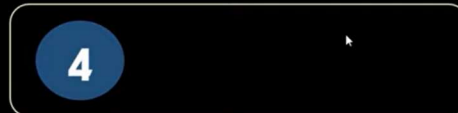


# Advanced Machine Learning Concepts - Ensemble Techniques

10 samples



4 samples

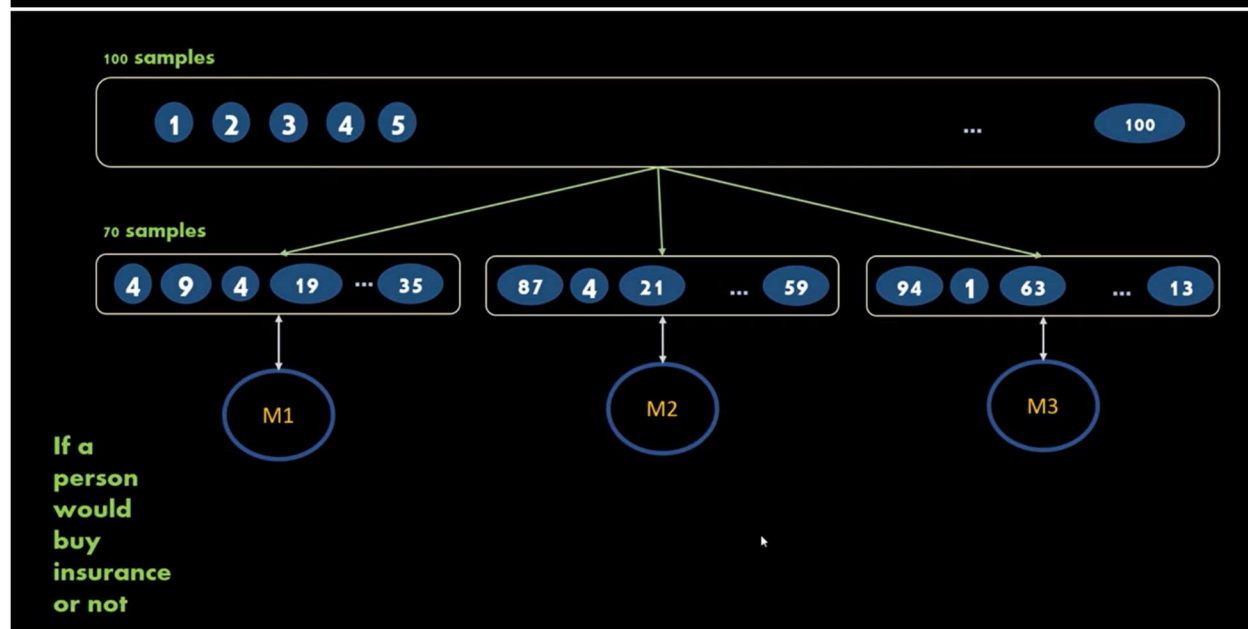
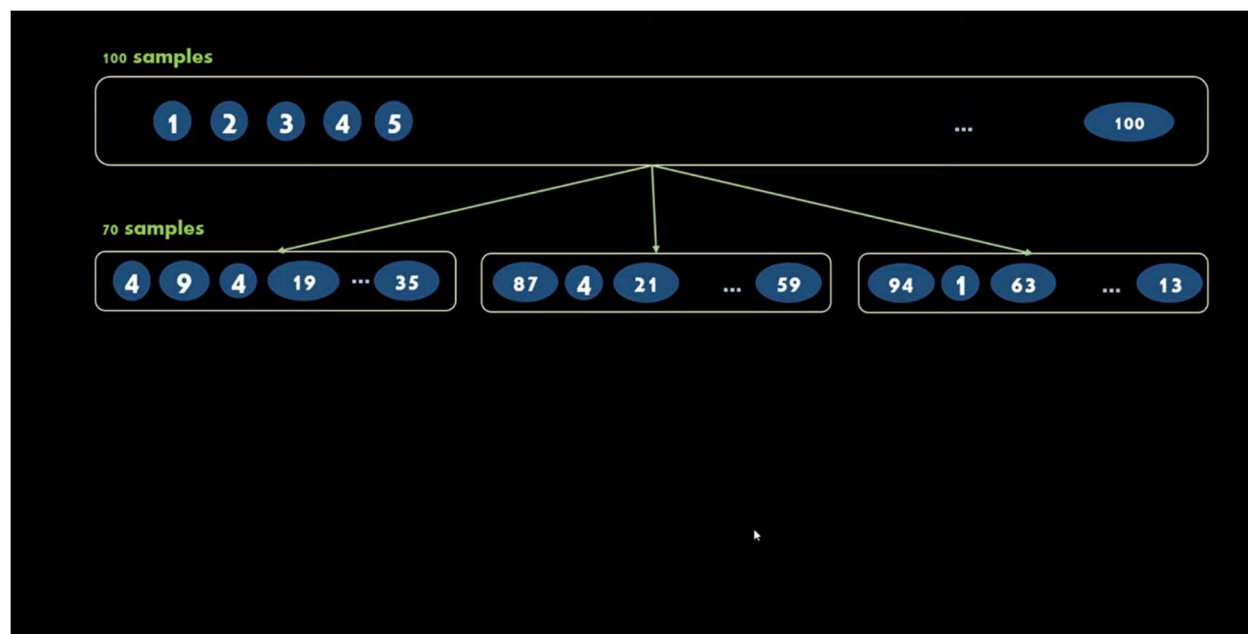


