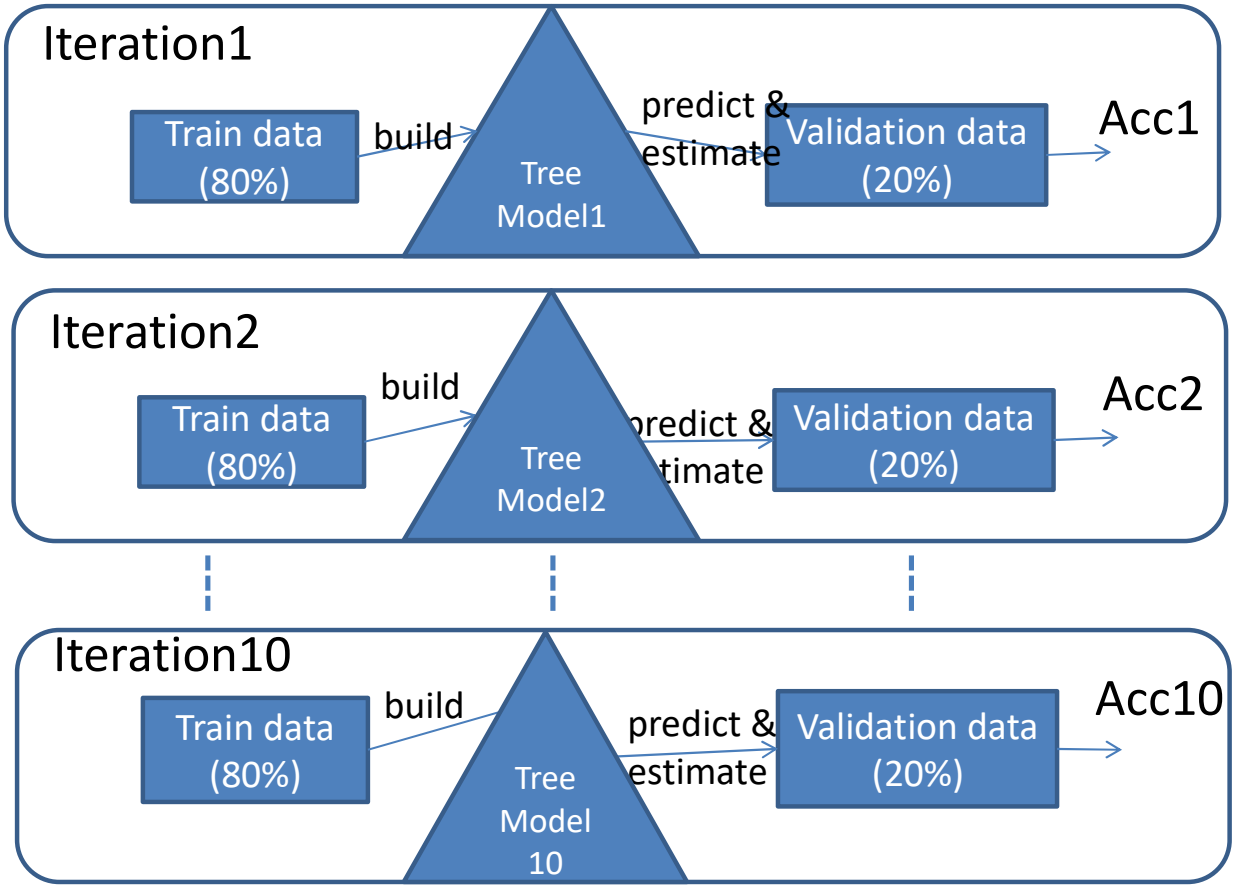
Resampling Methods

- Repeated Holdout*
- Cross Validation*
- Bootstrapping

*Stratified resampling is preferred

Repeated holdout



Compute Avg Acc

Repeated Holdout Idea

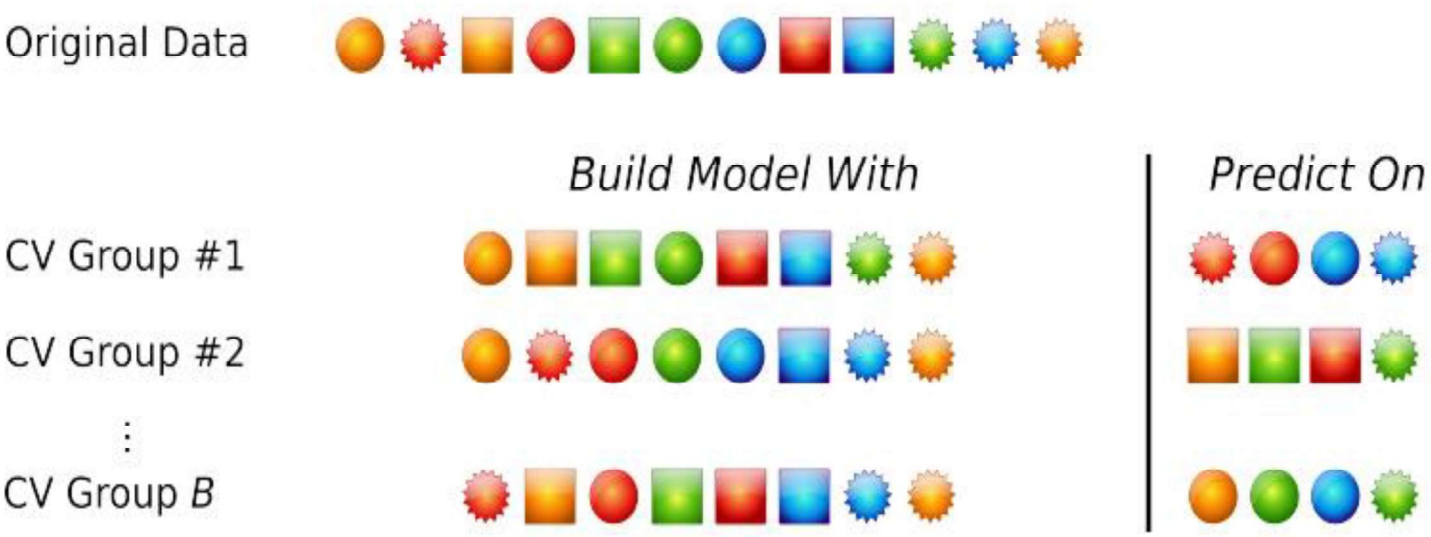
- n = total number of training data points
