

Consider a dataset  $D = \{(x_i, y_i)\}^N$  of  $N$  data points, where  $x_i = (x_{i1}, x_{i2}, \dots, x_{iM})$  is a feature vector with  $M$  features, and  $y_i$  is the target, i.e., the response, variable. Let  $x_j$  denote the  $j$ th variable in feature space. A typical linear regression model can then be expressed mathematically as:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_M x_M$$

This model assumes that the relationships between the target variable  $y_i$  and features  $x_j$  are linear and can be captured in slope terms  $\beta_1, \beta_2, \dots, \beta_M$ .