NTU ADL 2025 Fall
HW2

Deadline: 2025/10/13 23:59:59

Update Log

- datasets==3.0.1 is allowed

Links

- Homework 2 files (link)
- HW2 討論區

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：

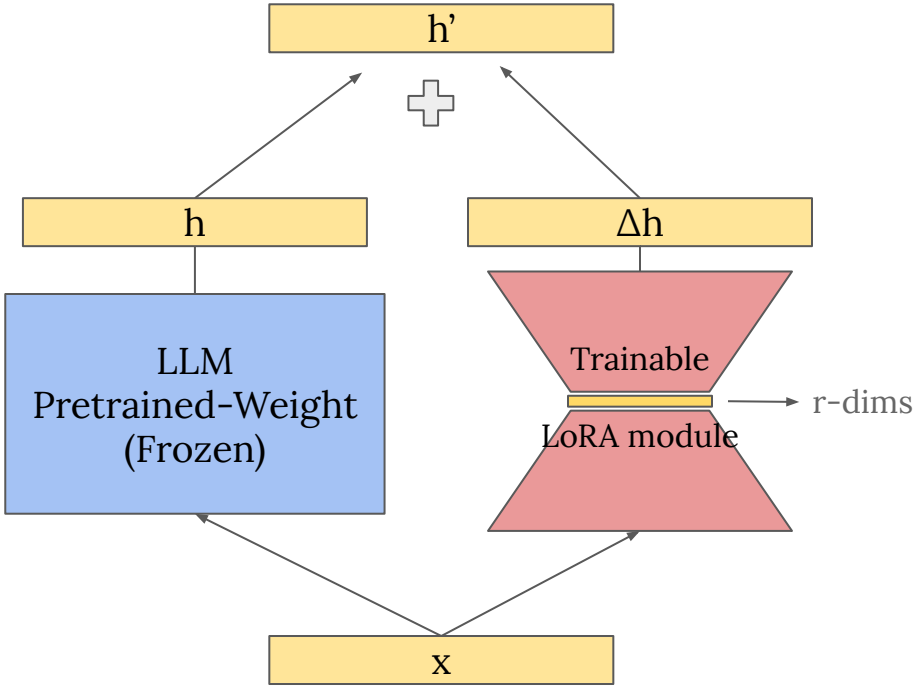
Output:

他的建議雖然不被采納，但天下都很敬重他的話。

Model- Qwen3-4B

- Qwen is a open source LLM trained by Alibaba
- For more information about the model: link

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:
  - Qwen/Qwen3-4B
- Packages:
  - torch==2.4.1, transformers>=4.51.0, bitsandbytes==0.44.1, peft==0.13.0, gdown

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  - Directly apply others' published / unpublished code..., including the codes written your classmates or public on the internet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
  ├── 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_config.json**) and weights (**adapter_model.safetensors**).
  - !!DO NOT download original model 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.safetensors** should be **in adapter_checkpoint**.

```
r11000000
├── download.sh
├── utils.py
├── 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.safetensors
```

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 model 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/model-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/`Qwen/Qwen3-8B` \
    /path/to/adapter_checkpoint/under/your/folder \
    /path/to/input \
    /path/to/output
```

- example:

```
bash run.sh \
    “Qwen/Qwen3-8B” 
    /home/hw3/r11922000/adapter_checkpoint \
    /home/data/public_test.json \
    /home/output/r11922000_output.json
```

Output from run.sh

- 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，曰長沙，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, RTX 3070 8GB VRAM, and 20GB disk space available
- Python3.10
- Packages
  - torch==2.4.1, transformers>=4.51.0, bitsandbytes==0.44.1, peft==0.13.0, gdown

Grading

- Model Performance (5%)
  - Public baseline: ppl = 7.2 ↓ (2%)
  - Private baseline: ppl = 15 ↓ (2%)
  - Human evaluation from private testing set (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/`Qwen/Qwen3-4B` \
    --peft_path /path/to/adapter_checkpoint/under/your/folder \
    --test_data_path /path/to/input/data
```

