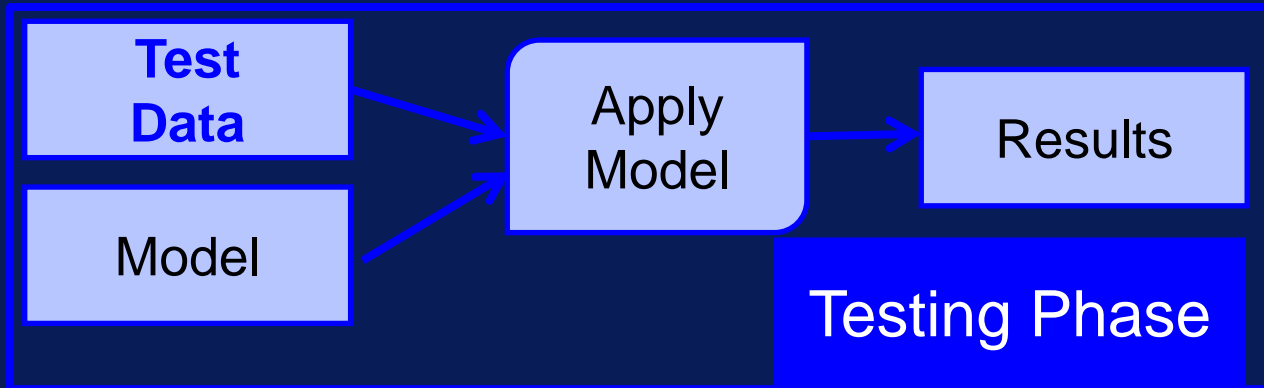
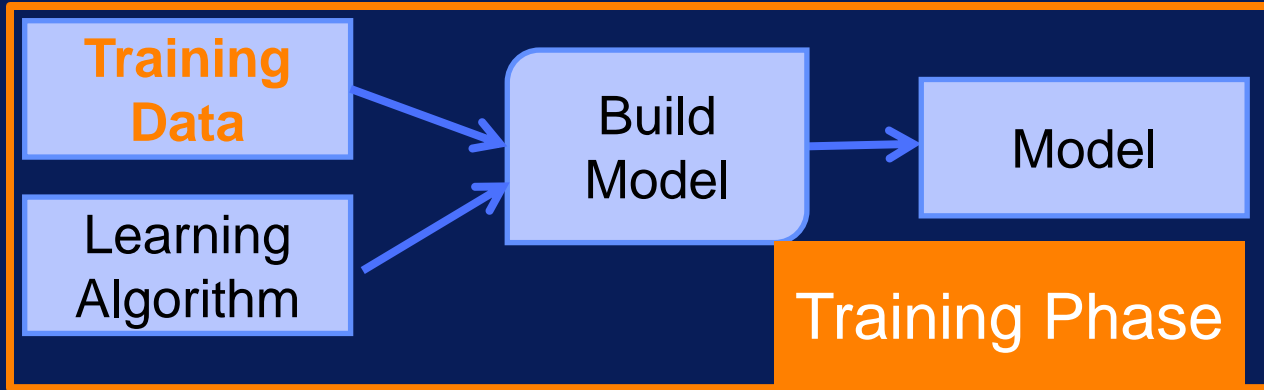


Using a Validation Set

After this video you will be able to..

