

Model Search Methods

Best Subset Selection

1. Let M_0 denote null model which contains no predictors. This model simply predicts the of the response for each observation.
2. For $k = 1, 2, \dots, p$
 - Fit all $\binom{p}{k}$ models that contain exactly p predictors
 - Pick the best among these $\binom{p}{k}$ models and call it M_k .

Here, *best* is defined as having the smallest RSS or largest R^2
3. Select a single best model from among M_0, M_1, \dots, M_p using cross validated prediction error, C_p (*AIC*), *BIC*, or Adjusted- R^2

requires training 2^p models

Example

$p = 3$

M_0 : intercept only (null)

C_1 : X_1 X_2 X_3



lowest training RSS within C_1

$\Rightarrow M_1$

C_2 : X_1, X_2 X_1, X_3 X_2, X_3



lowest training RSS within C_2

$\Rightarrow M_2$

M_3 : full model with

X_1 X_2 X_3

Model Search Methods

Forward Stepwise Selection

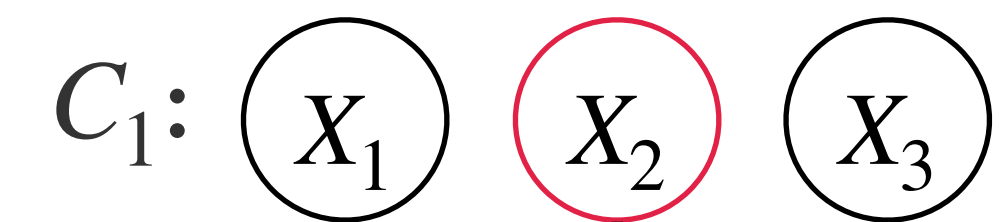
1. Let M_0 denote null model which contains no predictors.
2. For $k = 1, 2, \dots, p - 1$
 - ▶ Consider all $p - k$ models that augment the predictors in M_k with one additional predictor
 - ▶ Choose the best among these $p - k$ models and call it M_{k+1} .
Here, *best* is defined as having the smallest RSS or largest R^2
3. Select a single best model from among M_0, M_1, \dots, M_p using cross validated prediction error, C_p (AIC), BIC, or Adjusted- R^2

requires training $1 + \frac{p(p+1)}{2}$ models

Example

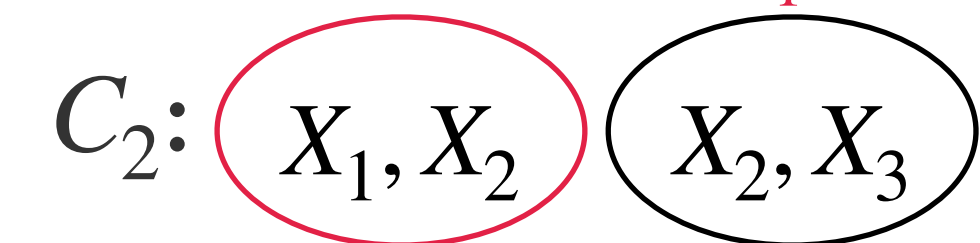
$$p = 3$$

M_0 : intercept only (null)



lowest training RSS within C_1

$\Rightarrow M_1$



lowest training RSS within C_2

$\Rightarrow M_2$

M_3 : full model with

