

$$= \frac{1}{n} \sum_{k=1}^K \sum_{i \in C_k} y_i^2 - 2 \sum_{k=1}^K$$

$$\sum (x_i^T \hat{\beta})^2$$

$$x_i^T \hat{\beta} = x_i^T (X^T X)^{-1} \sum x_i y_i$$

$$\cancel{x_i^T \hat{\beta}} \hat{\beta}^T \cancel{x_i}$$

$$\sum_i (x_i^T \hat{\beta})^2 = \sum \hat{\beta}^T x_i x_i^T \hat{\beta}$$

$$= \hat{\beta}^T \underbrace{\sum_i x_i x_i^T}_{=(X^T X)^{-1}} \hat{\beta} = \hat{\beta}^T (X^T X)^{-1} \hat{\beta}$$

$$(Y - X \hat{\beta})^T (Y - X \hat{\beta})$$