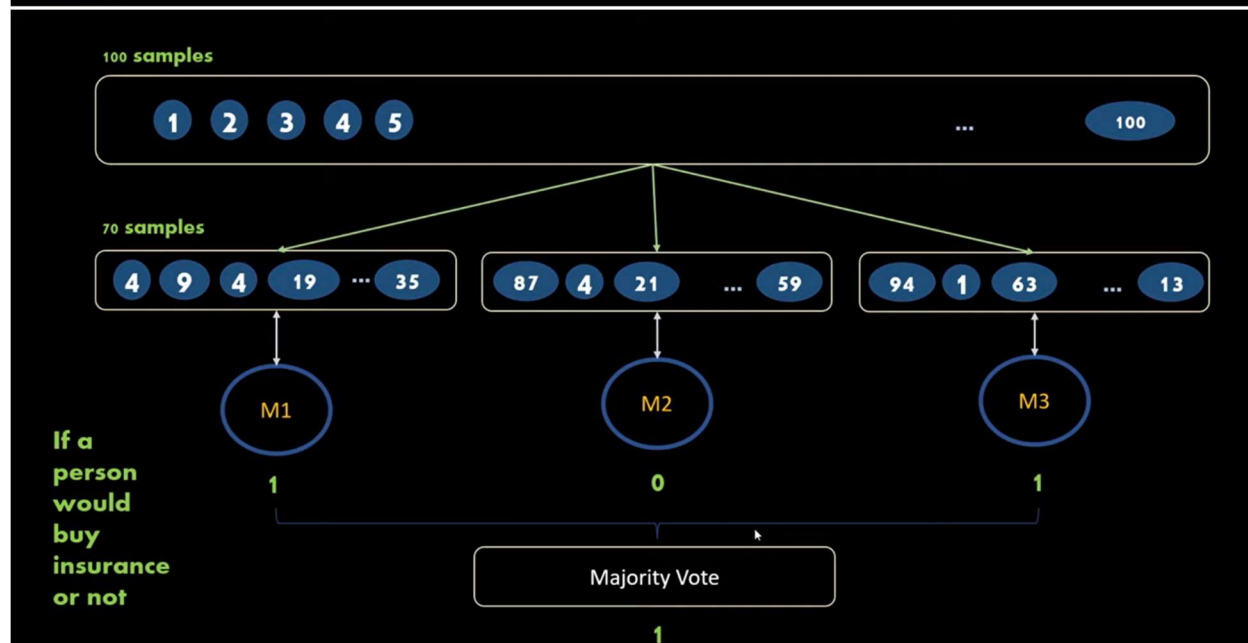
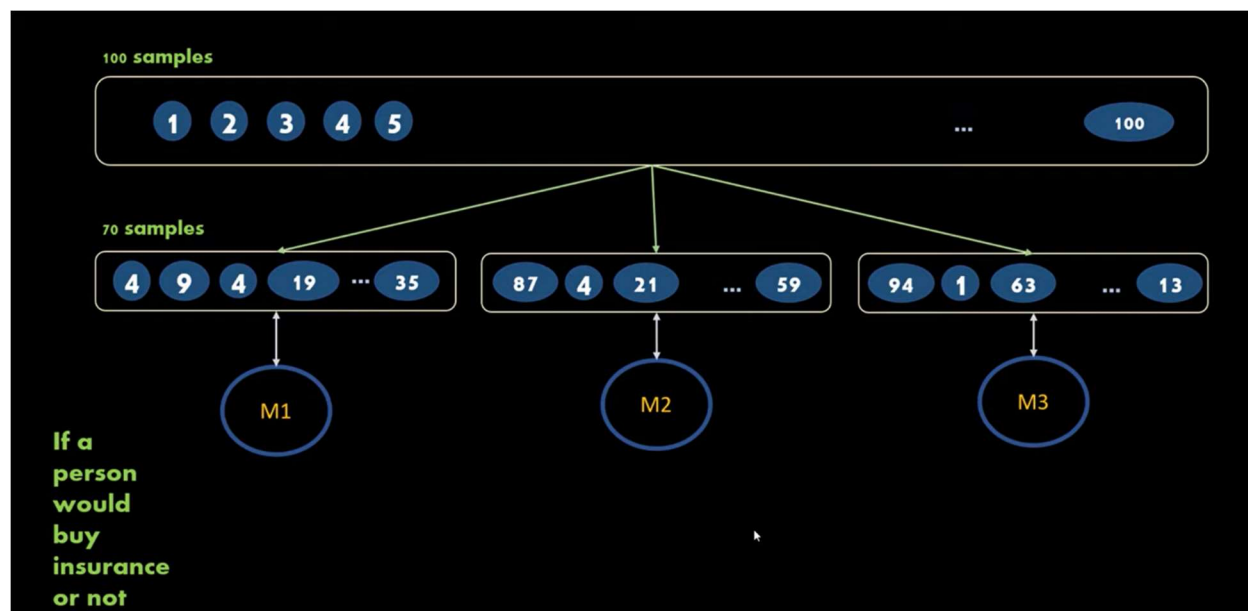
10 samples