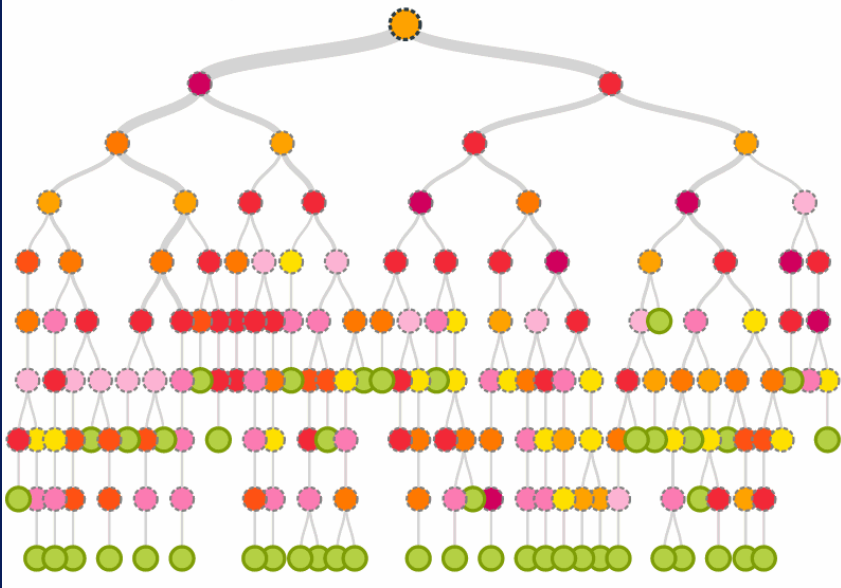
- Describe how a validation set can be used to avoid overfitting
- Articulate how training, validation, and test sets are used
- List three ways that validation can be performed

