

# COMS30035, Machine learning: Combining Models 3, Trees

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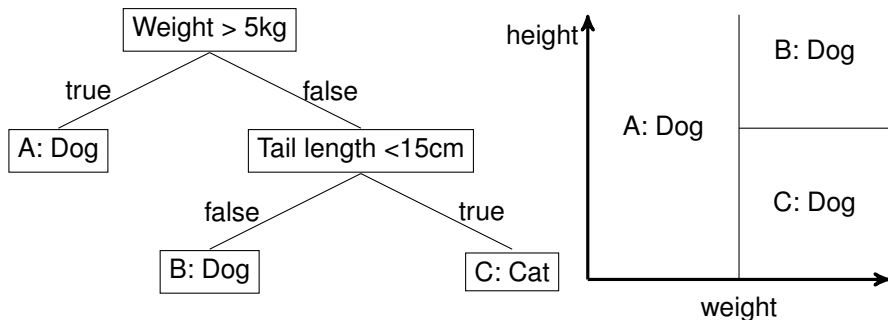
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# Agenda

- ▶ Model Selection
- ▶ Model Averaging
- ▶ Ensembles: Bagging and Boosting
- ▶ **Tree-based Models**
- ▶ Conditional Mixture Models
- ▶ Crowdsourcing

# Decision Trees



# Decision Trees as Partitioning Input Space

- ▶ One model is responsible for assigning a decision for each region of input space;
- ▶ The correct model for an input  $\mathbf{x}$  is chosen by traversing the binary decision tree, following the path from the top to a leaf.
- ▶ Leaf node is responsible for assigning a decision, such as a:
  - ▶ Class label;
  - ▶ Probability distribution over class labels;
  - ▶ Scalar value (for regression tasks).
- ▶ Mixtures of Experts assign points to regions of input space with soft borders, since each models are weighted by probability.

# Learning the Tree Structure

- ▶ Classification and Regression Trees (CART): one of many possible learning algorithms

# Pruning

# Boosted and Bootstrap Aggregated Trees

# Random Forest

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# Now do the quiz!

Please do the quiz for this lecture on Blackboard.