  k = number of repetitions

- for i = 1:k
  - Randomly hold 30% of data for validation
  - train on remaining 70% of data
  - Acc(i) = accuracy on 30% held data

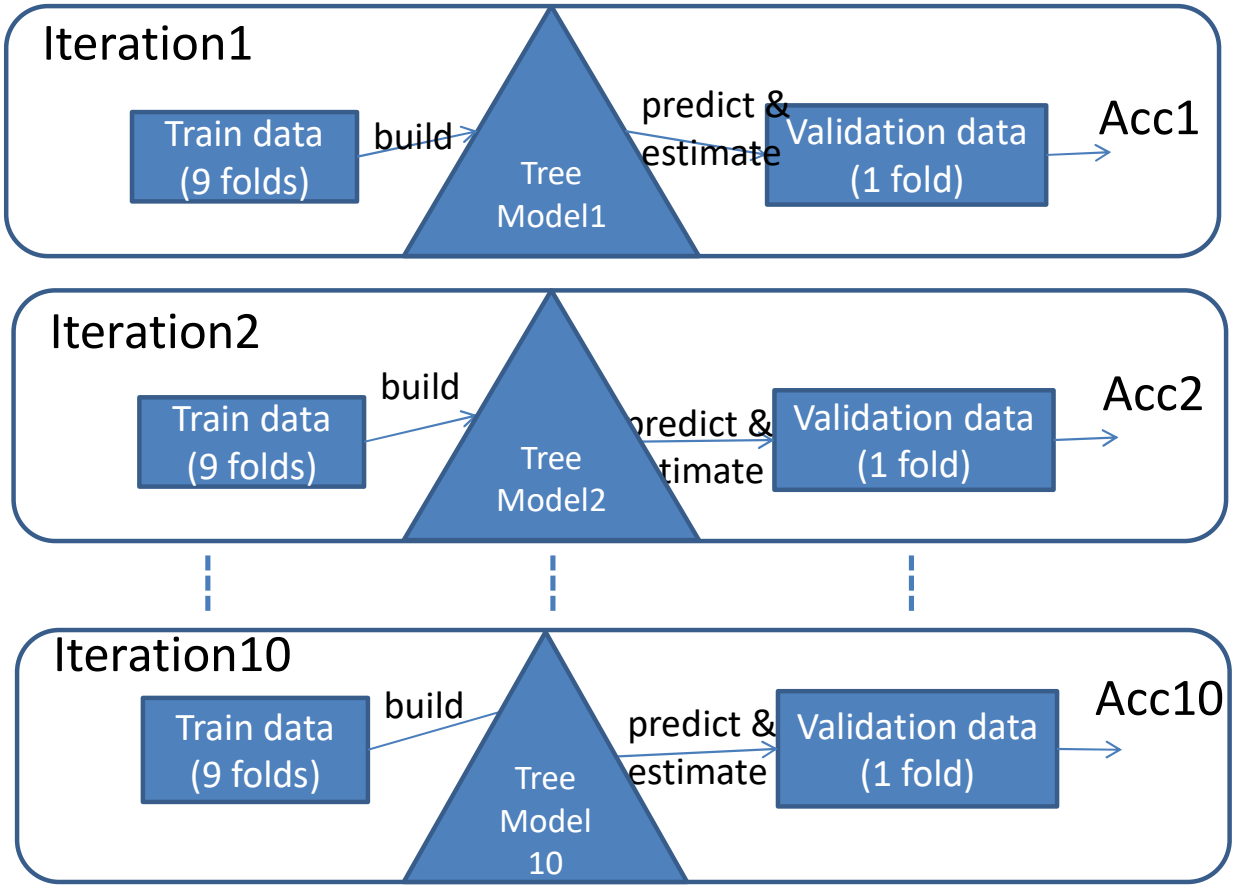
- Repeated holdout Accuracy = $1/k \ \Sigma_i$ Acc(i)

