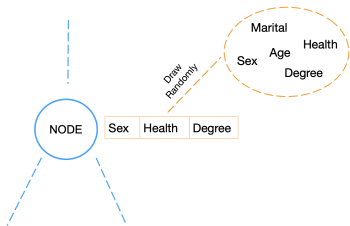


# Random Forest In a Nutshell

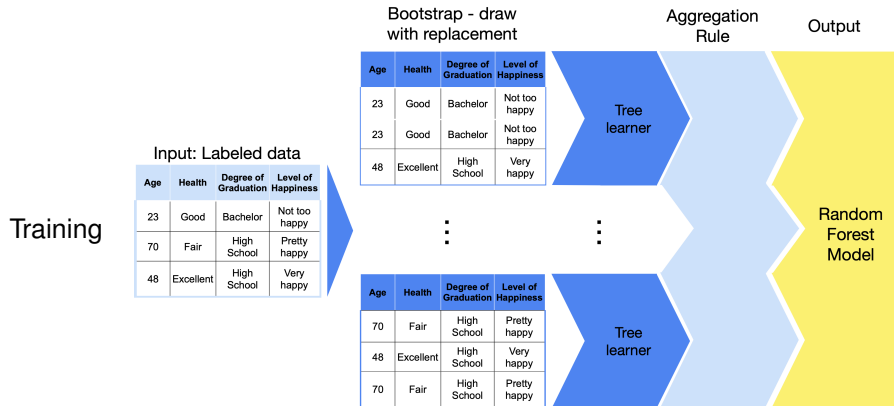


- Understand basic concept of random forest
- Know basic aggregation rules
- Understand concept of feature importance



# LEARNING AND PREDICTION WITH RF

- Stabilizes tree learner by bagging (bootstrap aggregation)
- Randomizes tree learner and combines models into one meta model
- Can be adapted to learning task, i.e., classification or regression



# LEARNING AND PREDICTION WITH RF

Prediction

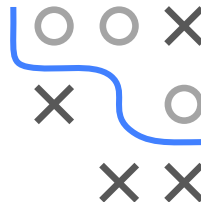
Input: Unlabeled data

| Age | Health | Degree of Graduation | Level of Happiness |
|-----|--------|----------------------|--------------------|
| 41  | Fair   | Bachelor             | ?                  |
| 35  | Good   | Bachelor             | ?                  |
| 22  | Fair   | High School          | ?                  |

Random  
Forest  
Model

Prediction

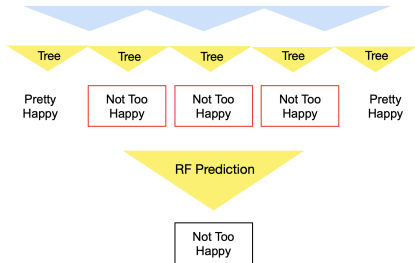
| Level of Happiness |
|--------------------|
| Not too happy      |
| Pretty happy       |
| Not too happy      |



# AGGREGATION RULES FOR DIFFERENT TASKS

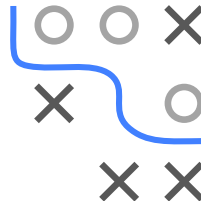
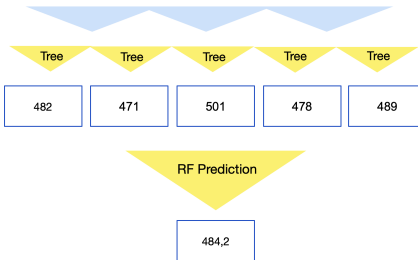
Classification Task - Majority Vote

| Age | Health | Degree of Graduation | Level of Happiness |
|-----|--------|----------------------|--------------------|
| 41  | Fair   | Bachelor             | ?                  |



Regression Task - Averaging

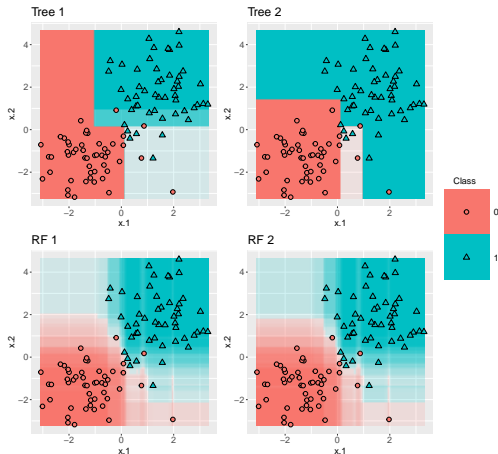
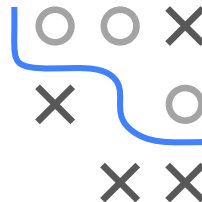
| Rating | Income | Credit Limit | Credit Card Balance |
|--------|--------|--------------|---------------------|
| 107    | 32.318 | 4351         | ?                   |





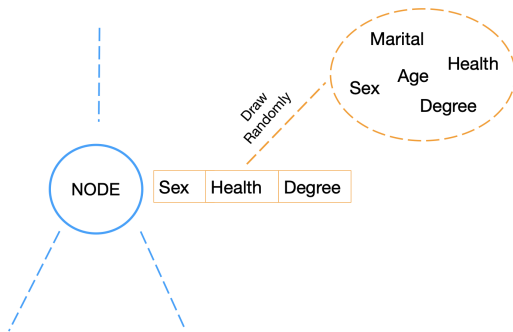
# PERFORMANCE OF RF

- RF performs well for classification tasks:
  - Two different trees → Quite different decision regions
  - Two different RFs → Similar decision regions



# PERFORMANCE OF RF

- Trees should be decorrelated, i.e., make mistakes in different directions
- Avoid correlation by
  - Bootstrap sampling
  - Randomized splits. In each node of each tree, consider different features for splitting:

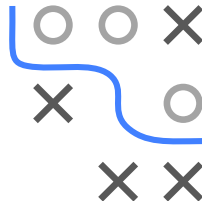
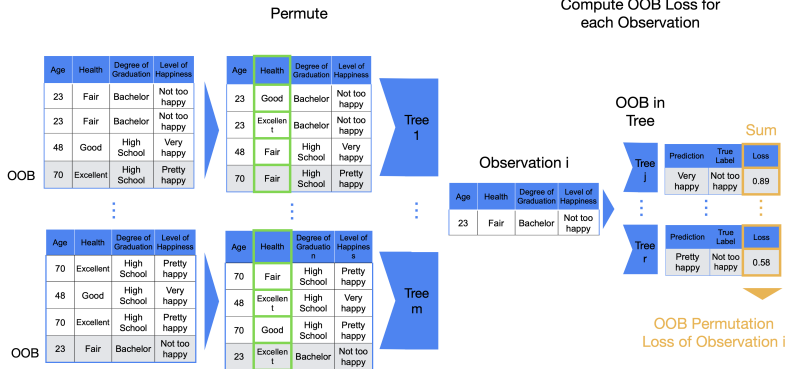






# FEATURE IMPORTANCE

- Measure based on OOB Loss



# FEATURE IMPORTANCE

