NTU ADL 2023 Fall HW3

Deadline: 2023/11/29 23:59:59

Update Logs

- Taiwan-LLaMa checkpoint reminder (see Taiwan-LLaMa page)
- Submission format (see File Layout)
- Arguments for run.sh (see run.sh)
- Question 2 Clarification (see report Q2)
- download.sh clarification (see File Layout - After downloading)
- Command for grading with ppl.py (see Grading - ppl.py)
- Command for run.sh (see run.sh - cont.)

Links

- Homework 3 files (link)

Task Description

Instruction Tuning (Classical Chinese)

- ***Example 1***

Instruction:

翻譯成文言文：

雅裏惱怒地說：從前在福山田獵時，你誣陷獵官，現在又說這種話。

答案：

Output:

雅裏怒曰：昔畋於福山，卿誣獵官，今復有此言。

- ***Example 2***

Instruction:

議雖不從，天下咸重其言。

翻譯成白話文：

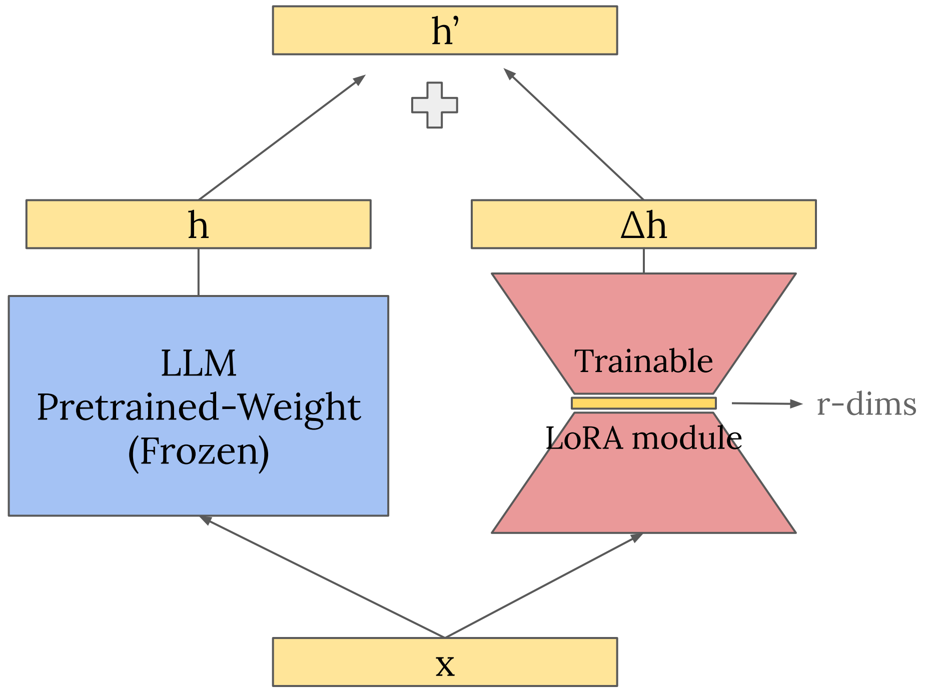
Output:

他的建議雖然不被采納，但天下都很敬重他的話。

Taiwan-LLaMa

- Traditional Mandarin support LLM based on LLaMa 2
- Github Repository
- Online Demo
- Due to the possibility of changes in the HuggingFace checkpoints, we recommend you to use the checkpoint we have downloaded (link) for this homework. If you still want to download the checkpoint from Huggingface, you can download it form this commit. (commit id: 5073b2bbc1aa5519acdc865e99832857ef47f7c9)

Low Rank Adaptation (LoRA)



https://arxiv.org/pdf/2106.09685.pdf

QLoRA Fine-tuning

- QLoRA reduces the memory usage of LLM fine-tuning by employing 4-bit quantization to compress a LLM, while utilizing 16-bit float to perform computations
- Paper

