Machine Learning Algorithms
Bagging – Random Forest

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Ensemble Methods

- Ensemble methods are meta-algorithms which combine several machine learning models together and creating a single predictive model out of it.
- The main goal of using ensemble methods are : to reduce variance (bagging), to reduce bias (boosting) and to improve the predictions.
- Stacking is also another method under ensemble methods but most widely used techniques are Bagging and Boosting.
- Bagging and boosting algorithms can be used in both regression problems and classification problems.
- Random Forest is one of the prominent bagging algorithms & Adaboost and Gradient Boosting are popular boosting methods.

Bagging – Random Forest

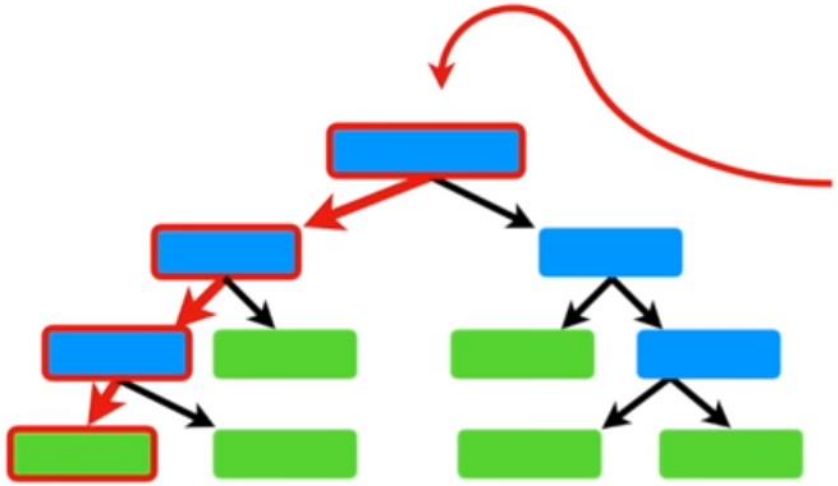
- Bagging is the short for Bootstrap Aggregation.
- Random Forest – is an extension to the decision tree algorithm.
- Constructing multiple decision trees creates the forest.
- Step 1: Create various bootstrapped datasets from the existing training data.
- Step 2: Create decision tree with the randomly selected bootstrapped data.
- Step 3: Repeat step 1 for “n” number of times and create “n” decision trees
- Step 4: Calculate the performance metrics for the dataset.

Random Forest – Intuition

Chest Pain	Good Blood Circ.	Blocked Arteries	Weight	Heart Disease
Yes	No	No	168	

…and now we want to know if they have heart disease or not.

