ACS234 Maths and Data Modelling

Tutorial 2
Wednesday 1pm LT04

https://github.com/ineskris/ACS234/tree/master/Tutorial2

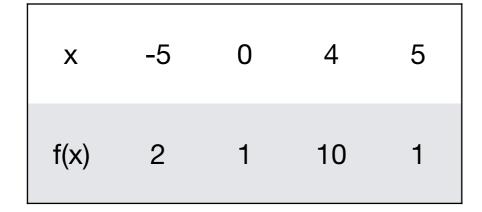
Done in Lecture (week 3 - week 4)

- Newton
- Simple Linear Regression Least Squares
- Introduction Multiple Linear Regression

Newton Interpolation

Exercice 1

The data



- a) Write the cubic interpolating polynomial in the Newton form.
- b) Can you write a Matlab code to solve this problem and check your results.

Exercice 1 - Solution

Simple Linear Regression

Simple linear regression allows us to study the relationship between only two variables.

$$\mathbf{Model} \qquad \qquad \mathbf{y} = a_0 + a_1 \mathbf{x} + e$$

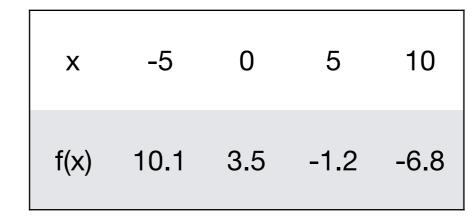
Prediction
$$\hat{y} = \hat{a}_0 + \hat{a}_1 x$$

Coefficient of determination
$$R^2 = 1 - \frac{S_r}{S_t}$$
 Sum of squared deviations $S_t = \sum_{i=1}^n (y_i - \bar{y})$

Sum of squares of the errors
$$S_r = \sum_{i=1}^n (y_i - \hat{y}_i)^2$$

Standard Error of Estimate
$$S_{y/x} = \sqrt{\frac{S_r}{n - (m+1)}}$$
 For a simple linear regression $m=1$

Exercice 2 - Calculate the coefficient of determination and the standard error of estimate of this dataset with the model y = 3.1 - x



Exercice 2 - Solution

Exercice 2bis

a) What model is the best to use for the dataset below (calculate the Mean square Error)

$$y = -40 + 61x$$
 Or $y = -39 + 62x$

Height 1.47 1.50 1.52 1.57

Mass 52.21 53.12 54.48 -57.20

b) We can find the exact model that minimises the MSE.

We need to find the two coefficients $\, \alpha \,$ and $\, \beta \,$ for the model $\, y = \alpha + \beta x \,$.

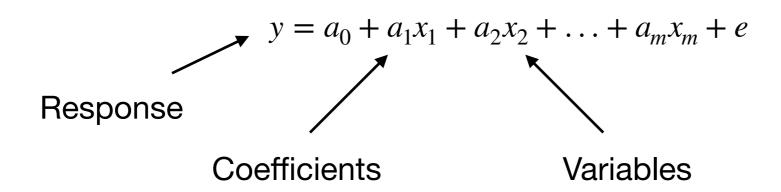
$$\hat{\alpha} = \hat{y} - \hat{\beta}\bar{x}$$

$$\hat{\beta} = \frac{\sum_{i=1}^{n} (x_i - \bar{x})(y_i - \bar{y})}{\sum_{i=1}^{n} (x_i - \bar{x})}$$

Calculate this two coefficients with the dataset above?

Exercice 2bis - Solution

Multiple Linear Regression



Exercice 3 -