



# **CIS 678 Machine Learning**

**ML Models: Decision Tree, Ensemble Learning**



# Key concepts summary review!

k-NN



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k-NN

Linear Regression



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Linear Regression

Polynomial Regression



# Key concepts summary review!

k-NN

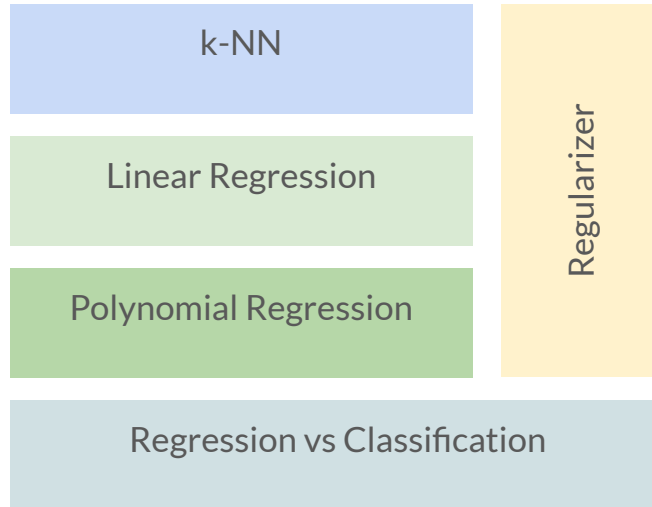
Linear Regression

Polynomial Regression

Regression vs Classification



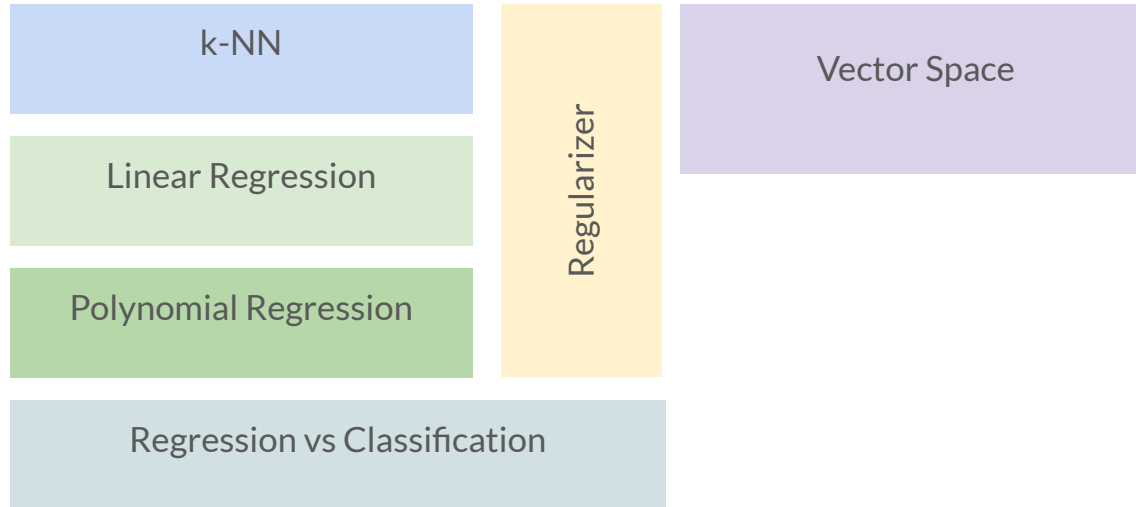
## Key concepts summary review!



Modeling  
Stack!!

