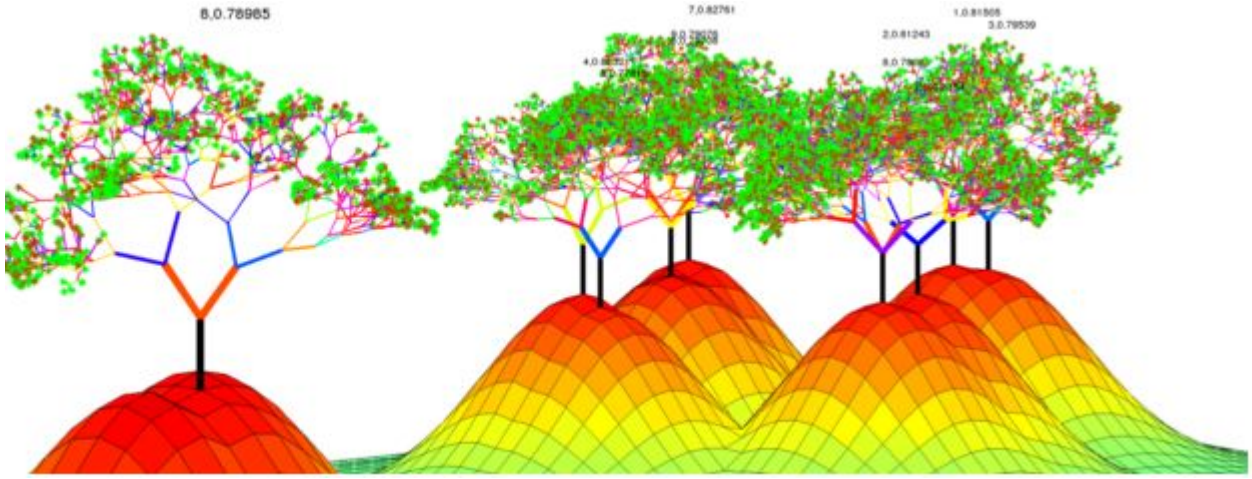
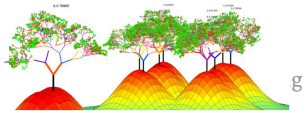


Random Forests Intro

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

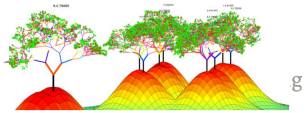
Success Criteria



By the end of lecture I will be able to...

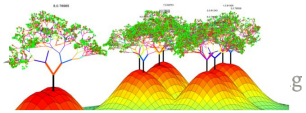
1. **Explain** bagging in one or two sentences
2. **discuss** the differences between bagging and a random forest
3. **interpret** how tuning “n_estimators” will affect the random forest model’s variance
4. **Explain** what is meant by Out-of-Bag (OOB) Score
5.

Ensemble Methods



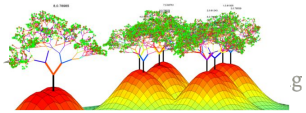
- **Combination** of many weak models
- **Example**: Jellybeans in a Jar
  - Individuals all have poor guesses
  - Average of poor guesses turns out to be a great guess
- Works for **Classification** or **Regression**

Decision Trees Review



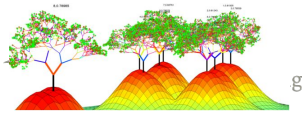
- Strengths of an individual Tree
  - _
  - _
  - _
- Weaknesses of an individual Tree
  - _
  - _

Decision Trees Review



- Strengths of an individual Tree
  - No scaling/normalization necessary
  - Useful for various data types
  - Easy to explain
- Weaknesses of an individual Tree
  - High variance
  - Propensity to overfit
  - Small change in data can cause instability

Decision Trees Cont…

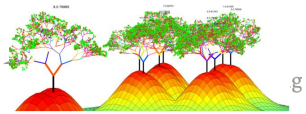


- How is a split determined for an individual tree?

