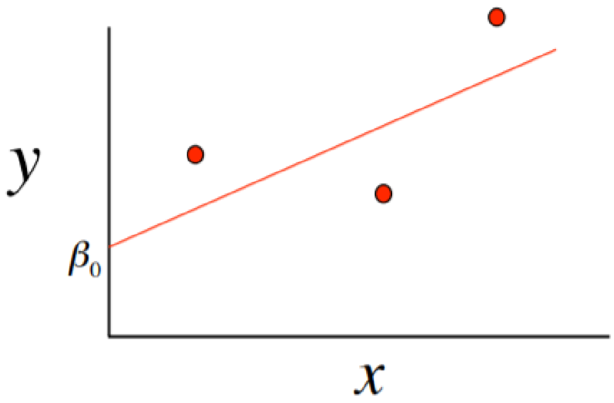
Estimating Model Parameters

• Point estimates of and are obtained by the principle of least squares

$$f(\beta_0,\beta_1)=\sum_{i=1}^{n}[y_i-(\beta_0+\beta_1 x_i)]^2$$



• $\hat{\beta}_0=\bar{y}-\hat{\beta}_1\bar{x}$

Predicted and Residual Values

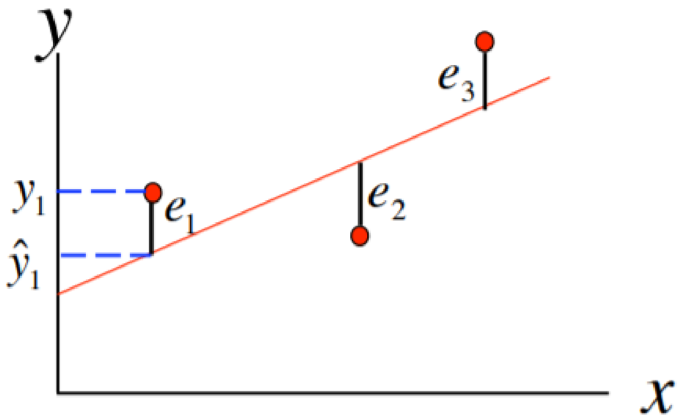
• Predicted, or fitted, values are values of y predicted by the least-squares regression line obtained by plugging in x1,x2,…,xn into the estimated regression line.

$$\hat{y}_1=\hat{\beta}_0-\hat{\beta}_1 x_1$$

$$\hat{y}_2=\hat{\beta}_0-\hat{\beta}_1 x_2$$

• Residuals are the deviations of observed and predicted values

$$e_1 = y_1 - \hat{y}_1$$
$$e_2 = y_2 - \hat{y}_2$$



Residuals Are Useful!

• They allow us to calculate the error sum of squares (SSE):

$$SSE = \sum_{i=1}^{n} (e_i)^2 = \sum_{i=1}^{n} (y_i - \hat{y}_i)^2$$

• Which in turn allows us to estimate σ^2:

$$\hat{\sigma}^2 = \frac{SSE}{n-2}$$

• As well as an important statistic referred to as the coefficient of determination:

$$r^2 = 1 - \frac{SSE}{SST} \qquad SST = \sum_{i=1}^{n} (y_i - \bar{y})^2$$