Linear Regression Regression (statistics) +2

What is nonlinear regression vs linear regression?

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Terminologies

β= Parameters

X = Independent Variables

Y = Dependent Variable

SSE = Sum of Square error

Linear Regression

The regression equation is linear when it is linear in parameters.

Linear regression: $Y = \beta_0 + \beta_1 * X_1$

Linear regression: $Y = \beta_0 + \beta_1 * X_1^2$

SSE is convex function for linear regression. So, we can able to find a closed form equation for it.

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$SSE = (y - X\beta)^2$

$$SSE = y^2 - 2y^T X\beta + \beta^T X^T X\beta.$$

$$\frac{\partial^2 SSE}{\partial \beta^2} = X^T X$$

$X^T X$ is positive semi-definite matrix.

Non Linear Regression

The regression equation is non linear when it is non linear in parameter. There are different forms of non linear function.

Some examples of non linear functions:

Power: $Y = \beta_1 * X^{beta_2}$

Weibull: $Y = \beta_1 + (\beta_2 - \beta_1) * e^{-\beta_3 * X_4^{\beta}}$

Fourier: $Y = \beta_1 * cos(X + \beta_4) + (\beta_2 * cos(2 * X + \beta_4) + \beta_3$

SSE function in non-linear regression may not be convex as linear regression. So, it is not possible to find a closed form equation to calculate the parameters value. It also has multiple local minima. Usually, numerical optimisation algorithm are applied to determine non linear regression parameters.

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Kiera Akhtar
Answered Jun 27, 2017

If you need more evidence - it is better to use linear regression. It can present curves lines. At the same time nonlinear regression can't do that. Linear regression is easier to use and to interpret, so it is better to use linear regression first. However, if you simply can't to get a good fit with linear regression, then you can to try nonlinear regression. http://www.spss-research.com/reg... Here is useful information about it.

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