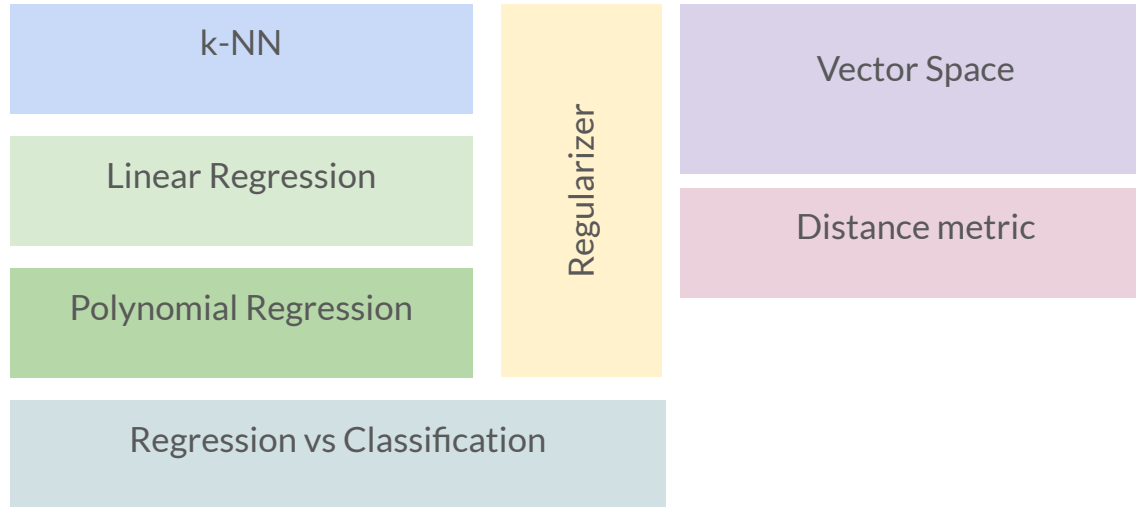


## Key concepts summary review!





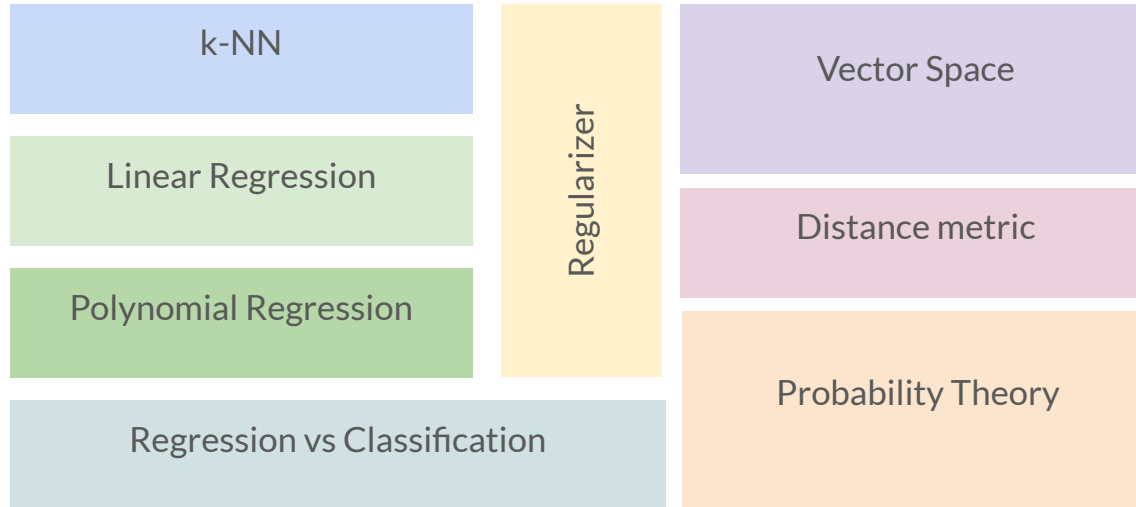
## Key concepts summary review!







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# Decision Tree

- Another non-parametric model
  - Recall k-NN, its an in memory model; right?



# Decision Tree

- Another non-parametric model
  - Recall k-NN, its an in memory model; right?
- We have Decision Tree, a second example



# Decision Tree

- Another non-parametric model
  - Recall k-NN, its an in memory model; right?
- We have Decision Tree, a second example
  - Those are with CS background are already aware of BST
  - Whiteboarding



# Decision Tree

- Let's start with the Classification Task
- Whiteboarding

nb of legs	weight (lb)	animal
4	2.1	Bunny
4	7	Cat
4	1.7	Bunny
4	9	Cat
4	2.75	Bunny



# Decision Tree

- Let's start with the Classification Task
- Whiteboarding

nb of legs	weight (lb)	animal
4	2.1	Bunny
4	7	Cat
4	1.7	Bunny
4	9	Cat
4	2.75	Bunny
2	2.5	Chicken
2	3	Chicken

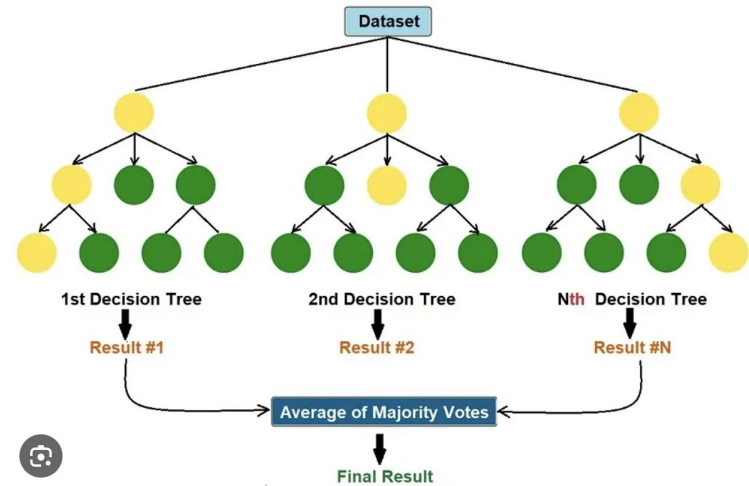


# Ensemble Learning/Meta Learning

- Ensemble (more than one model)
  - Bagging
    - Averaging (RF)
    - Reduces Variance
  - Boosting
    - Gradual improvement over weak learners (Adaboost/XGBoost)
    - Reduces Bias??