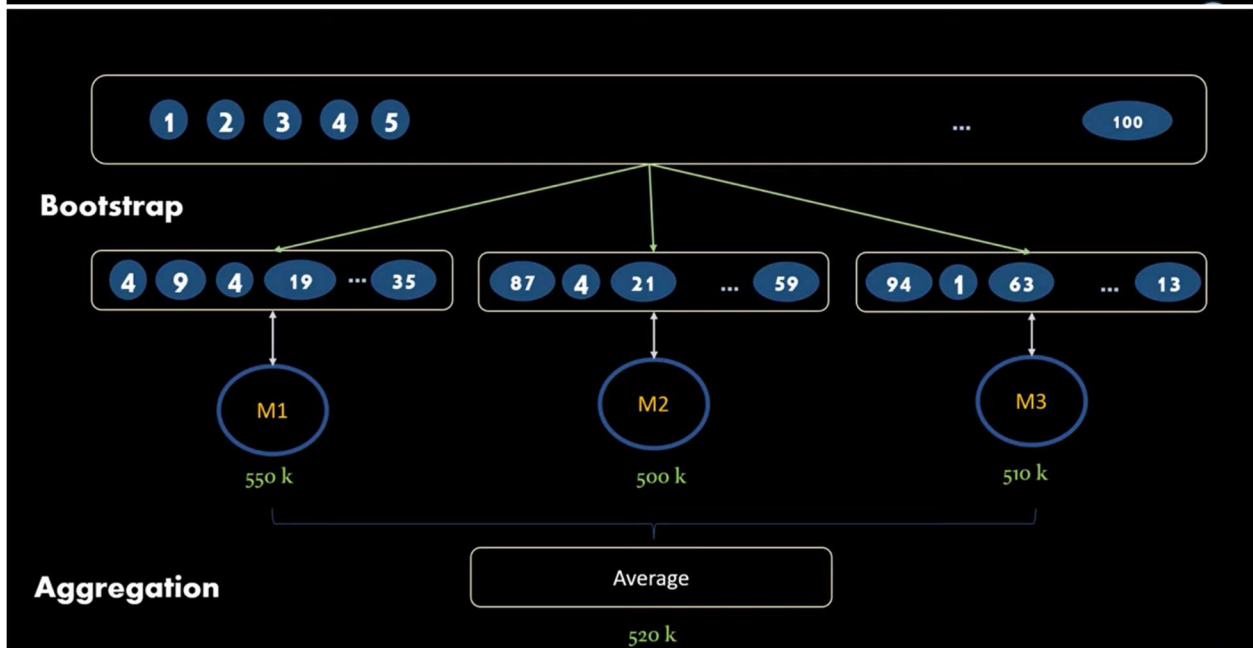
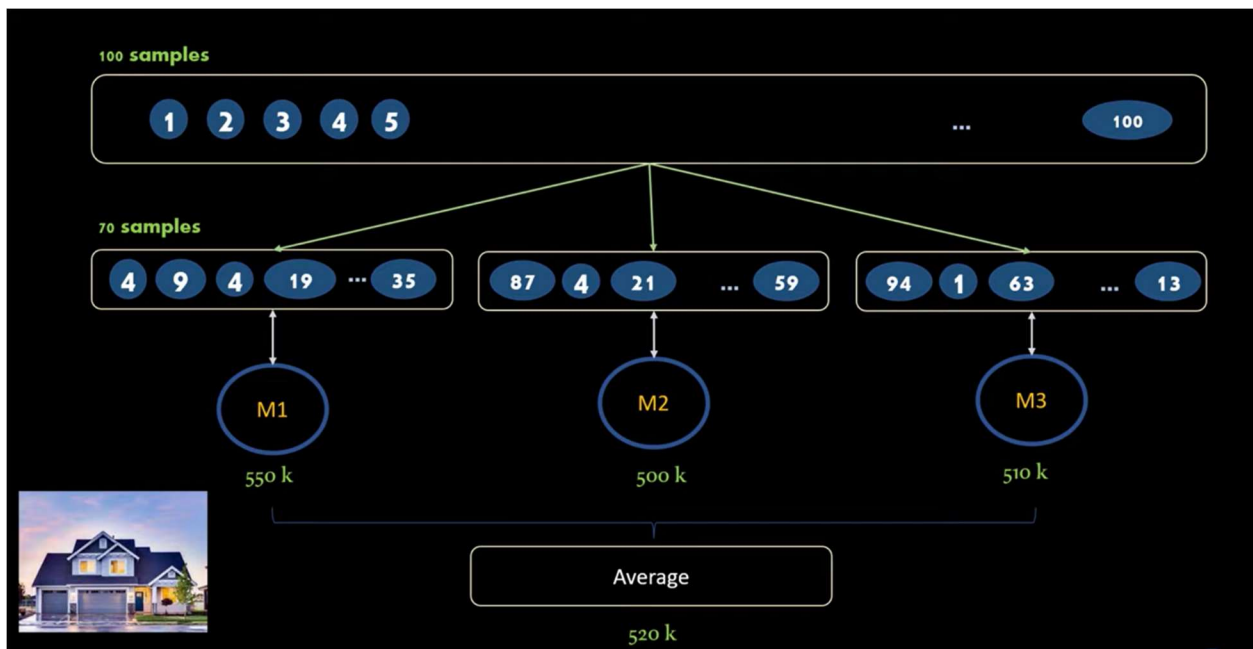