  - example:

```
python3 ppl.py \
    --base_model_path `Qwen/Qwen3-4B` \
    --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%)

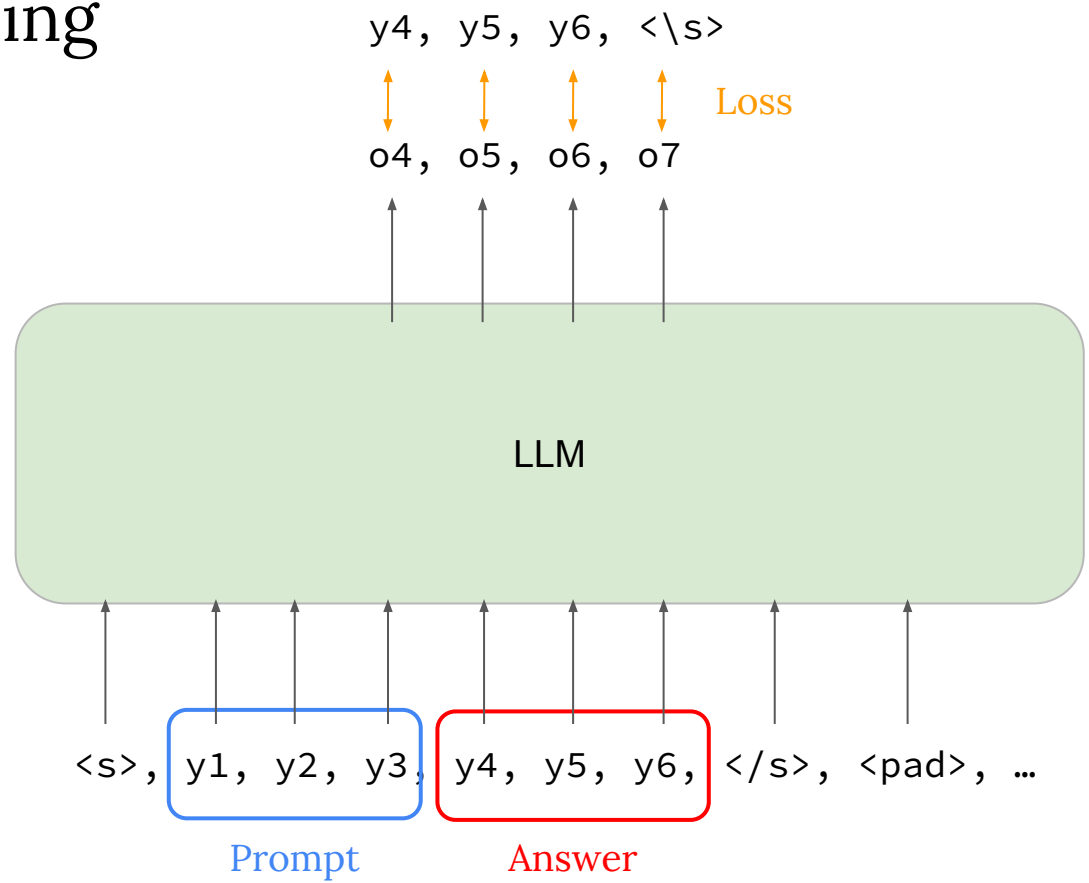
Note:
Please conduct zero-shot and few-shot experiments on Orginal Model that has not been fine-tuned with QLoRA

Q3: Bonus: Try Llama3-Taiwan (8B) (2%)

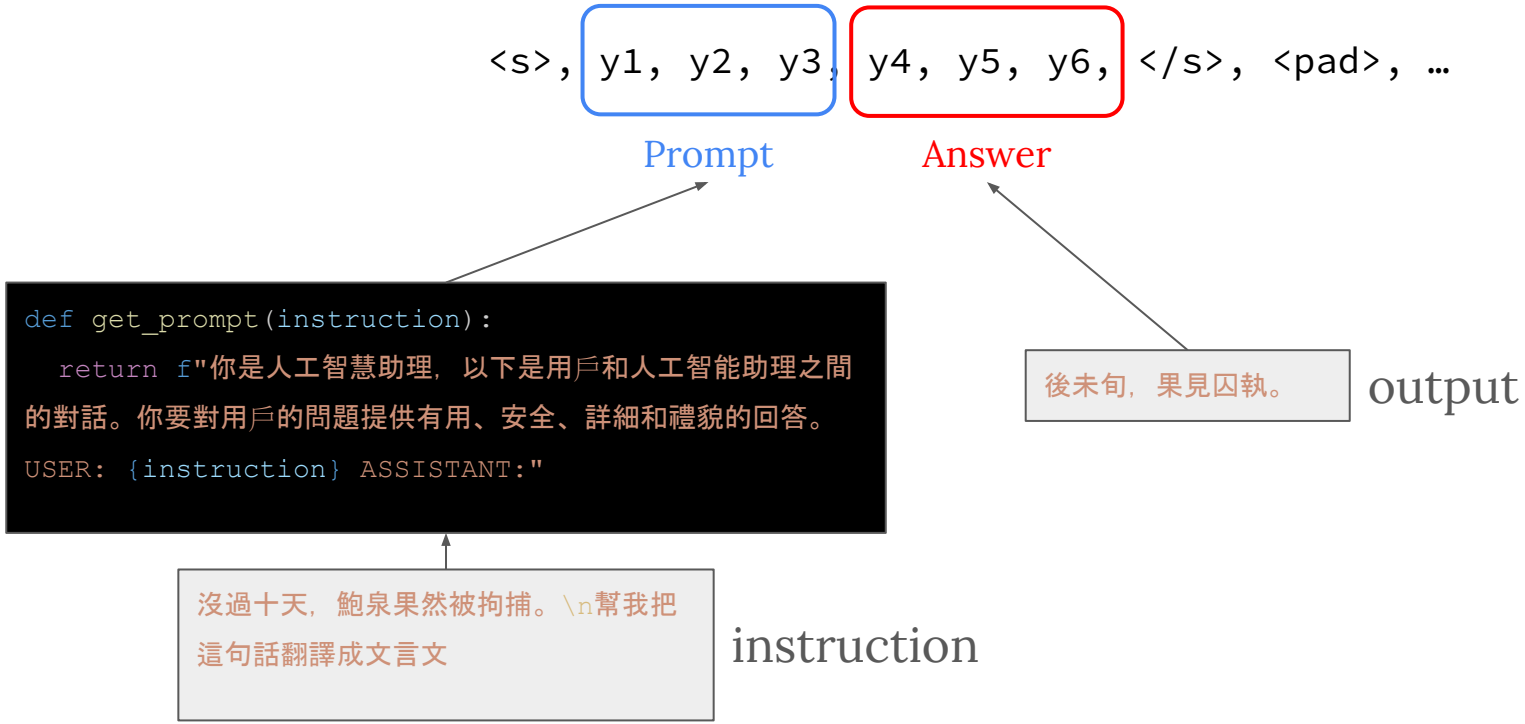
- Llama-3-8b trained by traditional Chinese data