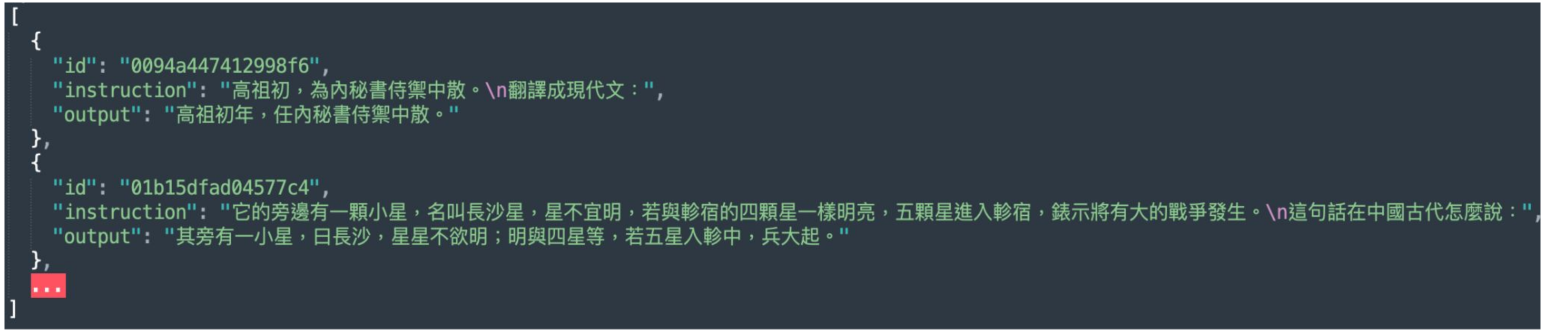
Experiments

- Dataset
    - Training (train.json): 10000
    - Testing (Public) (public_test.json): 250
    - Testing (Private) (private_test.json): 250

- Evaluation:
    - Perplexity (ppl.py)

Data Format

- json format



```
[
  {
    "id": "0094a447412998f6",
    "instruction": "高祖初，為內秘書侍禦中散。\n翻譯成現代文：",
    "output": "高祖初年，任內秘書侍禦中散。"
  },
  {
    "id": "01b15dfad04577c4",
    "instruction": "它的旁邊有一顆小星，名叫長沙星，星不宜明，若與軫宿的四顆星一樣明亮，五顆星進入軫宿，錶示將有大的戰爭發生。\n這句話在中國古代怎麼說：",
    "output": "其旁有一小星，曰長沙，星星不欲明；明與四星等，若五星入軫中，兵大起。"
  },
  ...
]
```

Rules

What You Can Do:

- LLM checkpoint:
  - yentinglin/Taiwan-LLM-7B-v2.0-chat
- Packages:
  - torch==2.1.0, transformers==4.34.1, bitsandbytes==0.41.1, peft==0.6.0
  - Others: no limitation

What You Can NOT Do

- Use external training data
- Any means of cheating or plagiarism, including but not limited to:
    - Directly apply others' published / unpublished code…, including the codes written your classmates or public on the internet
    - Give/get trained model/predictions to/from others.
    - Give/get report answers or plots to/from others.
    - Publish your code before deadline.
- Violations may cause zero/negative score and punishment from school.

Submission

File Layout - Before downloading

- Zip your folder, which should be named as your student id (lower-cased) (ex. r11000000) and submit the .zip to NTU Cool.

```
r11000000
├── download.sh
├── utils.py
├── prediction.json
├── run.sh
├── report.pdf
├── README.md
└── code/script (all the code/script you used to train, predict, or plot report figures should be included)
```

download.sh

- **download.sh** should download or create a folder called **adapter_checkpoint** which contains peft configuration file (adapter_confi.json) and weights (adapter_model.bin).
    - DO NOT download Taiwan-LLaMa checkpoint!!
- Do not modify your file after deadline, or it will be seen as cheating.
- Keep the URLs in download.sh valid for at least 3 weeks after deadline.
- You can download at most 4G, and download.sh should finish within 1 hour. (At csie dept with maximum 10MB/s bandwidth)
- Do not do things more than downloading. Otherwise, your **download.sh** may be killed.
- Do not pip install ANYTHING in your **download.sh**, you are not allowed to modify the testing environment
- We will execute **download.sh** before predicting scripts.