Training vs. Testing Phases



Avoiding Overfitting

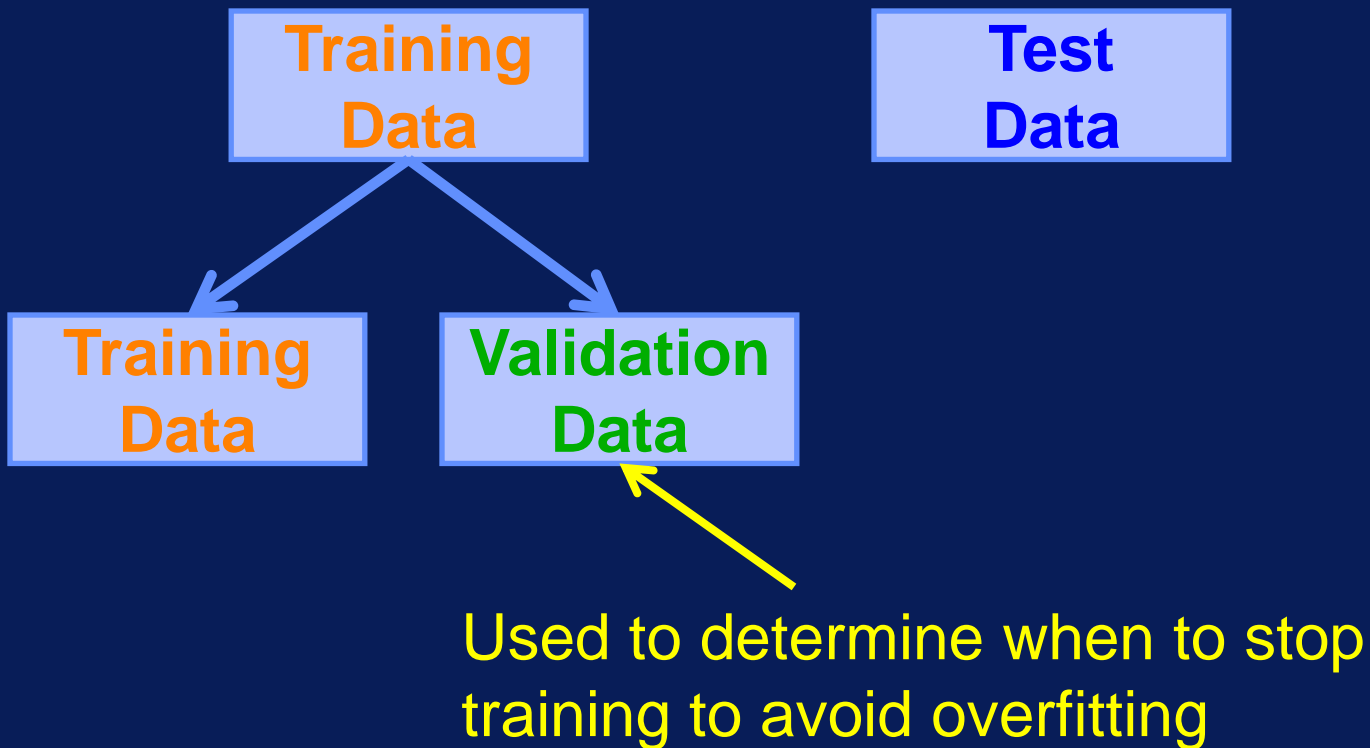
Overly complex model



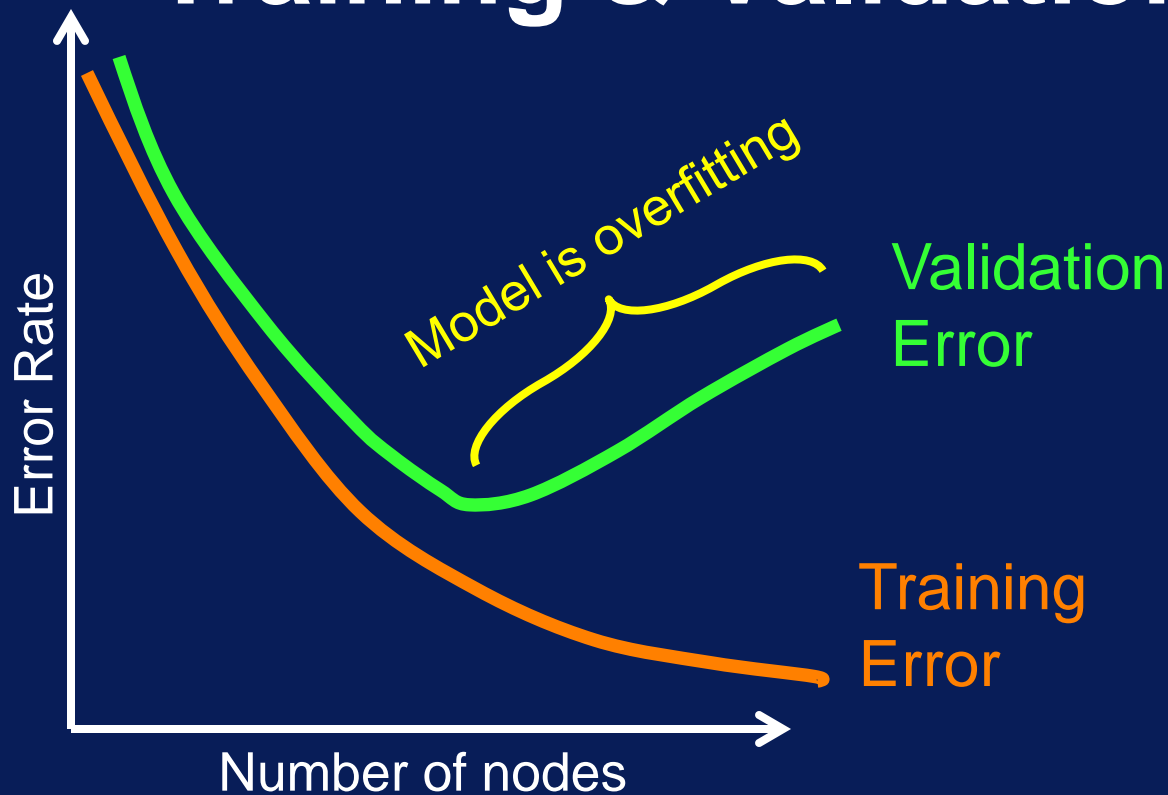
Overfitting

When to stop training before model gets too complex?

