

# Least squares



Least squares 가 ,

Least squares linear least squares non-linear least squares . Non-linear least squares linear equation linear least squares

## Linear least squares

$f(x)$   $(x_i, y_i)$

$$R_i^2 = [y_i - f(x_i, a_1, a_2, \dots, a_n)]^2$$

$f(x_i, a_1, a_2, \dots, a_n)$  가  $a_1, a_2, \dots, a_n$   $x$   $f(x)$   
 $x_i$

$$R^2 = \sum_{i=1}^n [y_i - f(x_i, a_1, a_2, \dots, a_n)]^2$$

$R^2$

$$\frac{\partial(R^2)}{\partial a_i} = 0$$

for  $i = 1, 2, \dots, n$

가  $a_1, a_2, \dots, a_n$  n 가 .

가  $f(a,b)=a+bx$  ,

$$\begin{aligned} & R^2 = \sum_{i=1}^n [y_i - (a+bx_i)]^2 \quad \& \quad \frac{\partial(R^2)}{\partial a} \\ & = -2 \sum_{i=1}^n [y_i - (a+bx_i)] \quad \& \quad \frac{\partial(R^2)}{\partial b} = -2 \sum_{i=1}^n [y_i - (a+bx_i)]x_i ; \end{aligned}$$

equation

$$\begin{aligned} & na + b \sum_{i=1}^n x_i = \sum_{i=1}^n y_i \quad \& \quad a \sum_{i=1}^n x_i + b \sum_{i=1}^n x_i^2 = \sum_{i=1}^n x_i y_i ; \end{aligned}$$

matrix form

$$\begin{aligned} & \left( \begin{array}{cc} n & \sum_{i=1}^n x_i \\ \sum_{i=1}^n x_i^2 & \sum_{i=1}^n x_i y_i \end{array} \right) \left( \begin{array}{c} a \\ b \end{array} \right) = \left( \begin{array}{c} \sum_{i=1}^n y_i \\ \sum_{i=1}^n x_i y_i \end{array} \right) \end{aligned}$$

matrix inverse  $a, b$

matrix inverse Gauss-Jordan elimination

<http://mathworld.wolfram.com/LeastSquaresFitting.html>

[http://en.wikipedia.org/wiki/Least\\_squares](http://en.wikipedia.org/wiki/Least_squares)

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