

# MACHINE LEARNING LAB WEEK 3

## 1)Dataset 1

```
PS C:\Users\Wajnuh Seher\Downloads\Week 3 - Decision Trees> python test.py --ID week3lab --data mushrooms.csv
Running tests with PYTORCH framework
=====
target column: 'class' (last column)
Original dataset info:
Shape: (8124, 23)
Columns: ['cap-shape', 'cap-surface', 'cap-color', 'bruises', 'odor', 'gill-attachment', 'gill-spacing', 'gill-size', 'gill-color', 'stalk-shape', 'stalk-root', 'stalk-surface-above-ring', 'stalk-surface-below-ring', 'stalk-color-above-ring', 'stalk-color-below-ring', 'veil-type', 'veil-color', 'ring-number', 'ring-type', 'spore-print-color', 'population', 'habitat', 'class']

First few rows:
cap-shape: ['x' 'b' 's' 'f' 'k'] -> [5 0 4 2 3]
cap-surface: ['s' 'y' 'f' 'g'] -> [2 3 0 1]
cap-color: ['n' 'y' 'w' 'g' 'e'] -> [4 9 8 3 2]
Class: ['p' 'e'] -> [1 0]

Processed dataset shape: torch.Size([8124, 23])
Number of features: 22
Features: ['cap-shape', 'cap-surface', 'cap-color', 'bruises', 'odor', 'gill-attachment', 'gill-spacing', 'gill-size', 'gill-color', 'stalk-shape', 'stalk-root', 'stalk-surface-above-ring', 'stalk-surface-below-ring', 's', 'veil-color', 'ring-number', 'ri', 'ring-type', 'spore-print-color', 'population', 'habitat']
Target: class
Framework: PYTORCH
Data type: <class 'torch.Tensor'>

=====
DECISION TREE CONSTRUCTION DEPO
=====
Total samples: 8124
Training samples: 6409
Testing samples: 1625

Constructing decision tree using training data...

Decision tree construction completed using PYTORCH!

OVERALL PERFORMANCE METRICS
=====
Accuracy: 1.0000 (100.00%)
Precision (weighted): 1.0000
Recall (weighted): 1.0000
F1-Score (weighted): 1.0000
Precision (macro): 1.0000
Recall (macro): 1.0000
F1-Score (macro): 1.0000

TREE COMPLEXITY METRICS
=====
Maximum Depth: 4
Total Nodes: 29
Leaf Nodes: 24
Internal Nodes: 5
```

## 2)Dataset 2:

```
PS C:\Users\Wajnuh Seher\Downloads\Week 3 - Decision Trees> python test.py --ID week3lab --data tictactoe.csv
Running tests with PYTORCH framework
=====
target column: 'Class' (last column)
Original dataset info:
Shape: (958, 10)
Columns: ['top-left-square', 'top-middle-square', 'top-right-square', 'middle-left-square', 'middle-middle-square', 'middle-right-square', 'bottom-left-square', 'bottom-middle-square', 'bottom-right-square', 'Class']

First few rows:
top-left-square: ['x' 'o' 'b'] -> [2 1 0]
top-middle-square: ['x' 'o' 'b'] -> [2 1 0]
top-right-square: ['x' 'o' 'b'] -> [2 1 0]
Class: ['positive' 'negative'] -> [1 0]

Processed dataset shape: torch.Size([958, 10])
Number of features: 9
Features: ['top-left-square', 'top-middle-square', 'top-right-square', 'middle-left-square', 'middle-middle-square', 'middle-right-square', 'bottom-left-square', 'bottom-middle-square', 'bottom-right-square']
Target: Class
Framework: PYTORCH
Data type: <class 'torch.Tensor'>

=====
DECISION TREE CONSTRUCTION DEPO
=====
Total samples: 958
Training samples: 766
Testing samples: 192

Constructing decision tree using training data...

Decision tree construction completed using PYTORCH!

OVERALL PERFORMANCE METRICS
=====
Accuracy: 0.8730 (87.30%)
Precision (weighted): 0.8741
Recall (weighted): 0.8730
F1-Score (weighted): 0.8734
Precision (macro): 0.8590
Recall (macro): 0.8638
F1-Score (macro): 0.8613

TREE COMPLEXITY METRICS
=====
Maximum Depth: 7
Total Nodes: 281
Leaf Nodes: 180
Internal Nodes: 101
```

## 3)Dataset 3:

# MACHINE LEARNING LAB WEEK 3

```
PS C:\Users\Wajid\Downloads\Week 3 - Decision Trees> python test.py --ID week3lab --data Nursery.csv
Running tests with PYTORCH framework
=====
target column: 'class' (last column)
Original dataset info:
Shape: (12960, 9)
Columns: ['parents', 'has_nurs', 'form', 'children', 'housing', 'finance', 'social', 'health', 'class']

First few rows:

parents: ['usual' 'pretentious' 'great_pret'] -> [2 1 0]
has_nurs: ['proper' 'less_proper' 'improper' 'critical' 'very_crit'] -> [3 2 1 0 4]
form: ['complete' 'completed' 'incomplete' 'foster'] -> [0 1 3 2]
class: ['recommend' 'priority' 'not_recom' 'very_recom' 'spec_prior'] -> [2 1 0 4 3]

Processed dataset shape: torch.Size([12960, 9])
Number of features: 8
Features: ['parents', 'has_nurs', 'form', 'children', 'housing', 'finance', 'social', 'health']
Target: class
Framework: PYTORCH
Data type: <class 'torch.Tensor'>

=====
DECISION TREE CONSTRUCTION DEMO
=====
Total samples: 12960
Training samples: 10368
Testing samples: 2592

Constructing decision tree using training data...

🟢 Decision tree construction completed using PYTORCH!

📊 OVERALL PERFORMANCE METRICS
=====
Accuracy: 0.9867 (98.67%)
Precision (weighted): 0.9876
Recall (weighted): 0.9867
F1-Score (weighted): 0.9872
Precision (macro): 0.7684
Recall (macro): 0.7854
F1-Score (macro): 0.7628

🌲 TREE COMPLEXITY METRICS
=====
Maximum Depth: 7
Total Nodes: 952
Leaf Nodes: 698
Internal Nodes: 272
```