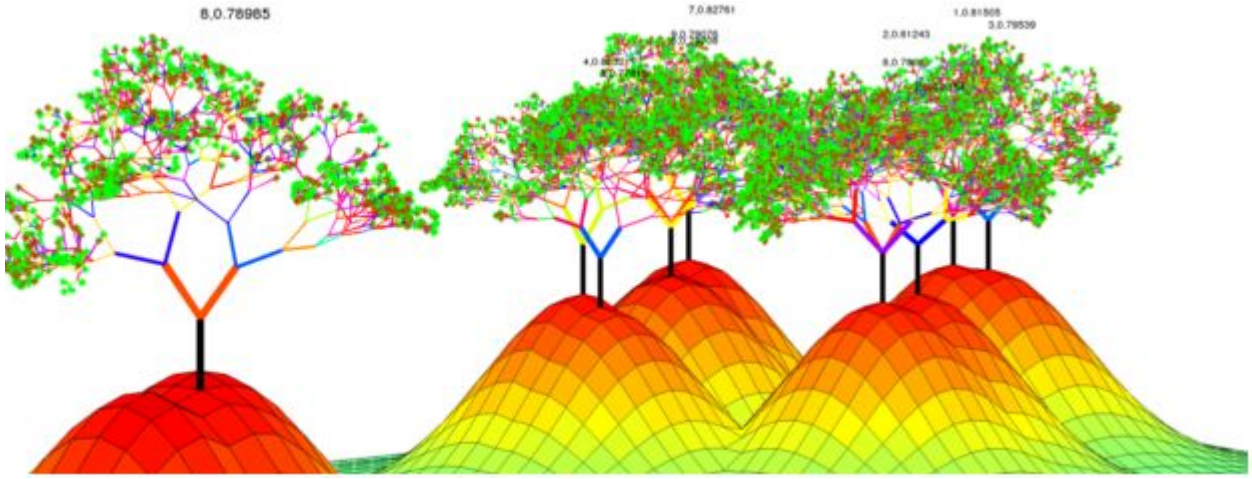
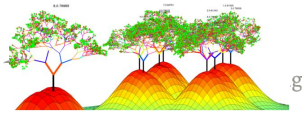


Random Forests Intro

What happens when our lonely tree, grows into a mighty forest?

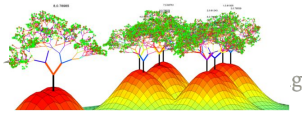
Objectives



In the next 45 minutes, students will be able to…

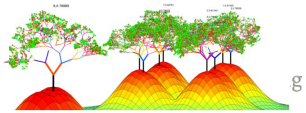
1. **explain and build** a classification random forest
2. **discuss** the differences between bagging and a random forest
3. **interpret** how tuning "n_estimators" will effect the random forest model's variance

Ensemble Methods



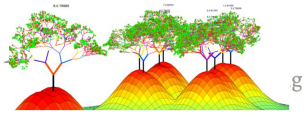
- **Combination** of many weak models
- **Example**: Jellybeans in a Jar
  - Individuals all have poor guesses
  - Average of poor guesses turns out to be a great guess
- Works for **Classification** or **Regression**

Decision Trees Review



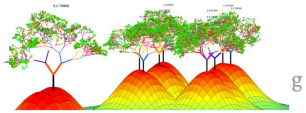
- Strengths of an individual Tree
  - _
  - _
  - _
- Weaknesses of an individual Tree
  - _
  - _

Decision Trees Review



- Strengths of an individual Tree
  - Quick computation time
  - Useful for various data types
  - easy to explain
- Weaknesses of an individual Tree
  - high variance
  - propensity to overfit

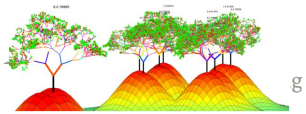
Decision Trees Cont…



- How is a split determined for an individual tree?
- What would be the difference between two decision trees trained with the same data?

