

# Session-14 (Boosting) John

11/22 EU ML 14

Training Clarusway

Pear Deck - September 1, 2022 at 7:48PM

## Part 1 - Summary

Use this space to summarize your thoughts on the lesson

## Part 2 - Responses

Slide 1



Use this space to take notes:

## Slide 2

### ► SUMMARY of PREVIOUS CLASS ➤

- Ensemble Models
- Ensemble Method: Bagging (Bootstrap Aggregating)
- Random Forest

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## Slide 3

### Your Response

I've completed the pre-class content?

Students, drag the icon!

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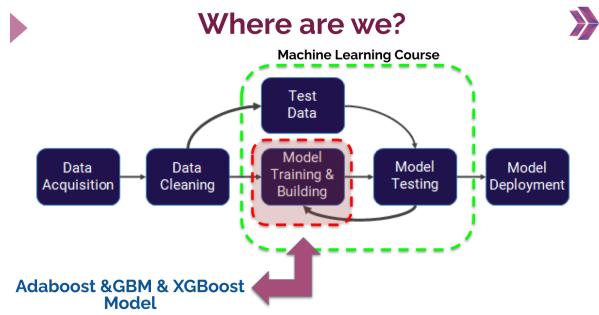
I've completed the pre-class content?

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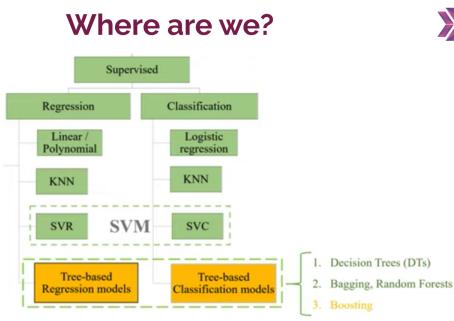
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## Slide 4



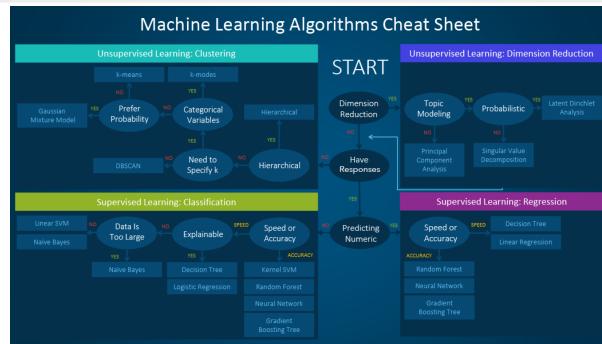
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## Slide 5



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## Slide 6



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## Slide 7



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WAY TO REINVENT YOURSELF



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## Slide 8

### ► Ensemble Methods: Bagging & Boosting ➤

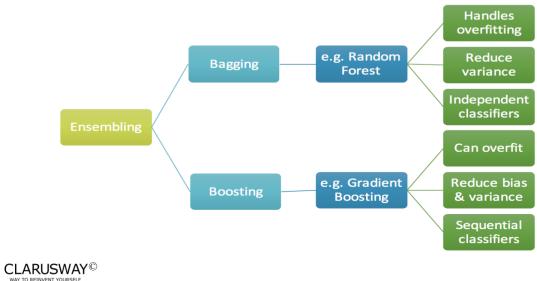
	Bagging	Boosting
Similarities	<ul style="list-style-type: none"><li>• Uses voting</li><li>• Combines models of the same type</li></ul>	
Differences	<p>Individual models are built separately</p> <p>Equal weight is given to all models</p>	<p>Each new model is influenced by the performance of those built previously</p> <p>Weights a model's contribution by its performance</p>



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## Slide 9

### Boosting Algorithms ➤

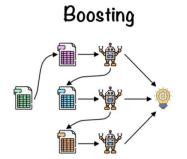


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## Slide 10

### Boosting Algorithms

- Boosting consists of using the "original" training data and iteratively creating models by using a weak learner.
- Each new model would be different from the previous ones in the sense that the weak learner, by building each new model tries to "fix" the errors which previous models make.
- In boosting, each tree is grown using information from previous tree.



#### Sequential

AdaBoost,  
Gradient Boosting,  
XGBoost,  
Light GBM,  
CAT Boost  
etc.

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Link(s) on this slide:

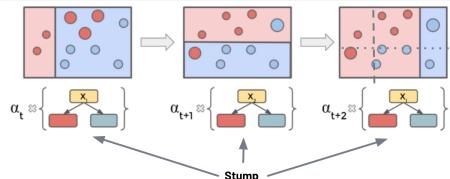
- [https://www.youtube.com/watch?v=wGdtA09Aq\\_0&t=740s](https://www.youtube.com/watch?v=wGdtA09Aq_0&t=740s)
- [https://www.youtube.com/watch?v=wGdtA09Aq\\_0&t=740s](https://www.youtube.com/watch?v=wGdtA09Aq_0&t=740s)

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## Slide 11

### AdaBoost - Adaptive Boosting

- Each tree (stump) gets different weight based on its prediction accuracy
- Each observation gets a weight inversely related to its predicted outcome (misclassified ones get more weight)
- Aggregation is done based on each weak learner's weight.