- Common value for k is 10

Repeated Holdout Illustrated



K-fold cross validation

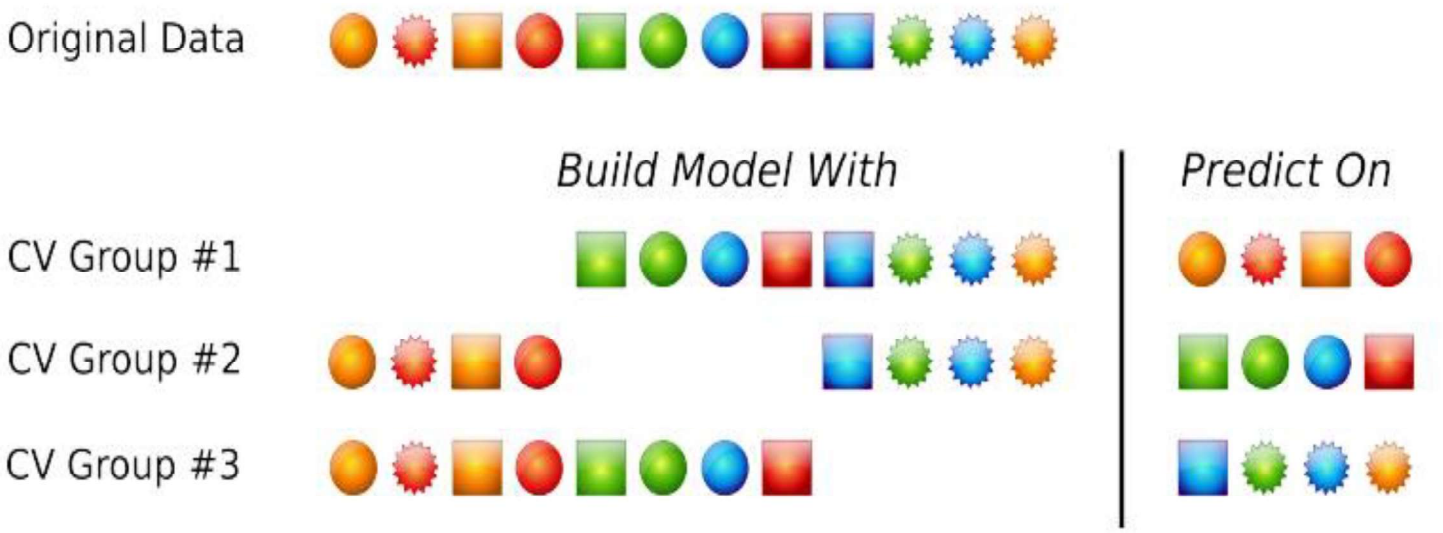


Compute Avg Acc

K-Fold CV Idea

- n = total number of training data points
  k = number of folds
- Randomly partition our full data set into k disjoint subsets (each roughly of size n/k)
- for i = 1:k
  - train on all folds of data except i^{th}
  - Acc(i) = accuracy on i^{th} fold
- Cross-Validation Accuracy = $1/k \ \Sigma_i$ Acc(i)
- Common values for k are 5 and 10 and called as "leave-one-out" when k = n

K-Fold CV Illustrated



Bootstrapping Idea

Bootstrap sample: sample with replacement from a dataset

The probability that a given example is not selected for a bootstrap sample of size n:

$$(1 - 1/n)^n$$

This has a limit as n goes to infinity: 1/e = 0.368

Conclusion: each bootstrap sample is likely to leave out about a third of the examples.

Bootstrapping Illustrated