

LINEAR ALGEBRA AND ITS APPLICATIONS UE19MA251

Projection Matrices



The matrix P that projects onto C(A) is given by

Projection matrix
$$P = A(A^{T}A)^{-1}A^{T}$$
.

Also , if P and Q are the matrices that project onto orthogonal subspaces then it is always true that PQ = 0 and P + Q = I

Least Squares Fitting Of Data



Suppose we do a series of experiments and expect the output b to be a linear function of the input t. We look for a straight line

$$b = C + Dt$$

If there is no experimental error then two measurements of b will determine the line. But, if there is error, we minimize it by the method of least squares and find the optimal straight line.

Least Squares Fitting Of Data



Consider the following system of equations:

$$C + Dt_1 = b_1$$

 $C + Dt_2 = b_2$
 $C + Dt_m = b_m$

In matrix form,
$$\begin{bmatrix} 1 & t_1 \\ 1 & t_2 \\ -- \\ 1 & t_m \end{bmatrix} \begin{bmatrix} C \\ D \end{bmatrix} = \begin{bmatrix} b_1 \\ b_2 \\ - \\ b_m \end{bmatrix} \text{ or } Ax = b$$

The best solution \hat{x} can be obtained by solving the normal equations.

Problems on Least Squares Fitting Of Data

Use the method of least square to fit the best line to the data b = 413,110 at t = -2,-1,0,2 respectively. Find the projection of b = (41,3,11,0) onto the column space of A. Calulabo the current vector e' and check that e' is anthogonal to the columns of A.

Solution: Let C+D+=b be the best fit straight line for the given data.



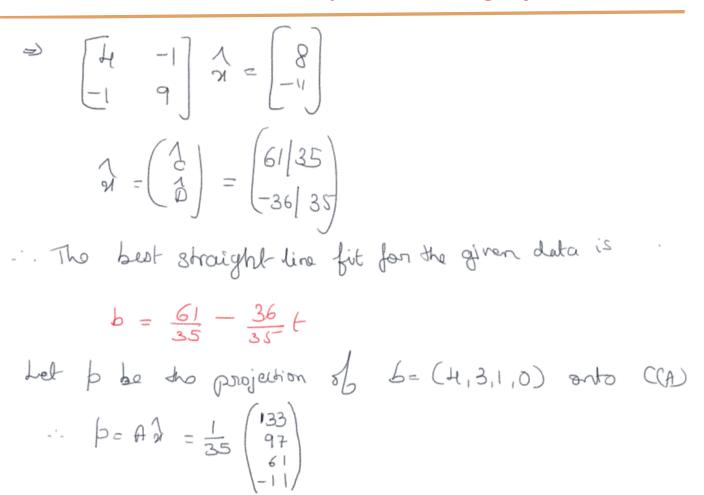
Unit 3. Linear Transformations and Orthogonality Problems on Least Squares Fitting Of Data

Given that b=4,3,1,0 at t=-2,-1,0,2

The system is incomistent. To find least square solution of, we have to solve noomal equation

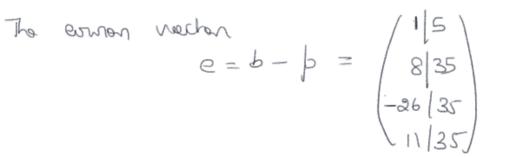


Unit 3. Linear Transformations and Orthogonality Problems on Least Squares Fitting Of Data





Problems on Least Squares Fitting Of Data



The everyon volter e is orthogonal to both the

exteriors of A

i.e.
$$e^{T}$$
. $\binom{1}{1} = 0$ and $e^{T} \binom{-2}{-1} = 0$

Therefore the vector 'e' is orthogonal to orthorn





THANK YOU