$y = \beta x$

Loss : Difference b/w our model's predictions and the true values.

Measure : x^{true}, y^{true}

Model : x^{true}, y^{pred}

$\Big\}$ difference $\equiv$ loss

absolute loss: $|y^{true} - y^{pred}|$

quadratic loss: $(y^{true} - y^{pred})^2$ ✓

(squared)

Loss for a single observation

$y = \beta x$

$$L_i = \left(y_i^{pred} - y_i^{true}\right)^2$$

$$L_i(\beta) = \left(\beta x_i^{true} - y_i^{true}\right)^2$$

Total Loss

$$L(\beta) = \sum_{i=1}^{n} L_i = \sum_{i=1}^{n} \left(\beta x_i^{true} - y_i^{true}\right)^2$$

Model: $y = \beta_0$

$$L = \sum_{i=1}^{n} \left(y_i^{pred} - y_i^{true} \right)^2$$

quadratic loss

$$= \sum_{i=1}^{n} \left(\beta_0 - y_i^{true} \right)^2$$

$$\frac{dL}{d\beta_0} = \frac{d}{d\beta_0} \sum_{i=1}^{n} \left(\beta_0 - y_i^{true} \right)^2$$

$$\frac{d}{dx}(a + b + c)$$

$$\frac{da}{dx} + \frac{db}{dx} + \frac{dc}{dx}$$

$$= \sum_{i=1}^{n} \frac{d}{d\beta_0} \left(\beta_0 - y_i^{true} \right)^2$$

$$= \sum_{i=1}^{n} \cancel{2} \left(\beta_0 - y_i^{true} \right) \cancel{1} = 0$$

$$= \sum_{i=1}^{n} \beta_0 - \sum_{i=1}^{n} y_i^{true} = 0$$

$$= n\beta_0 - \sum_{i=1}^{n} y_i^{true} = 0 \Rightarrow \beta_0 = \frac{1}{n} \sum_{i=1}^{n} y_i^{true} = \mathrm{mean}\left[y_i^{true} \right]$$