4 samples











# Random Forest Algorithm

Data set as well as  
**features** are sampled

| town         | area | bedrooms | bathroom | plot  | school rating | basement | price  |
|--------------|------|----------|----------|-------|---------------|----------|--------|
| monroe       | 2600 | 2        | 2        | 8500  | 8.1           | Yes      | 550000 |
| monroe       | 3000 | 3        | 3        | 9200  | 8.7           | Yes      | 565000 |
| monroe       | 3200 | 3        | 3        | 8750  | 8.7           | No       | 610000 |
| monroe       | 3600 | 4        | 4        | 10200 | 8.7           | Yes      | 680000 |
| monroe       | 4000 | 5        | 4        | 15000 | 8.1           | Yes      | 725000 |
| west windsor | 2600 | 2        | 2        | 7000  | 9.5           | No       | 585000 |
| west windsor | 2800 | 3        | 3        | 9000  | 9.5           | No       | 615000 |
| west windsor | 3300 | 3        | 4        | 10000 | 9.1           | Yes      | 650000 |
| west windsor | 3600 | 4        | 4        | 10500 | 9.1           | Yes      | 710000 |

| town         | area | bedrooms | bathroom | plot  | school rating | basement | price  |
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| west windsor | 3600 | 4        | 4        | 10500 | 9.1           | Yes      | 710000 |
| west windsor | 3100 | 3        | 3        | 7500  | 9.5           | Yes      | 750000 |

| town         | area | school rating | basement | price  |
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| west windsor | 2800 | 9.5           | No       | 615000 |
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| west windsor | 2600 | 9.5           | No       | 585000 |
| west windsor | 2800 | 9.5           | No       | 615000 |
| monroe       | 4000 | 8.1           | Yes      | 725000 |
| west windsor | 3100 | 9.5           | Yes      | 750000 |

| town         | bathroom | plot  | school rating | price  |
|--------------|----------|-------|---------------|--------|
| west windsor | 3        | 7500  | 9.5           | 750000 |
| monroe       | 4        | 15000 | 8.1           | 725000 |
| west windsor | 3        | 7500  | 9.5           | 750000 |
| monroe       | 4        | 10200 | 8.7           | 680000 |
| west windsor | 2        | 7000  | 9.5           | 585000 |
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| west windsor | 2600 | 2        | No       | 585000 |
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Decision Tree 1 550 k

Decision Tree 2 500 k

Decision Tree 3 510 k

Average 520 k

**Bagging**

Underlying model can be anything (SVM, knn, Logistic regression etc.)