- What would be the difference between two decision trees trained with the same data?

move into ipynb

Decision Trees Cont…



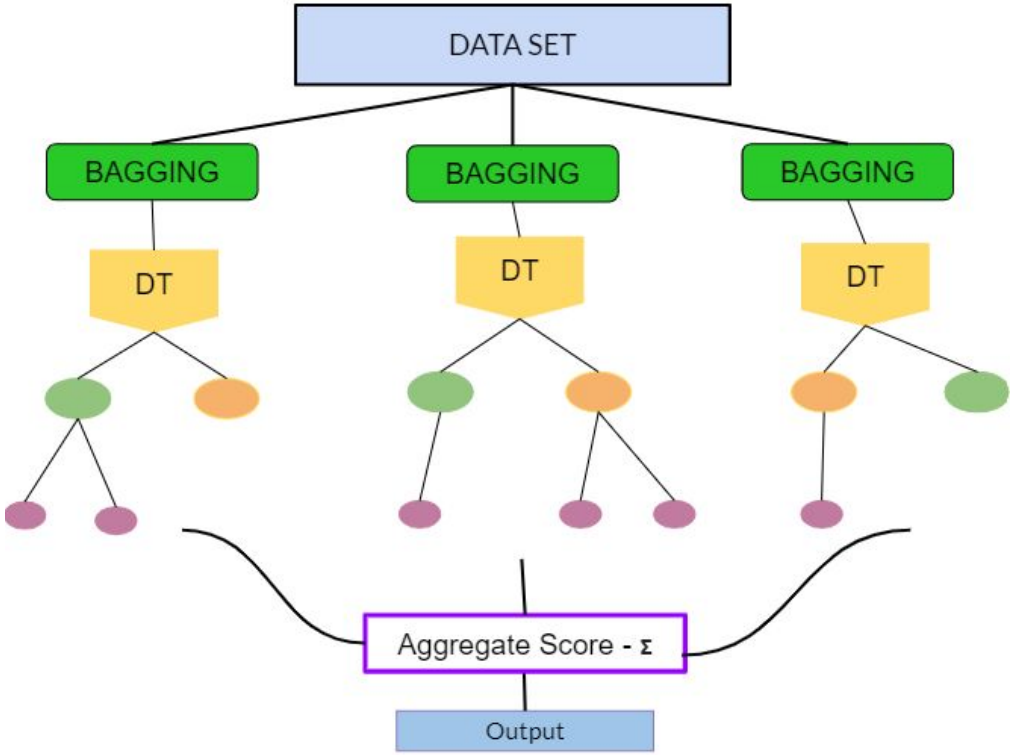
- How is a split determined for an individual tree?
  - Numerical feature:
    - Split at a threshold (like a percentile or value)
  - Categorical feature:
    - Split on value (is or is not value)
  - Information Gain

- 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

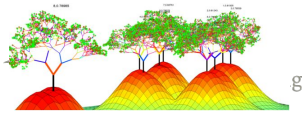
Bagging

- Bagging:
  - “bootstrap” + “aggregation”

- procedure used to reduce variance of a statistical learning method

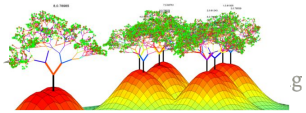


Bagging



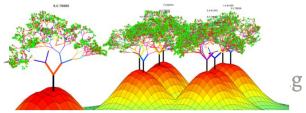
- Term Bagging?
- How does Bagging accuracy compare to a singular Decision Tree?
- What is an Ensemble method?
  - Example?

A Random Forest



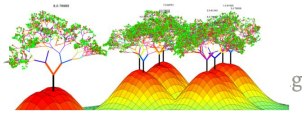
- “ensemble” aka “forest” of decision trees
- Each tree gets a vote
- Bagging combined with random feature subsets considered
  - higher decorrelation with individual tree
  - Decrease variance

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.