

Exercise Sheet 4, Business Analytics, SoSe 2011, 13.06.2011
Dr. Tomáš Horváth, Osman Akcatepe

1. a) Work out the covariance between the x and y dimensions in the following 2 dimensional data set, and describe what the result indicates about the data.

Item Number:	1	2	3	4	5
x	10	39	19	23	28
y	43	13	32	21	20

b) Calculate the covariance matrix for this 3 dimensional set of data.

Item Number:	1	2	3
x	1	-1	4
y	2	1	3
z	1	3	-1

c) For the following square matrix:

$$\begin{pmatrix} 3 & 0 & 1 \\ -4 & 1 & 2 \\ -6 & 0 & -2 \end{pmatrix}$$

Decide which, if any, of the following vectors are eigenvectors of that matrix and give the corresponding eigenvalue.

$$\begin{pmatrix} 2 \\ 2 \\ -1 \end{pmatrix} \begin{pmatrix} -1 \\ 0 \\ 2 \end{pmatrix} \begin{pmatrix} -1 \\ 1 \\ 3 \end{pmatrix} \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix} \begin{pmatrix} 3 \\ 2 \\ 1 \end{pmatrix}$$

2. a) What do the eigenvectors of the covariance matrix give us?

b) At what point in the PCA process can we decide to compress the data? What effect does this have?

3. Calculate the four-point Discrete Fourier Transform of the aperiodic sequence $x[k]$ of length $N = 4$, which is defined as follows:

$$x[k] = \begin{cases} 2 & k = 0 \\ 3 & k = 1 \\ -1 & k = 2 \\ 1 & k = 3. \end{cases}$$

4. Outline the schemes of Haar basis function $\Phi_{s,t}$ for the values $s = -4, t = 0; s = -3, t = 0; s = -2, t = 0; s = -3, t = 1; s = -2, t = 3$.

5. Assume that $f(x)$ is a Haar Wavelet Discrete Transformation function. For the values $t = \{6, 12, 15, 14, 120, 116\}$, what would be the smoothed coefficients $a_{s,t}, c_{s,t}$ and their corresponding spectra?

Good Luck !