File Layout - After downloading

- After we run download.sh, the **adapter_config.json** and **adapter_model.bin** should be **in adapter_checkpoint**.

```
r11000000
├── download.sh
├── utils.py
├── prediction.json
├── run.sh
├── report.pdf
├── README.md
├── code/script (all the code/script you used to train, predict, or plot report figures should be included)
└── adapter_checkpoint
              ├── adapter_config.json
              └── adapter_model.bin
```

utils.py

- Two functions are required:
  - def get_prompt(instruction: str) -> str:
    - return the prompt to input into the LLM
  - def get_bnb_config() -> BitsAndBytesConfig:
    - return your bnb configuration
- TAs will include “from utils import get_prompt, get_bnb_config” when testing.
- Make sure that your function's input and output fields are correct and can be used accurately

README.md

- README.md should contain step-by-step instructions on how to setup your environments and how to train your model with your codes/scripts.
- You will get a **-2** penalty if you have no or empty README.md.
- If necessary, you will be required to reproduce your results based on the README.md.
- If you cannot reproduce your result, you may lose points.

run.sh

- **run.sh** should perform text generation using your trained models and output predictions on testing file (.json)
- arguments
  - ${1}: path to the Taiwan-LLaMa checkpoint folder
  - ${2}: path to the adapter_checkpoint downloaded **under your folder**
  - ${3}: path to the input file (.json)
  - ${4}: path to the output file (.json)
- TA will predict testing data as follow:
  1. bash ./download.sh
  2. bash ./run.sh /path/to/Taiwan-LLaMa-folder /path/to/adapter_checkpoint \
     /path/to/input.json /path/to/output.json
- run.sh should finish within 2 hours. (See environment details)

run.sh - cont.

Command:

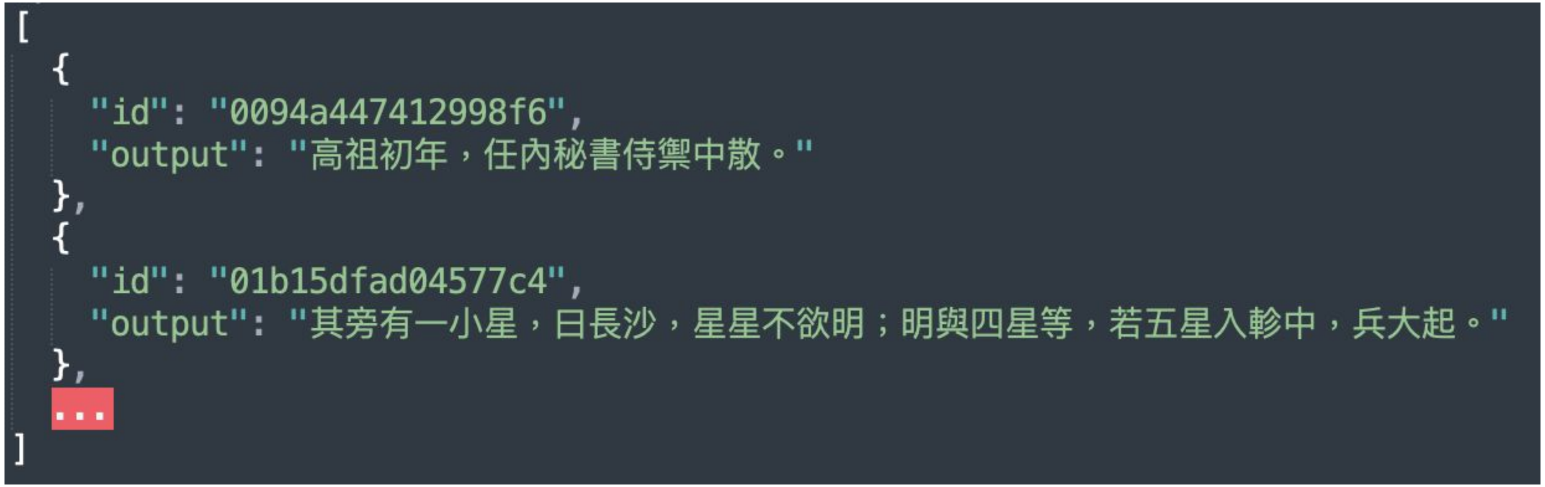
```
bash run.sh \
    /path/to/Taiwan-Llama \
    /path/to/adapter_checkpoint/under/your/folder \
    /path/to/input \
    /path/to/output
```

- example:

```
bash run.sh \
    /home/Taiwan-LLM-7B-v2.0-chat \
    /home/hw3/r11922000/adapter_checkpoint \
    /home/data/public_test.json \
    /home/output/r11922000_output.json
```

prediction.json

- Testing set (Private)
- DO NOT include any special tokens (<s>, </s>, ...) and your prompt in your output



```
[
  {
    "id": "0094a447412998f6",
    "output": "高祖初年，任內秘書侍禦中散。"
  },
  {
    "id": "01b15dfad04577c4",
    "output": "其旁有一小星，日長沙，星星不欲明；明與四星等，若五星入軫中，兵大起。"
  },
  ...
]
```