Move to ipython Notebook: Part 1

Decision Trees Cont…

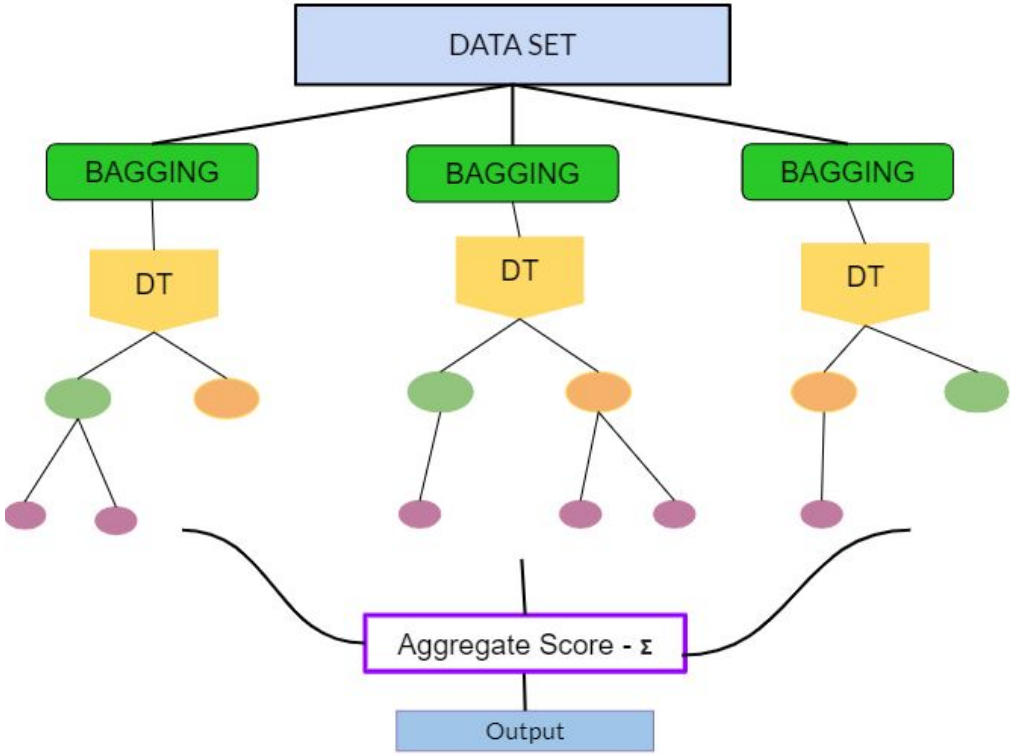


- How is a split determined for an individual tree?
  - Numerical feature:
    - Split at a threshold (like a percentile or value)
  - Categorical feature:
    - Split on value (is or is not value)
  - Information Gain

- What would be the difference between two decision trees trained with the same data?
  - Since each split is mathematically determined and all features are considered for each split, there would be no difference

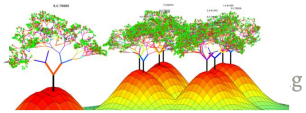
Bagging

- Bagging:
  - “bootstrap” + “aggregation”
- procedure used to reduce variance of a statistical learning method



Move to ipython Notebook:
Part 2

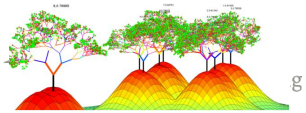
Bagging



- Term Bagging?
- How does Bagging accuracy compare to Decision Tree accuracy?
- What is an Ensemble method?
  - Example?

Move to ipython Notebook:
Part 2

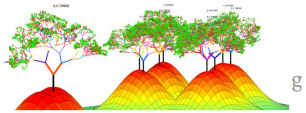
A Random Forest



- “ensemble” aka “forest” of decision trees
- Each tree gets a vote
- Bagging combined with random feature subsets considered
  - higher decorrelation with individual tree
  - Decrease variance

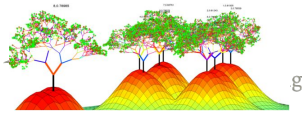
Move to ipython Notebook: Part 3

Random Forest vs. Bagging



- Bagging
  - Bagging decision trees are pretty cool, but the trees still tend to look pretty similar
  - all features are considered for splitting a node
- Random Forest
  - Bootstrapped datasets
  - Only a random selection of features are chosen for each split in each decision tree

Check for Success



- You are successful today if you can ...
  - Explain Bagging in 1 - 2 sentences.
  - Express why Random Forests work better than traditional Bagging.
  - Explain how changing n_estimators will affect the Random Forest model's variance.