WED NOV 22

LAST TIME CROSS-VALIDATION

METHOD FOR ESTIMATING PREDICTIVE ERROR ONCE A MODEL HAS BEEN FIT

$(y_i, x_{i1}, \dots x_{ik})$ $i = 1, \dots, n$ once fit a model

$\hat{y}_i$ is the fitted value when plugging these inputs $x_{i1}, \dots, x_{ik}$ into fitted model

Linear model

$$y_i = b_0 + b_1 x_{i1} + \dots + b_k x_{ik} + \varepsilon_i$$
$$\hat{y}_i = \hat{b}_0 + \hat{b}_1 x_{i1} + \dots + \hat{b}_k x_{ik}$$

Estimate predictive error over m data points

$$\frac{1}{m} \sum_{i=1}^{m} (y_i - \hat{y}_i)^2$$

MEAN SQUARED ERROR OVER m data points

TEST DATA TRAINING DATA

m points

$$X_i \sim \begin{cases} 1 & \text{w.p } p(\eta_i) \\ 0 \end{cases}$$

$$p(x) = \frac{1}{1 + e^{-x}}$$

$$\eta_i = b_0 + b_1 x_{i1} + \dots + b_k x_{ik}$$

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y_i = coffee cups

$$y_i \sim \text{Poisson}(\lambda_i)$$
$$\lambda_i = e^{\eta_i}$$
$$\log \lambda_i = \eta_i$$

$\lambda_i = E(Y_i)$

$\eta_i = b_0 + b_1 x_i$

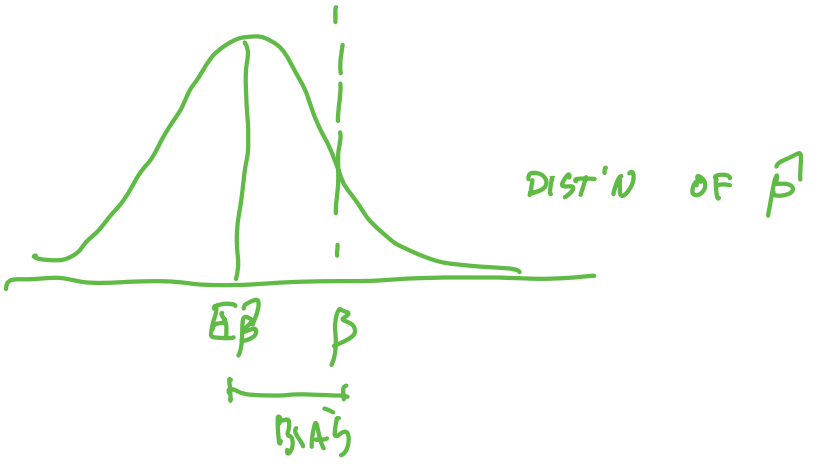
x_i = amount of sleep

Estimator $\hat{\beta}$ of parameter β

$$\underbrace{E[(\hat{\beta}-\beta)^2]}_{MSE} = E[(\hat{\beta}-E\hat{\beta}+E\hat{\beta}-\beta)^2]$$

$$= E[(\hat{\beta}-E\hat{\beta})^2] + (E\hat{\beta}-\beta)^2$$

$$= Var(\hat{\beta}) + BIAS^2$$



In practice: how to choose α?

Run the model w/ different values

Compute $\widehat{MSEP}$ using cross-validation

(ESTIMATED)

Choose α to minimize MSEP

CROSS VALIDATION

INPUT DATA, MODEL SPECIFICATION, METHOD FOR FIT

OUTPUT MSEP

CV(DATA, MODEL, FIT)


MSE
α