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Non-Linear Models Linear Regression +3

How would you explain linear and nonlinear regression in the simplest terms?



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3 Answers



Joinal Ahmed, former Mentor at Typeset.io

Answered Jul 6, 2018



Linear Regression Equations :

Linear regression requires a linear model. No surprise, right? But what does that really mean? A model is linear when each term is either a **constant** or the product of a **parameter** and a **predictor variable**. A linear equation is constructed by adding the results for each term. This constrains the equation to just one basic form:

 $Response = constant + parameter * predictor + ... + parameter * predictor$ 

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transform the predictor variables in ways that produce curvature.

For instance, you can include a squared variable to produce a U-shaped curve.

$$Y = b_0 + b_1X_1 + b_2X_1^2$$

This model is still linear in the parameters *even though the predictor variable is squared*. You can also use log and inverse functional forms that are linear in the parameters to produce different types of curves.

Nonlinear Regression Equations

While a linear equation has one basic form, nonlinear equations can take many different forms. The easiest way to determine whether an equation is nonlinear is to focus on the term “nonlinear” itself. Literally, it’s not linear. If the equation doesn’t meet the criteria above for a linear equation, it’s nonlinear. That covers many different forms, which is why nonlinear regression provides the most flexible curve-fitting functionality. Here are several examples from [Minitab’s](#) nonlinear function catalog. Thetas represent the parameters and X represents the predictor in the nonlinear functions. Unlike linear regression, these functions can have more than one parameter per predictor variable.



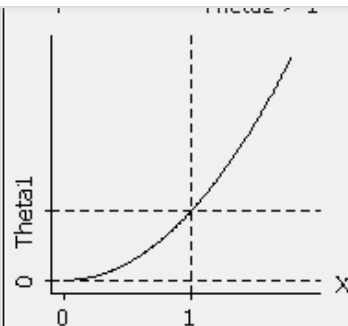
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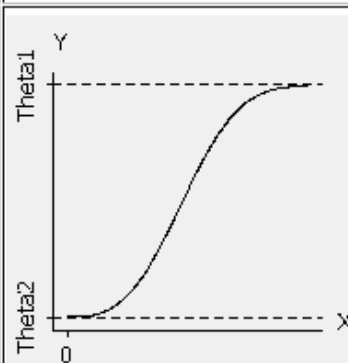
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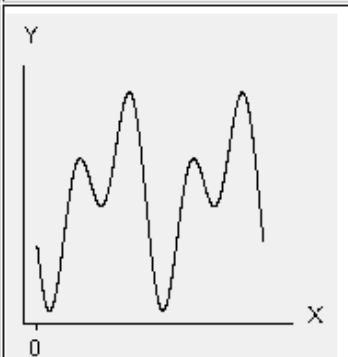
Power (convex): $\text{Theta1} * X^{\text{Theta2}}$



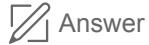
Weibull growth: $\text{Theta1} + (\text{Theta2} - \text{Theta1}) * \exp(-\text{Theta3} * X^{\text{Theta4}})$



Fourier: $\text{Theta1} * \cos(X + \text{Theta4}) + (\text{Theta2} * \cos(2 * X + \text{Theta4}) + \text{Theta3})$



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Stev Iones, ... Physics, Math, Computer Programming

Answered Apr 3



Stev Iones's answer to What is the simplest explanation of non linear regression?

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Ajay Bisoi, former Professor(retired) at Utkal University, Bhubaneswar

Answered Oct 26, 2018



In simplest terms

Linear regression is fitting data by a *straight line* $y = a + bx$ (highest power of x is one)

Nonlinear regression is fitting Data by a curve $y = a + bx + cx^2$ or by a **polynomial of degree more than one, quadratic, cubic, quartic,**



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Stev Jones

Nonlinear regression does not have to be a polynomial.

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