

In this section we discuss conceptually the algorithms we use to build prediction models: Least Squares, Ridge Regression, LASSO Regression, Principal Component Regression, and Partial Least Squares Regression.

## Least Squares Regression

The linear model with several explanatory variables is given by the equation:

$$y_i = \beta_0 + \beta_1 x_1 + \dots + \beta_n x_n + \epsilon_i, i = (1, \dots, n)$$

For  $n$  responses we write the model in matrix form  $Y = X\beta + \epsilon$ ,

$$Y = \begin{pmatrix} y1 \\ y2 \\ \dots \\ yn \end{pmatrix}$$

$$X = \begin{pmatrix} x11 & x12 & \dots & x1p \\ x21 & x22 & \dots & x2p \\ \cdot & & & \cdot \\ \cdot & & & \cdot \\ \cdot & & & \cdot \\ xn1 & \cdot & \cdot & xnp \end{pmatrix}$$

$$\beta = \begin{pmatrix} \beta_0 \\ \beta_1 \\ \dots \\ \beta_n \end{pmatrix}$$