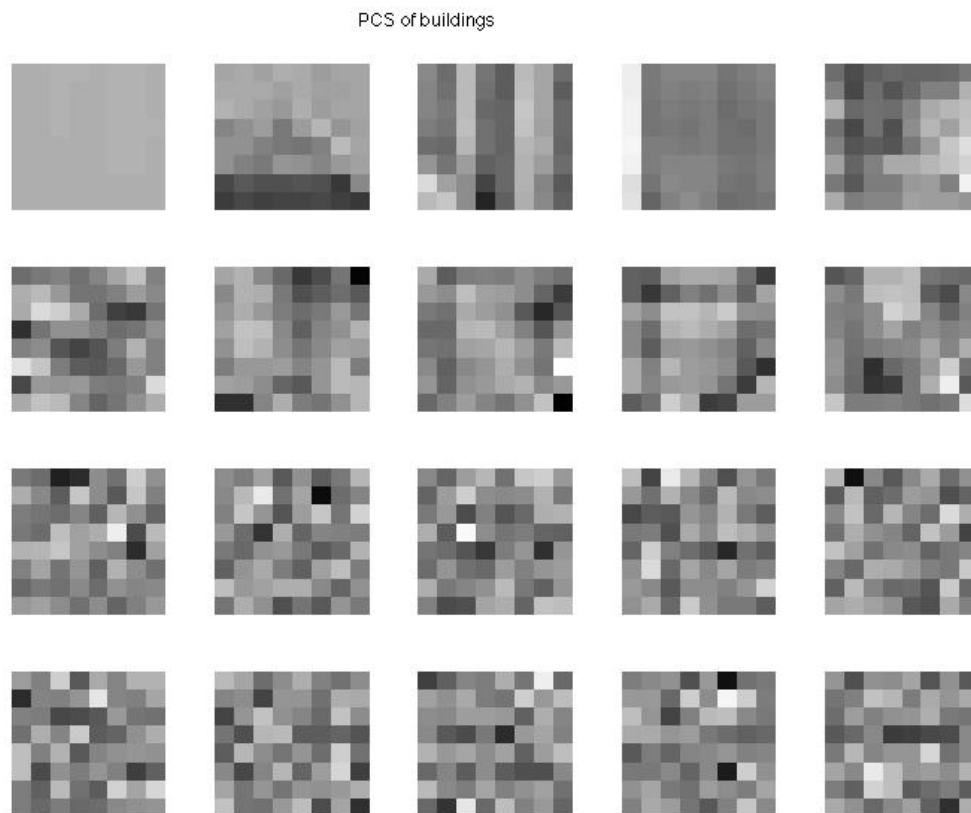
Figure 3: PCs of natural images

Figure 4: PCs of buildings

3 Kernel PCA

The principal components which are lines in the kernel space are gaussians when projected in the input space. The result also shows that in the kernel space data is linearly separable and this is what we expect because data is also gaussian distributed. Finally we see that using just the very first principal components we can reconstruct the main structure that is in the data.
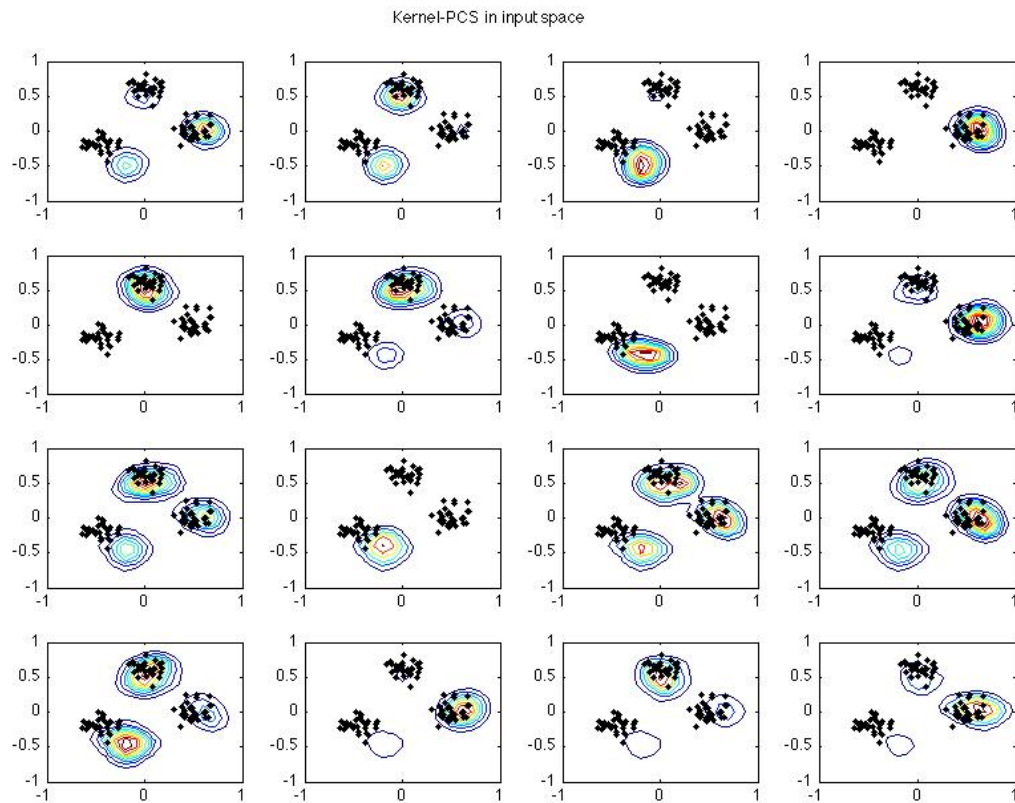

Figure 5: The Kernel PCs plotted in input space