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## Slide 12

### Boosting Algorithms

#### AdaBoost Algorithm Hyperparameters:

##### "base\_estimator" parameter: (default=None)

The base estimator from which the boosted ensemble is built.  
If None, then the base estimator is DecisionTreeClassifier initialized with max\_depth=1 (aka stump).

##### "n\_estimators" parameter: (default=50)

The maximum number of estimators at which boosting is terminated. In case of perfect fit, the learning procedure is stopped early.

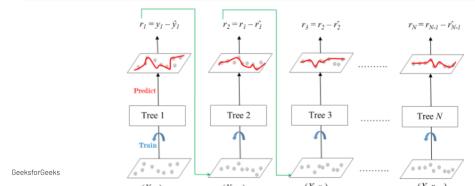
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## Slide 13

### Gradient Boosting Machine (GBM)

- In gradient boosting, each weak learner corrects its predecessor's error.
- Each predictor is trained using the residual errors of predecessor as labels.
- Each tree can be larger than a stump.



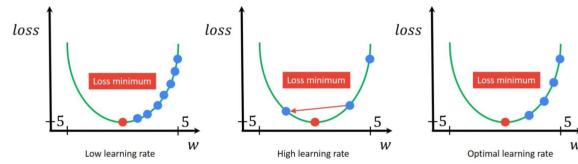
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## Slide 14

### Gradient Boosting Machine (GBM)

- Learning rate shrinks the contribution of each tree.
- There is a trade-off between learning rate and number of trees.



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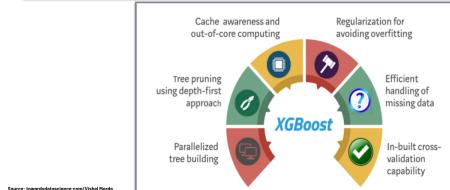
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## Slide 15

### XGBoost (EXtreme Gradient Boosting)

- As the name suggests, XGBoost is from the same family as Gradient Boosting.
- XGBoost is a refined and customized version of a gradient boosting decision tree system, created with performance and speed in mind.
- Extreme refers to the fact that the algorithms and methods have been customized to push the limit of what is possible for gradient boosting algorithms.

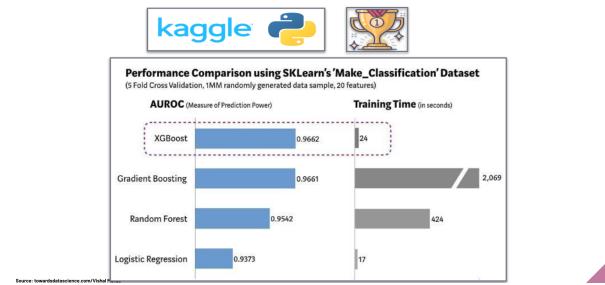


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## Slide 16

### XGBoost (EXtreme Gradient Boosting)



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## Slide 17

### XGBoost Algorithm

XGBoost Algorithm Hyperparameters :

#### "n\_estimators" parameter: (default=100)

The number of boosting stages to perform.

#### "subsample" parameter: (default=1.0)

The fraction of samples to be used for fitting the individual base learners.  
Choosing subsample < 1.0 leads to a reduction of variance and an increase in bias.

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## Slide 18

### XGBoost Algorithm

#### XGBoost Algorithm Hyperparameters :

##### "max\_depth" parameter: (default=3)

Max. depth of the individual estimators. This parameter **limits the number of nodes** in the tree.

##### "learning\_rate" parameter: (default=0.1)

Learning rate shrinks the contribution of each tree by learning\_rate. There is a trade-off between learning\_rate and n\_estimator

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## Slide 19

### XGBoost Algorithm

#### Pros & Cons

##### Pros:

- Handles large sized datasets well
- Perfect for quick predictions
- Ranking for feature importance
- Good model performance (wins most of the Kaggle competitions)

##### Cons:

- Difficulty interpretation due to visualization difficulties
- Harder to tune as there are too many hyperparameters

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## Slide 20

### Your Response

You Chose

- clear

## Slide 20

Is everything clear so far?

Students choose an option

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## Your Response

### Other Choices

- so so
- confused

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## Slide 21

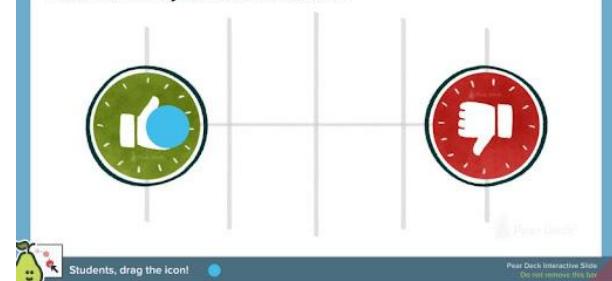
How well did you like this lesson?

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## Your Response

### How well did you like this lesson?



Use this space to take notes:

## Slide 22

### ► DT & RF & XGBoost Algorithm ►



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## Slide 23

THANKS!  
Any questions?

You can find me at:  
[johnbayway@gmail.com](mailto:johnbayway@gmail.com)

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