

# $\lambda$ Tuning

- $K$ -fold Cross Validation
  1. Choose the number of folds  $K$
  2. Split the data accordingly into training and testing sets.
  3. Define a grid of values for  $\lambda$
  4. For each  $\lambda$ , calculate the validation MSE within each fold
  5. For each  $\lambda$ , calculate the overall cross-validation MSE
  6. Locate under which  $\lambda$  cross-validation MSE is minimized, i.e. **minimum\_cv**  $\lambda$
- Packages such as `glmnet` do this automatically



# Hybrid Approach: Elastic Nets

$$\text{RSS} + \underbrace{\lambda_1 \sum_{j=1}^p \beta_j^2}_{\text{"ridge"}} + \underbrace{\lambda_2 \sum_{j=1}^p |\beta_j|}_{\text{"lasso"}}$$

$\lambda_1$  and  $\lambda_2$  are regularization parameters controlling the strength of the penalties

- Helps stabilize the solution when predictors are correlated
- Shrinks some coefficients to zero, enabling feature selection
- Particularly useful for high-dimensional datasets with correlated predictors