Execution Environment

- We will run the testing codes on the computer with
  - Ubuntu 20.04
  - 32GB RAM, GTX 3070 8GB VRAM, and 20GB disk space available
- Python3.10
- Packages
  - torch==2.1.0, transformers==4.34.1, bitsandbytes==0.41.1, peft==0.6.0

Grading

- Model Performance (5%)
  - Public baseline: ppl = 4.000↓ (2%)
  - Private baseline: ppl = 4.500↓ (2%)
  - prediction.json: Human evaluation (1%)
- Report (15% + 2%)
- Format
  - You may lose (some or all) of your model performance score if your script is at wrong location, causes any error, etc.

Grading - ppl.py

- TA will use our own ppl.py (which is the same as we published), so you don't have to upload ppl.py
- Command:

```
python3 ppl.py \
    --base_model_path /path/to/Taiwan-Llama \
    --peft_path /path/to/adapter_checkpoint/under/your/folder \
    --test_data_path /path/to/input/data
```

  - example:

```
python3 ppl.py \
    --base_model_path /home/Taiwan-LLM-7B-v2.0-chat \
    --peft_path /home/hw3/r11922000/adapter_checkpoiint \
    --test_data_path /home/data/public_test.json
```

Late Submission

- Late submission penalties:
  - 0 day < late submission ≤ 1 day: original score * 0.95
  - 1 day < late submission ≤ 3 day: original score * 0.90
  - 3 day < late submission ≤ 4 day: original score * 0.75
  - 4 day < late submission ≤ 5 day: original score * 0.50
  - 5 day < late submission ≤ 6 day: original score * 0.25
  - 6 day < late submission: original score * 0.00
- Late submission is determined by the last submission.
  - Update your submission after deadline implies that you will get penalty.

Report

Q1: LLM Tuning

- Describe:
  - How much training data did you use? (2%)
  - How did you tune your model? (2%)
  - What hyper-parameters did you use? (2%)

- Show your performance:
  - What is the final performance of your model on the public testing set? (2%)
  - Plot the learning curve on the public testing set (2%)

Q2: LLM Inference Strategies

- Zero-Shot
  - What is your setting? How did you design your prompt? (1%)
- Few-Shot (In-context Learning)
  - What is your setting? How did you design your prompt? (1%)
  - How many in-context examples are utilized? How you select them? (1%)
- Comparison:
  - What's the difference between the results of zero-shot, few-shot, and LoRA? (2%)

Note:
Please conduct zero-shot and few-shot experiments on Taiwan-LLaMa that has not been fine-tuned with QLoRA