- Tune this model on the classical chinese data
- Describe your experimental settings and compare the results to those obtained from your original methods

Guides

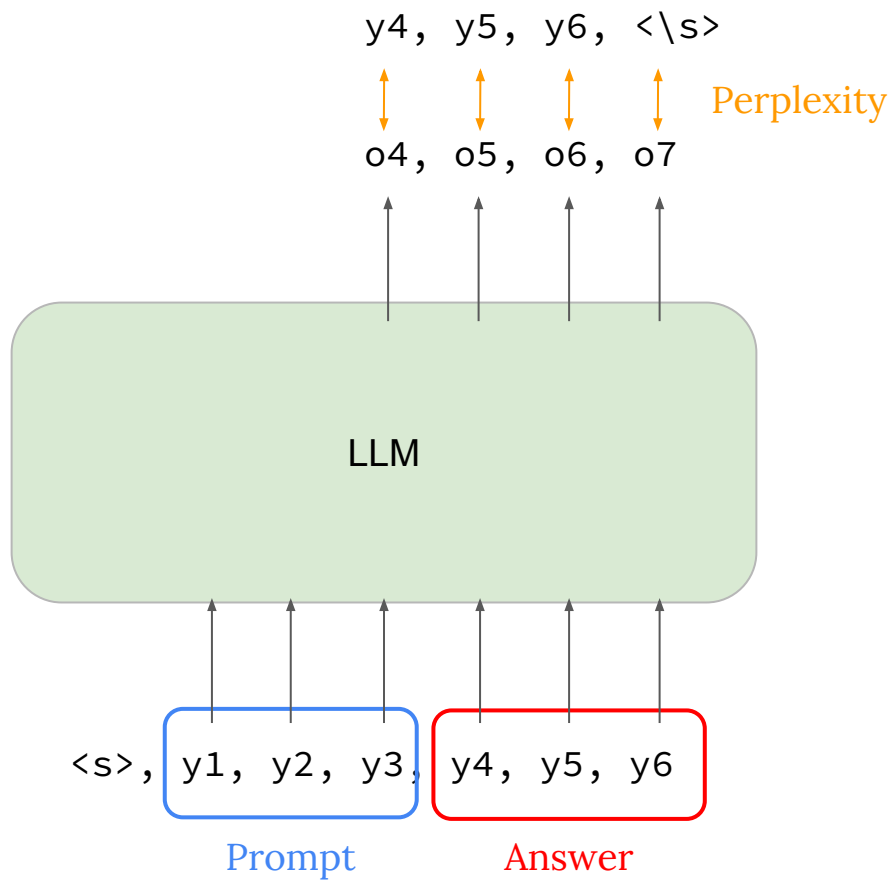
Instruction Tuning



Instruction Tuning



Perplexity


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

Quantization (4 bit)

```
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
  - Fri. 16 :00 ~ 17:00 @ 德田 524 or @ meeting link