

Choice of λ

- Leave-one-out (LOO) CV (n -fold CV)

$$\begin{aligned}\text{LOO-CV}(\lambda) &= \frac{1}{n} \sum_{i=1}^n [y_i - \hat{g}^{[-i]}(x_i)]^2 \\ &= \frac{1}{n} \sum_{i=1}^n \left(\frac{y_i - \hat{g}(x_i)}{1 - S_\lambda(i, i)} \right)^2\end{aligned}$$

where $\hat{g}^{[-i]}$ denotes the model learned based on $n - 1$ samples (i.e., leave the i -th sample out).

- Generalized CV

$$\text{GCV}(\lambda) = \frac{1}{n} \sum_{i=1}^n \left(\frac{y_i - \hat{g}(x_i)}{1 - \frac{1}{n} \text{tr} S_\lambda} \right)^2$$

- In R, you tune λ through $df(\lambda) = \text{tr} S_\lambda = \sum_{i=1}^n \frac{1}{1 + \lambda d_i}$.