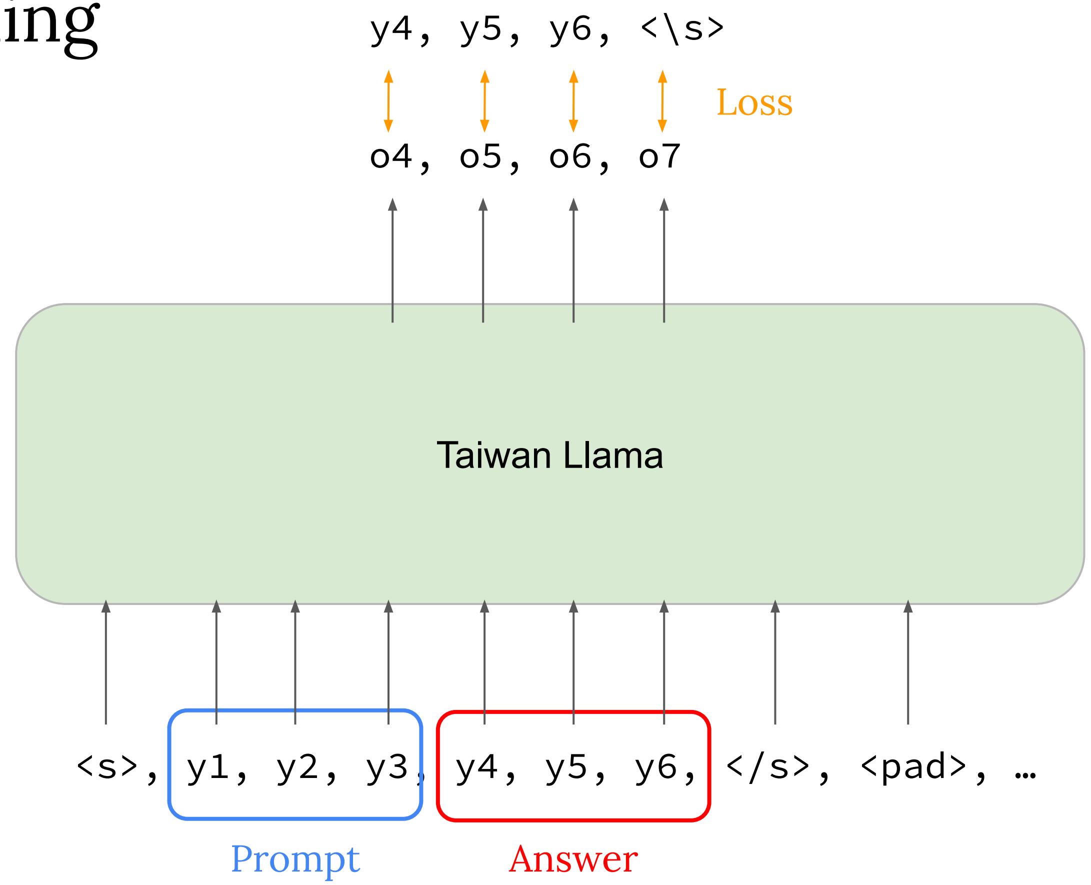
Q3: Bonus: Other methods (2%)

- Choose one of the following tasks for implementation
  - Experiments with different PLMs
  - Experiments with different LLM tuning methods

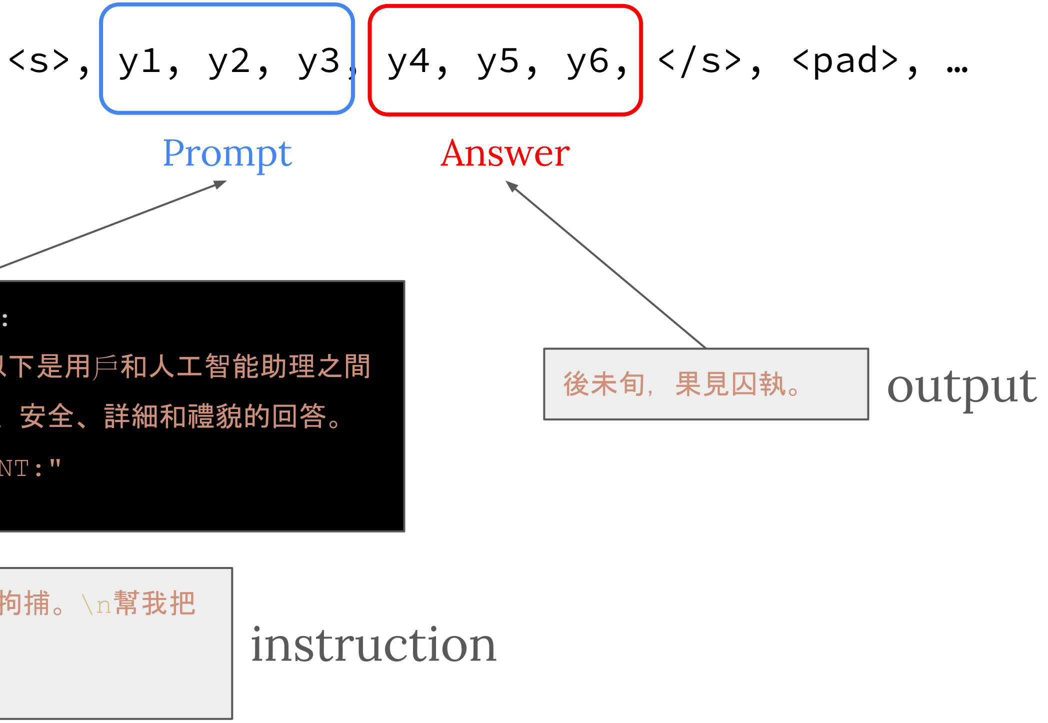
- Describe your experimental settings and compare the results to those obtained from your original methods

