MAT-INF4130
Mandatory Assignment 2

Andreas Slyngstad

18. oktober 2016

We are presented the general problem
Find a k-dimensional subspace W of R m so that the sum of the (squared) distances from a set of n given points x1,x2,. . . ,xn in R m to W is as small as possible We define the *matrix of observations* $\mathbf{X}$ as

$$\mathbf{X} = \begin{pmatrix} x_1^{(1)} & x_2^{(1)} & \cdots & x_n^{(1)} \\ x_1^{(2)} & x_2^{(2)} & \cdots & x_n^{(2)} \\ \vdots & \vdots & \ddots & \vdots \\ x_1^{(m)} & x_2^{(m)} & \cdots & x_n^{(m)} \end{pmatrix}$$

1 Problem 1

First we assume that W is known such that $\{w_i\}_{i=1}^{k}$ is an orthonormal basis for W, and let $\{w_i\}_{i=k+1}^{m}$ be an orthonormal basis for $W^{\perp}$. We define the projection operator $proj_u v = \frac{\langle v,u \rangle}{\langle u,u \rangle}$ as the projection of a vector v onto the vector u.
Now using this operator to find the projection of the columns of the matrix of observations x_i on the space $W^{\perp}$ we get

$$\sum_{i=1}^{n}$$