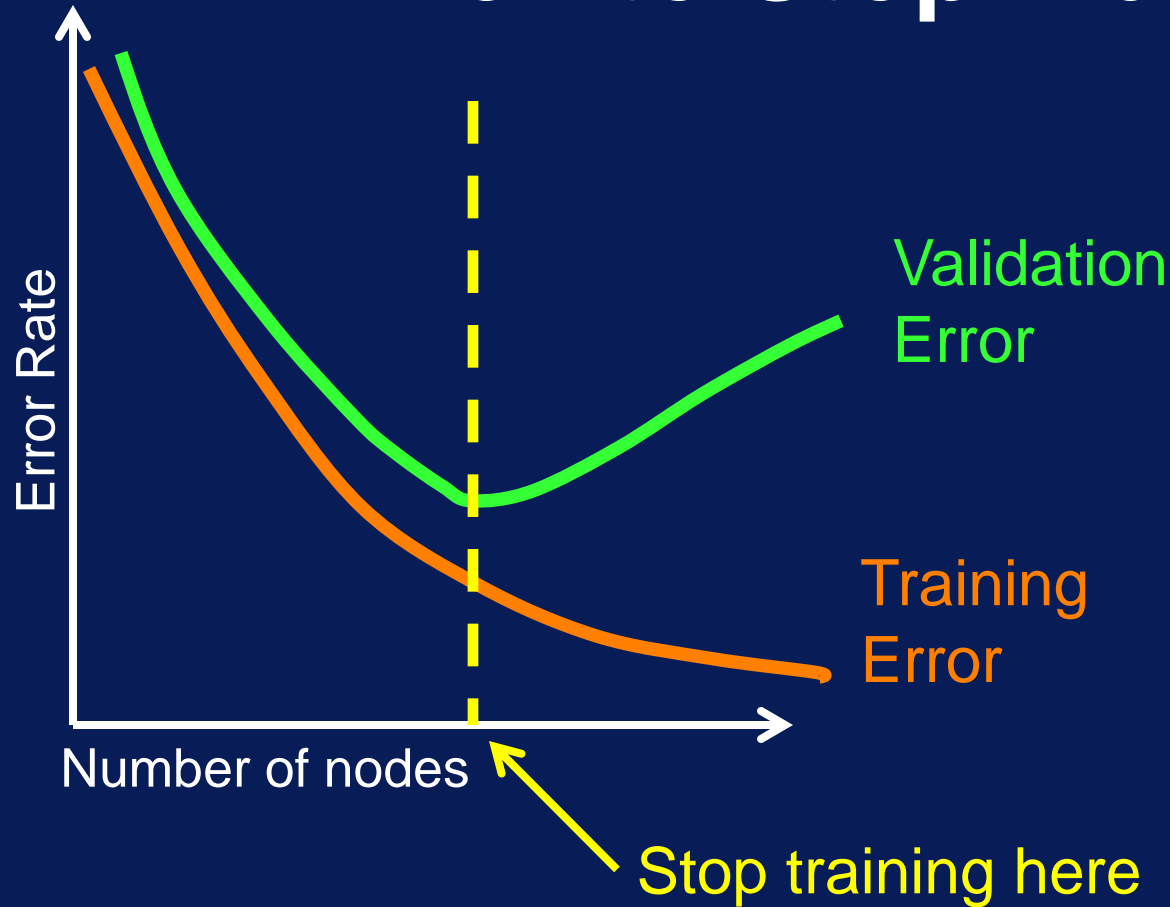
Validation Set



Training & Validation Errors



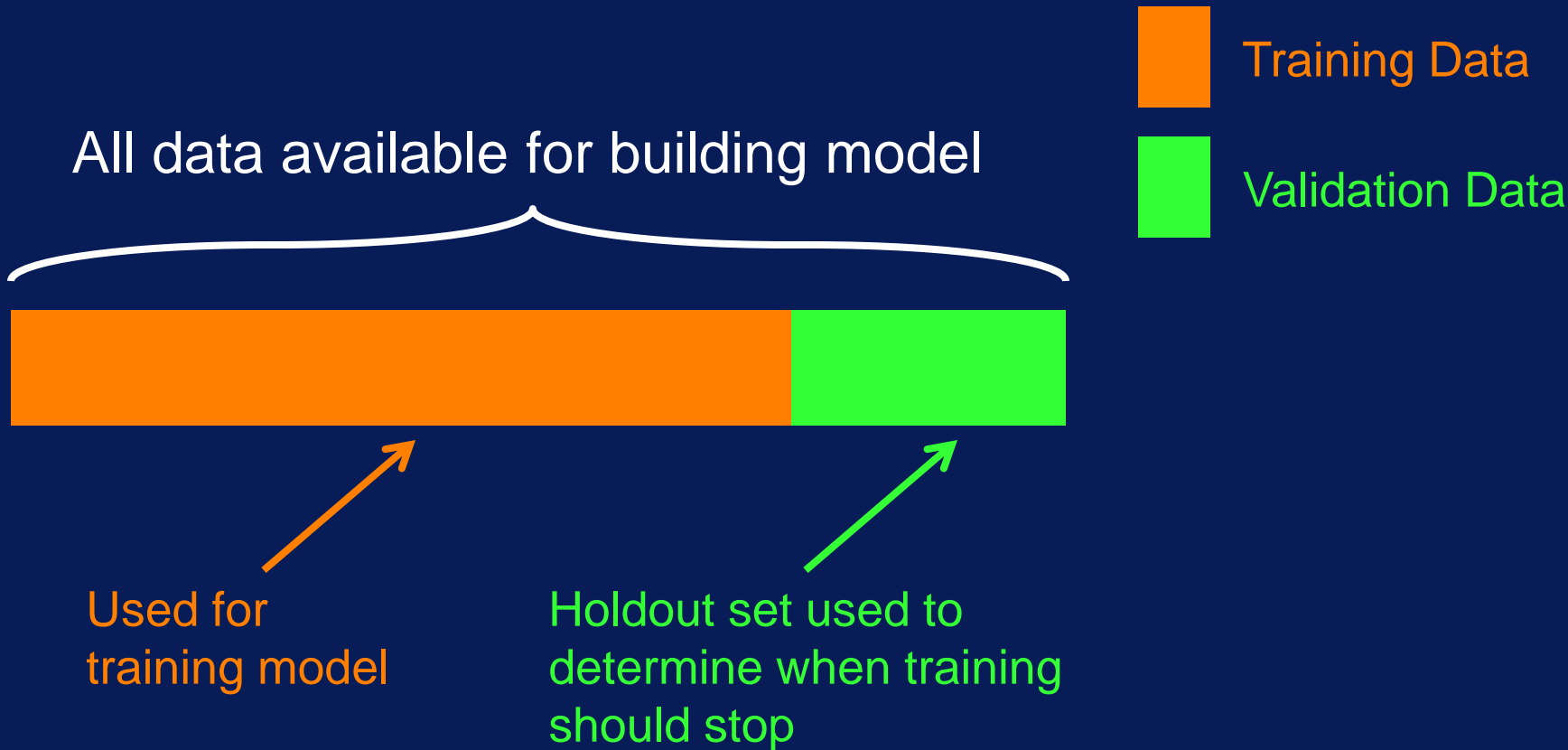
When to Stop Training



Ways to Create & Use Validation Set

- Holdout method
- Random subsampling
- K-fold cross-validation
- Leave-one-out cross-validation

Holdout Method



Repeated Holdout



Training Data



Validation Data

- Repeating holdout method several times
- Randomly select different hold out set each iteration
- Average validation errors over all repetitions

K-Fold Cross-Validation



Leave-One-Out Cross-Validation



Uses of Validation Set

**Validation
Data**

- Uses:
 - Address overfitting
 - Estimate generalization performance

Datasets

**Training
Data**

Adjust model
parameters

**Validation
Data**


Determine
when to stop
training (avoid
overfitting)

Estimate
generalization
performance

**Test
Data**

Evaluate
performance
on new data

**Cannot be
used in any
way in model
creation!**



Validation Set Summary

Training
Data

Validation
Data

Test
Data

- Datasets: training, validation, test
- Validation set: avoid overfitting, estimate generalization
- Using validation: holdout, repeated holdout, cross-validation (k-fold, leave-one-out)