**Bagged Trees**

Each model is a tree



## Cross Validation Techniques

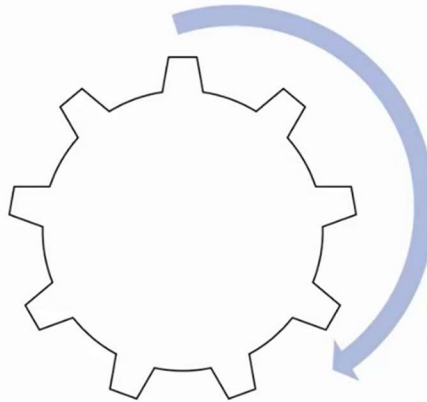
### Option 1

**Use all available data for training  
and test on same dataset**

■ spam  
■ not a spam



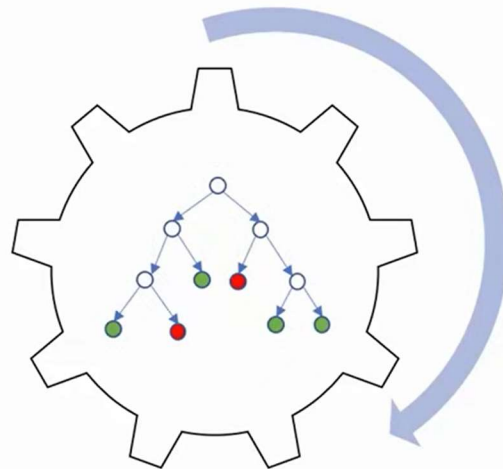
