< Programming Assignment #2 >

Submission: **LMS** (learning.hanyang.ac.kr)

- **Until May 2 (Thursday), 23:59 PM.**

1. Environment

- OS: Windows, Mac OS, or Linux
- Language: Python (any version is fine, but python3 is recommended)

2. Goal: Build a **decision tree**, and then classify the test dataset using the tree.

3. Requirements

The program must meet the following requirements:

- File name: studentID_name_hw2**.py** **(not ipynb!)**
  - You can put your name in either Korean or English. For english name students, do NOT put space between your first and last names. And only use plain alphabet, do not use like ñ
  - Example 1: **2008011666_채동규_hw2.py**
  - Example 2: **2025016242_albertkarlo_hw2.py**
- I will execute your code with **three** arguments: **training dataset file name**, **test dataset file name**, **classification result file name**
  - Example: python 2008011666_채동규_hw2.py dt_train.txt dt_test.txt dt_result.txt
    - This means that Training file name=‘**dt_train.txt**’, test file name=‘**dt_test.txt**’, classification result file name=‘**dt_result.txt**’
    - I will test your assignment using several different train/test datasets.
- Dataset
  - I will provide you with 2 datasets on LMS
    - Buy_computer: dt_train.txt, dt_test.txt
    - Car_evaluation: dt_train1.txt, dt_test1.txt
  - But please be aware that you need to make your program that can deal with **any** datasets
  - We will evaluate your program with other datasets. (format will be the same)
- File format for a training set

  [*attribute_name_1*]\t[*attribute_name_2*]\t … [*attribute_name_n*]\n

  [*attribute_1*]\t[*attribute_2*]\t … [*attribute_n*]\n

  [*attribute_1*]\t[*attribute_2*]\t … [*attribute_n*]\n

  [*attribute_1*]\t[*attribute_2*]\t … [*attribute_n*]\n

  - [*attribute_name_1*] ~ [*attribute_name_n*]: *n* attribute names
  - [*attribute_1*] ~ [*attribute_n-1*]

- *n-1* attribute values of the corresponding tuple
- All the attributes are **categorical** (not continuous-valued)

- [*attribute_n*]: a **class label** that the corresponding tuple belongs to
- Example 1 (data_train.txt):

age	income	student	credit_rating	Class:buys_computer
<=30	high	no	fair	no
<=30	high	no	excellent	no
31…40	high	no	fair	yes
>40	medium	no	fair	yes

Figure 1. An example of the first training set.

- Example 2 (data_train1.txt):

buying	maint	doors	persons	lug_boot	safety	car_evaluation
high	high	3	4	big	low	unacc
med	high	2	2	small	med	unacc
low	med	5more	2	big	high	unacc
low	high	2	4	med	low	unacc
med	vhigh	4	2	med	med	unacc

Figure 2. An example of the second training set.

- Data name: car evaluation database
- Attribute values
  - Buying: vhigh, high, med, low
  - Maint: vhigh, high, med, low
  - Doors: 2, 3, 4, 5more
  - Persons: 2, 4, more
  - Lug_boot: small, med, big
  - Safety: low, med, high
- **Class labels**: unacc, acc, good, vgood
- Number of instances: training set - 1,382; test set - 346

- Attribute selection measure: **gain ratio**
- File format for a test set

[*attribute_name_1*]\t[*attribute_name_2*]\t … [*attribute_name_n-1*]\n

[*attribute_1*]\t[*attribute_2*]\t … [*attribute_n-1*]\n

[*attribute_1*]\t[*attribute_2*]\t … [*attribute_n-1*]\n

[*attribute_1*]\t[*attribute_2*]\t … [*attribute_n-1*]\n

- Example 1 (dt_test.txt):

age	income	student	credit_rating
<=30	low	no	fair
<=30	medium	yes	fair
31…40	low	no	fair

Figure 3. An example of the first test set.

- Example 2 (dt_test1.txt):

buying	maint	doors	persons	lug_boot	safety
med	vhigh	2	4	med	med
low	high	4	4	small	low
high	vhigh	4	4	med	med
high	vhigh	4	more	big	low
low	high	3	more	med	low

Figure 4. An example of the second test set.

- **The test set does NOT** have [*attribute_name_n*] (class label). You need to predict the class labels with the trained decision tree, and record the classification results on the result file (see below).

- Classification result (output) file format

  [*attribute_name_1*]\t[*attribute_name_2*]\t … [*attribute_name_n*]\n

  [*attribute_1*]\t[*attribute_2*]\t … [*attribute_n*]\n

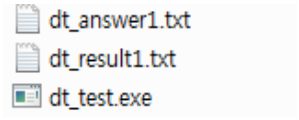
  [*attribute_1*]\t[*attribute_2*]\t … [*attribute_n*]\n

  [*attribute_1*]\t[*attribute_2*]\t … [*attribute_n*]\n

  - Output file name: **dt_result.txt (for 1th dataset), or, dt_result1.txt (for 2nd dataset)**
  - You must print the following values:
    - [*attribute_1*] ~ [*attribute_n-1*]: given attribute values in the test set
    - [*attribute_n*]: a class label predicted by your model for the corresponding tuple
  - Please **DO NOT CHANGE the order of the tuples** in each test set when you print your outputs
  - **Please be sure to use \t to identify your attributes.**

4. Testing program

- Please put the following files in a same directory: Testing program, your output files (dt_result.txt, dt_result1.txt), an attached answer file (dt_answer.txt, dt_answer1.txt)



- Execute the testing program with two arguments (answer file name and your output file name)

```
DM_assignment2>dt_test.exe dt_answer1.txt dt_result1.txt
```

- Check your score for the input file

```
346 / 346
```

  - the number of your correct prediction / the number of correct answers

- The test program was build with program 'mono'. So, even if you are using mac or linux instead of window, you can run dt_test.exe using C# mono.

5. Important Notes:

- Your tree may not be perfect. It is almost impossible to perfectly classify all the data in the test set. So a slight number of misclassification is natural.
- You don’t need to apply the “pruning” strategy.

6. Submission

- Please make **a single, runnable .py file** and upload it on LMS.

7. Penalty

- Late submission
  - 1 week delay: 20%
  - 2 weeks delay: 50%
  - Delay more than 2 weeks: 100%
- Requirements unsatisfied
  - Penalty up to 100% will be given depending on how the requirements are well-satisfied
- Plagiarim (from Internet, assisted by ChatGPT or any other AI-based generation, borrowed from someone else, etc)
  - Such plagiarim can be easily detected, and if detected, F grade will be given.
  - Please do it your own. This is not a difficult assignment.