ACS234 Maths and Data Modelling

Tutorial 3
Wednesday 1pm LT04

https://github.com/ineskris/ACS234/tree/master/Tutorial3

Done in Lecture (week 5)

• Multiple Linear Regression

Matrix - Basics

Matrix 2 x 2

Transpose

Inverse

$$A = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$$

$$A^T = A' = \begin{pmatrix} a & c \\ b & d \end{pmatrix}$$

$$A^{T} = A' = \begin{pmatrix} a & c \\ b & d \end{pmatrix} \qquad A^{-1} = \frac{1}{ad - bc} \begin{pmatrix} d & -b \\ -c & a \end{pmatrix}$$

Multiplication Matrix 2 x 2

$$\begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix} \times \begin{pmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{pmatrix} = \begin{pmatrix} a_{11}b_{11} + a_{12}b_{21} & a_{11}b_{12} + a_{12}b_{22} \\ a_{21}b_{11} + a_{22}b_{12} & a_{21}b_{21} + a_{22}b_{22} \end{pmatrix}$$

Exercice 1 - Let A, B, D be the matrices below.

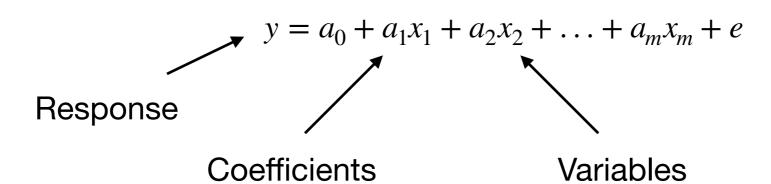
$$A = \begin{pmatrix} 1 & -2 \\ 3 & 0 \end{pmatrix} \qquad B = \begin{pmatrix} 4 & 4 \\ -1 & 1 \end{pmatrix} \qquad C = \begin{pmatrix} 7 \\ 0 \end{pmatrix} \qquad D = (-3 \quad 1)$$

Compute AB, BA, BB', B'B, AC, BD' and A^{-1}

Exercice 1 - Solution

Multiple Linear Regression

Multiple regression is like linear regression, but with more than one independent value, meaning that we try to predict a value based on two or more variables.



Coefficient of determination

$$R^2 = 1 - \frac{S_r}{S_t}$$
 Sum of squared deviations

$$S_t = \sum_{i=1}^n (y_i - \bar{y})^2$$

Standard Error of Estimate

$$S_{y/x} = \sqrt{\frac{S_r}{n - (m+1)}}$$
 Sum of squares of the errors $S_r = \sum_{i=1}^n (y_i - \hat{y}_i)^2$

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Standard Error of Estimate $\hat{a} = (XX')^{-1}X'Y$

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Exercice 2 - Find the coefficients of the model as well as R^2 and $S_{\nu/x}$.

Height	76	69	63	72
Age	57	25	28	36
Mass	451	302	288	385

$$\mathbf{Height} = a_0 + a_1 \times \mathbf{weight} + a_2 \times \mathbf{age}$$

Case Study

Can you use a multiple regression model to predict the housing price in Boston?

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Exercice 2 - Solution