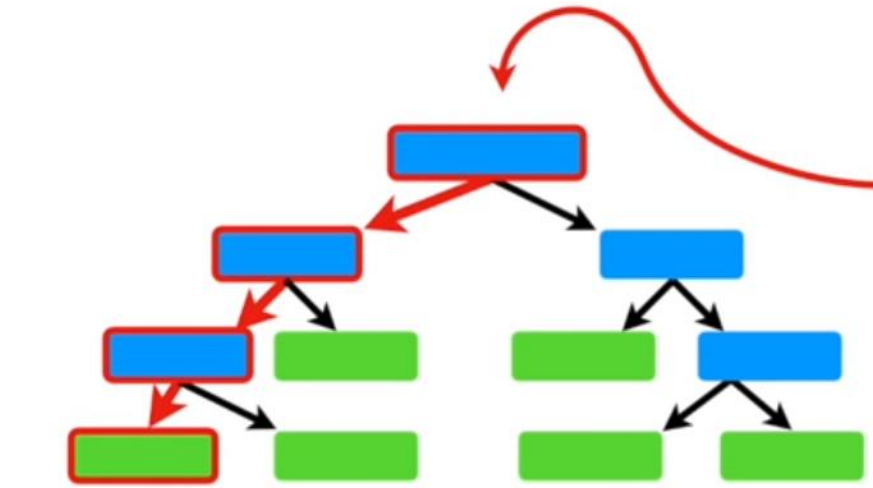
Random Forest – Intuition



Chest Pain	Good Blood Circ.	Blocked Arteries	Weight	Heart Disease
Yes	No	No	168	

The first tree says "Yes"…

Random Forest – Intuition



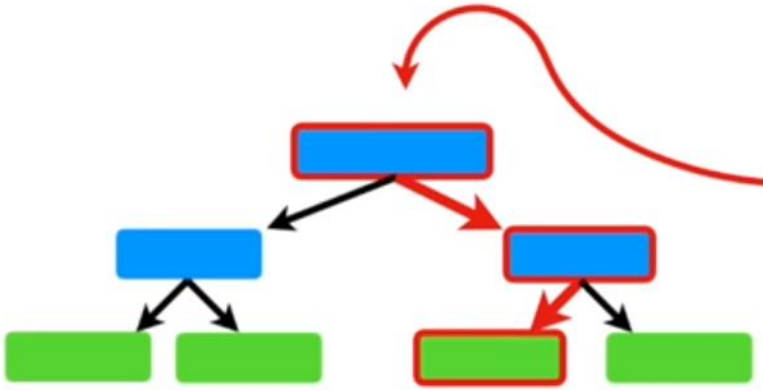
Chest Pain	Good Blood Circ.	Blocked Arteries	Weight	Heart Disease
Yes	No	No	168	

Heart Disease	
Yes	No
1	0

The first tree says "Yes"…

…and we keep track of that here.

Random Forest – Intuition

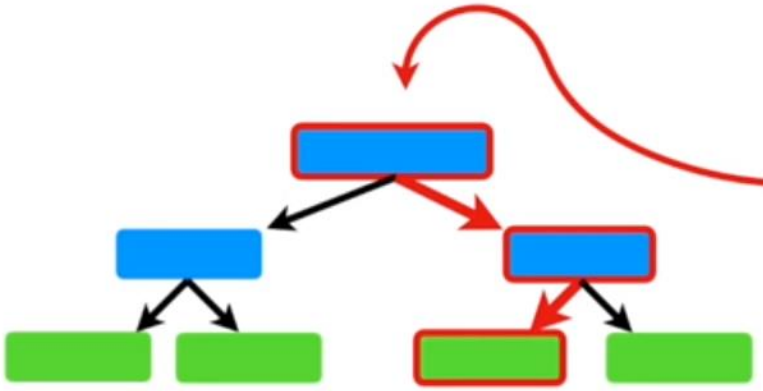


The second tree also says "Yes"…

Chest Pain	Good Blood Circ.	Blocked Arteries	Weight	Heart Disease
Yes	No	No	168	

Heart Disease	
Yes	No
1	0

Random Forest – Intuition



Chest Pain	Good Blood Circ.	Blocked Arteries	Weight	Heart Disease
Yes	No	No	168	

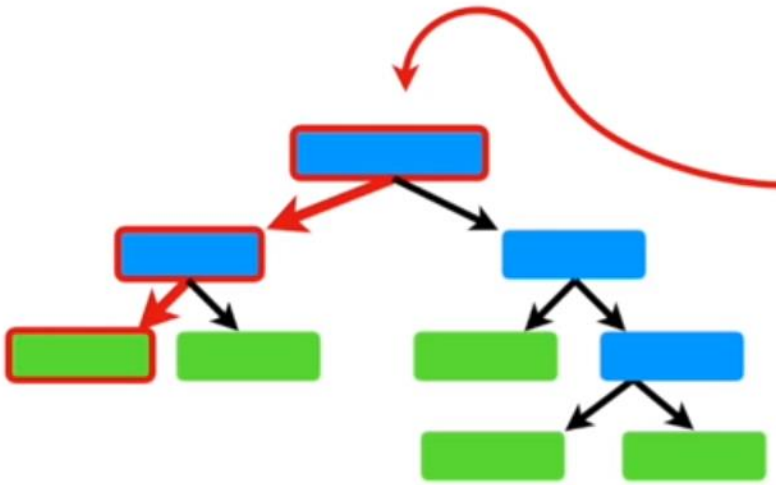
The second tree also says "Yes"…

Heart Disease	
Yes	No
2	0

…and we keep track of that here.

Random Forest – Intuition

Then we repeat for all the trees that we made…



Chest Pain	Good Blood Circ.	Blocked Arteries	Weight	Heart Disease
Yes	No	No	168	

Heart Disease	
Yes	No
5	1

Random Forest – Intuition

Chest Pain	Good Blood Circ.	Blocked Arteries	Weight	Heart Disease
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After running the data down all of the trees in the random forest, we see which option received more votes.

Heart Disease	
Yes	No
5	1

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Random Forest – Summary

- More the number of trees, more will be the accuracy. Having exceedingly higher number of trees can lead to overfitting.
- For every stage of boostrapped data, we will have few data left behind. They are called as Out-of-bag samples (OOB).
- The trees generated will be functioning in parallel.