Guides

Instruction Tuning



Instruction Tuning

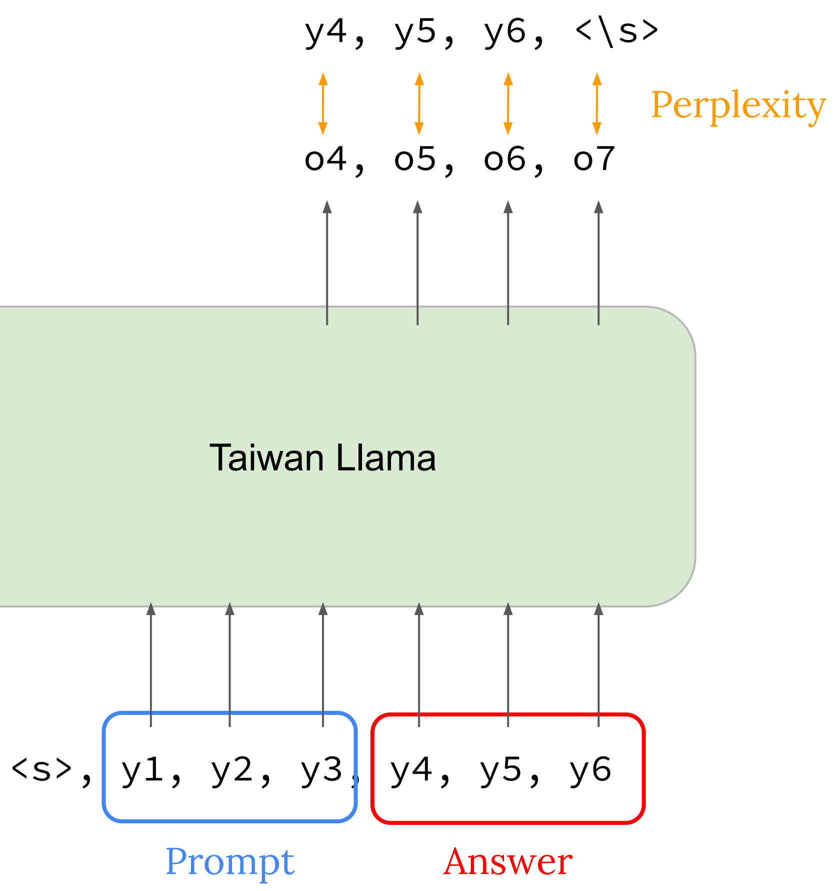


```
def get_prompt(instruction):
  return f"你是人工智慧助理，以下是用戶和人工智能助理之間
的對話。你要對用戶的問題提供有用、安全、詳細和禮貌的回答。
USER: {instruction} ASSISTANT:"
```

沒過十天，鮑泉果然被拘捕。\n幫我把這句話翻譯成文言文

後未旬，果見囚執。

Perplexity


y4, y5, y6, <\s>
Perplexity
o4, o5, o6, o7
Taiwan Llama
<s>, y1, y2, y3, y4, y5, y6
Prompt
Answer

Quantization (4 bit)

```python
from utils import get_bnb_config
from peft import prepare_model_for_kbit_training

bnb_config = get_bnb_config() # return a BitsAndBytesConfig

model = AutoModelForCausalLM.from_pretrained(
  model_name_or_path,
  quantization_config=bnb_config
)

if training:
  model = prepare_model_for_kbit_training(model)
```

Ref:

1. https://huggingface.co/blog/4bit-transformers-bitsandbytes
2. https://huggingface.co/docs/transformers/main_classes/quantization#advanced-use-cases
3. https://github.com/artidoro/qlora

Reference

1. https://huggingface.co/docs/peft/index
2. https://github.com/huggingface/peft
3. https://huggingface.co/blog/4bit-transformers-bitsandbytes
4. https://huggingface.co/docs/transformers/main_classes/quantization#advanced-use-cases
5. https://github.com/artidoro/qlora
6. https://github.com/huggingface/trl

Any questions

- NTU COOL discussion
- Email:
  - adl-ta@csie.ntu.edu.tw
- TA hours
  - Tue. 11:00 ~ 12:00 @ 德田 524
  - Fri. 14:00 ~ 15:00 @ 德田 524