Train



■ spam  
■ not a spam

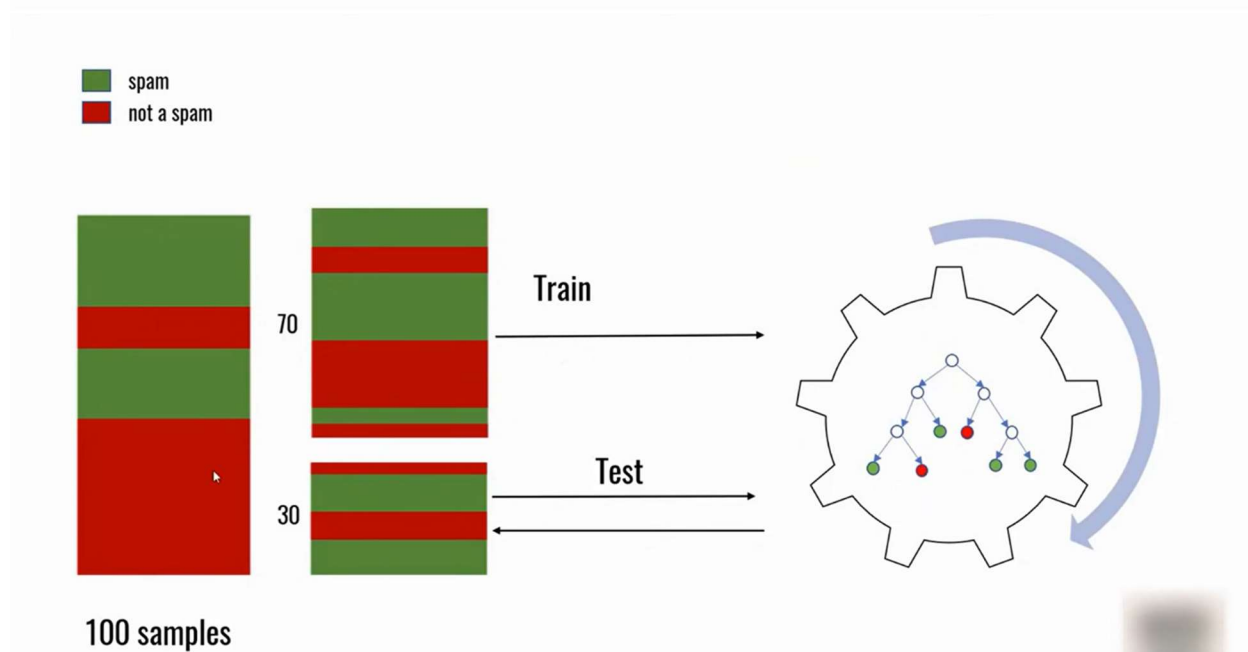
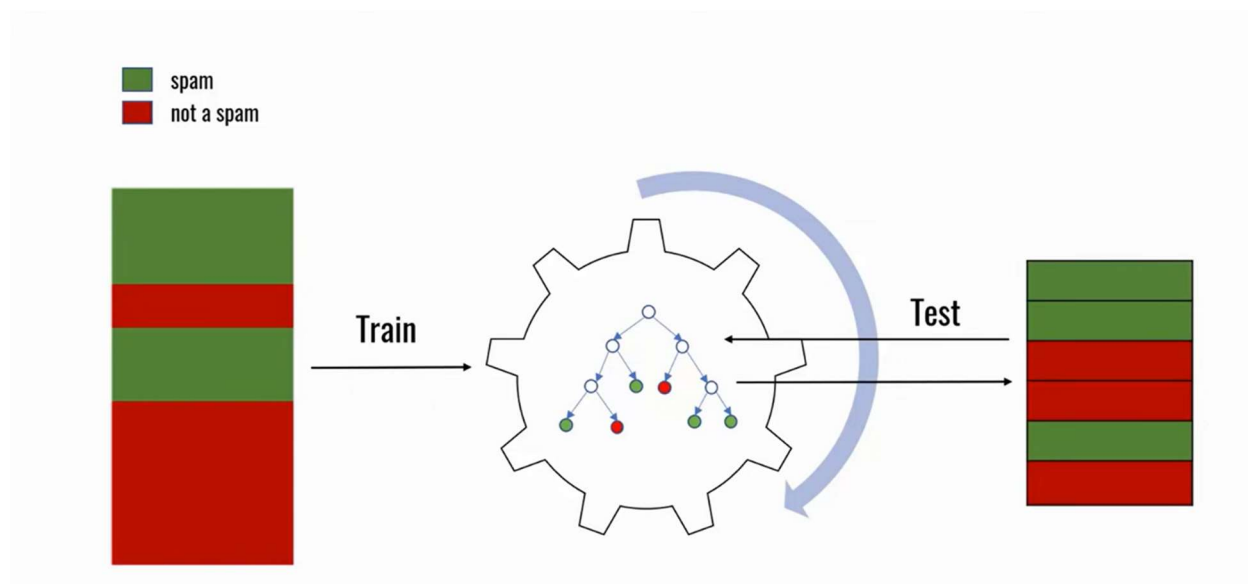


Train



# Option 2

**Split available dataset into  
training and test sets**



# Option 3

## K fold cross validation