# Random Forest

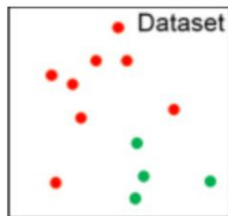
- Instead of one, we have many (but finite) Trees



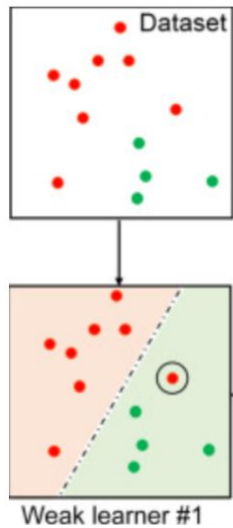


# Boosting

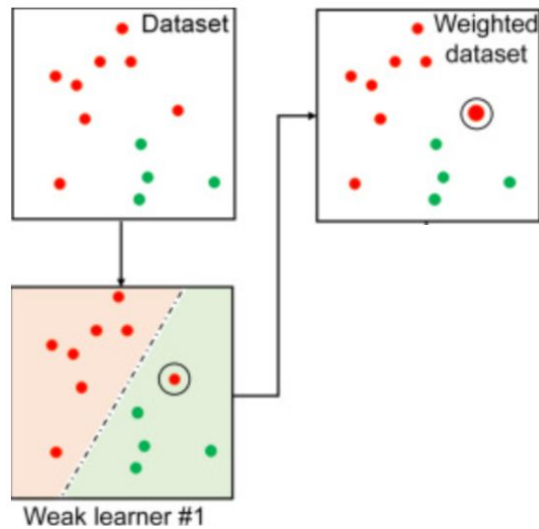
- Combination of some weak models
- Power of many



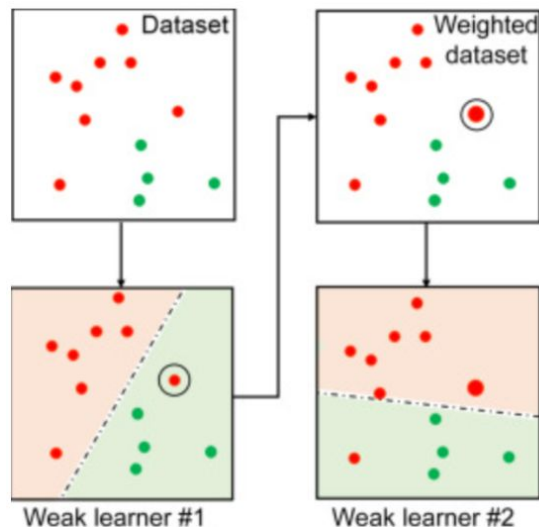
# Boosting



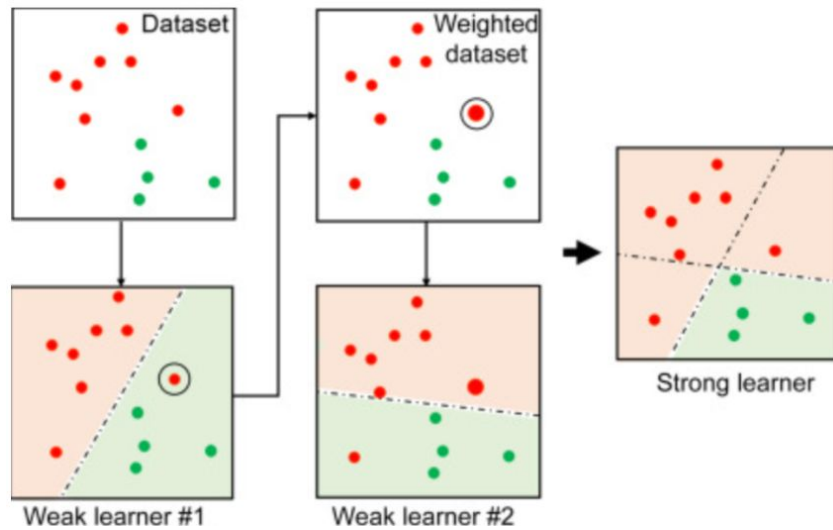
# Boosting



# Boosting



# Boosting





# Classification vs Regression

- Simple ideas!
- Whiteboarding



## Notebook extension/presentation

- See notebooks section (Blackboard)