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or more of the p parameters $\beta_1, \dots, \beta_p$. In practice, the parameters have to be estimated from the data. Consider a dataset consisting of n pairs $(x_1, y_1), \dots, (x_n, y_n)$. (The number of parameters occurring in f should be less than the number of observations; that is, $p < n$.) The relationship in Equation (1.1) is for the ideal situation where both the predictor values $x_1, \dots, x_n$ and the response values $y_1, \dots, y_n$ are observed without error. In reality, there will be measurement errors that will distort the picture such that none of the pairs $(x_1, y_1), \dots, (x_n, y_n)$ will fit Equation (1.1) exactly. Therefore, we will assume that the value x_i is predicting the value y_i according to Equation (1.1) apart from some measurement error. In other words, it is more realistic to entertain the idea that the relationship in Equation (1.1) is correct only on average. We can formalise this notion by introducing the conditional mean response $E(y_i|x_i)$ (conditional on the predictor value x_i) and recast Equation (1.1) as follows:

$$E(y_i|x_i) = f(x_i, \beta) \quad (1.2)$$

Equation (1.2) reads as follows: Given the predictor value x_i , we will expect the response to be centered around the value $f(x_i, \beta)$. Therefore, we will refer to f as the mean function.