深度學習

期末作業程式執行過程截圖

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Bert_embedding.ipynb

```
!pip install transformers
```

```
Requirement already satisfied: transformers in /usr/local/lib/python3.11/dist-packages (4.50.3)
Requirement already satisfied: filelock in /usr/local/lib/python3.11/dist-packages (from transformers) (3.18.0)
Requirement already satisfied: huggingface-hub<1.0,>=0.26.0 in /usr/local/lib/python3.11/dist-packages (from transformers) (0.30.1)
Requirement already satisfied: numpy>=1.17 in /usr/local/lib/python3.11/dist-packages (from transformers) (2.0.2)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.11/dist-packages (from transformers) (24.2)
Requirement already satisfied: pyyaml>=5.1 in /usr/local/lib/python3.11/dist-packages (from transformers) (6.0.2)
Requirement already satisfied: regex!=2019.12.17 in /usr/local/lib/python3.11/dist-packages (from transformers) (2024.11.6)
Requirement already satisfied: requests in /usr/local/lib/python3.11/dist-packages (from transformers) (2.32.3)
Requirement already satisfied: tokenizers<0.22,>=0.21 in /usr/local/lib/python3.11/dist-packages (from transformers) (0.21.1)
Requirement already satisfied: safetensors>=0.4.3 in /usr/local/lib/python3.11/dist-packages (from transformers) (0.5.3)
Requirement already satisfied: tqdm>=4.27 in /usr/local/lib/python3.11/dist-packages (from transformers) (4.67.1)
Requirement already satisfied: fsspec>=2023.5.0 in /usr/local/lib/python3.11/dist-packages (from huggingface-hub<1.0,>=0.26.0->transformers) (2025.3.2)
Requirement already satisfied: typing-extensions>=3.7.4.3 in /usr/local/lib/python3.11/dist-packages (from huggingface-hub<1.0,>=0.26.0->transformers) (4.13.1)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.11/dist-packages (from requests->transformers) (3.4.1)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.11/dist-packages (from requests->transformers) (3.10)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.11/dist-packages (from requests->transformers) (2.3.0)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.11/dist-packages (from requests->transformers) (2025.1.31)
```

transformer為Huggingface的套件，需要Huggingface的token授權

- 請至huggingface網站註冊並申請token，並把token加入colab中，名為HF_TOKEN的環境變數
- 可參考筆記Huggingface與Transformer套件
- 從列印出來的模型參數中，可以看到Bert的embedding token數量有30522個(類似字典裏面的單字數量)，每個token有768維的隱向量空間(Latent vector space)

```
[2] from transformers import AutoTokenizer, AutoModel
model=AutoModel.from_pretrained("bert-base-uncased");
print(model)
```

```
config.json: 100% ▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰ 570/570 [00:00<00:00, 43.7kB/s]
Xet Storage is enabled for this repo, but the 'hf_xet' package is not installed. Falling back to regular HTTP download. For better performance, instal
WARNING:huggingface_hub.file_download:Xet Storage is enabled for this repo, but the 'hf_xet' package is not installed. Falling back to regular HTTP do
model.safetensors: 100% ▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰ 440M/440M [00:06<00:00, 54.8MB/s]
BertModel(
  (embeddings): BertEmbeddings(
    (word_embeddings): Embedding(30522, 768, padding_idx=0)
    (position_embeddings): Embedding(512, 768)
    (token_type_embeddings): Embedding(2, 768)
    (LayerNorm): LayerNorm((768,), eps=1e-12, elementwise_affine=True)
    (dropout): Dropout(p=0.1, inplace=False)
  )
  (encoder): BertEncoder(
    (layer): ModuleList(
      (0-11): 12 x BertLayer(
        (attention): BertAttention(
          (self): BertSdpaSelfAttention(
            (query): Linear(in_features=768, out_features=768, bias=True)
            (key): Linear(in_features=768, out_features=768, bias=True)
            (dropout): Dropout(p=0.1, inplace=False)
          )
          (output): BertSelfOutput(
            (dense): Linear(in_features=768, out_features=768, bias=True)
            (LayerNorm): LayerNorm((768,), eps=1e-12, elementwise_affine=True)
            (dropout): Dropout(p=0.1, inplace=False)
          )
        )
        (intermediate): BertIntermediate(
          (dense): Linear(in_features=768, out_features=3072, bias=True)
          (intermediate_act_fn): GELUActivation()
        )
        (output): BertOutput(
          (dense): Linear(in_features=3072, out_features=768, bias=True)
          (LayerNorm): LayerNorm((768,), eps=1e-12, elementwise_affine=True)
          (dropout): Dropout(p=0.1, inplace=False)
        )
      )
    )
  )
  (pooler): BertPooler(
    (dense): Linear(in_features=768, out_features=768, bias=True)
    (activation): Tanh()
  )
)
```

Bert的參數總量為109,482,240，約一億個參數

```
[3] print(model.num_parameters())
```

```
109482240
```

```
[4] from transformers import AutoTokenizer
tokenizer=AutoTokenizer.from_pretrained("bert-base-uncased")
raw_inputs = [
        "I've been waiting for a HuggingFace course my whole life.",
        "I hate this so much!",
]
inputs = tokenizer(raw_inputs, padding=True, truncation=True, return_tensors="pt")
print(inputs)
```

```
tokenizer_config.json: 100% ▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰ 48.0/48.0 [00:00<00:00, 2.79kB/s]
vocab.txt: 100% ▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰ 232k/232k [00:00<00:00, 3.87MB/s]
tokenizer.json: 100% ▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰ 466k/466k [00:00<00:00, 9.59MB/s]
{'input_ids': tensor([[  101,  1045,  1005,  2310,  2042,  3403,  2005,  1037, 17662, 12172,
          2607,  2026,  2878,  2166,  1012,   102],
        [  101,  1045,  5223,  2023,  2061,  2172,   999,   102,     0,     0,
             0,     0,     0,     0,     0,     0]]), 'token_type_ids': tensor([[0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0],
        [0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0]]), 'attention_mask': tensor([[1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1],
        [1, 1, 1, 1, 1, 1, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0]])}
```

Finetune_Chinese_Weibo.ipynb

利用中文微博評價資料進行Bert微調

```
[ ] ! pip install transformers datasets
    ! pip install evaluate
```

```
Requirement already satisfied: transformers in /usr/local/lib/python3.11/dist-packages (4.50.3)
Collecting datasets
  Downloading datasets-3.5.0-py3-none-any.whl.metadata (19 kB)
Requirement already satisfied: filelock in /usr/local/lib/python3.11/dist-packages (from transformers) (3.18.0)
Requirement already satisfied: huggingface-hub<1.0,>=0.26.0 in /usr/local/lib/python3.11/dist-packages (from transformers) (0.30.1)
Requirement already satisfied: numpy>=1.17 in /usr/local/lib/python3.11/dist-packages (from transformers) (2.0.2)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.11/dist-packages (from transformers) (24.2)
Requirement already satisfied: pyyaml>=5.1 in /usr/local/lib/python3.11/dist-packages (from transformers) (6.0.2)
Requirement already satisfied: regex!=2019.12.17 in /usr/local/lib/python3.11/dist-packages (from transformers) (2024.11.6)
Requirement already satisfied: requests in /usr/local/lib/python3.11/dist-packages (from transformers) (2.32.3)
Requirement already satisfied: tokenizers<0.22,>=0.21 in /usr/local/lib/python3.11/dist-packages (from transformers) (0.21.1)
Requirement already satisfied: safetensors>=0.4.3 in /usr/local/lib/python3.11/dist-packages (from transformers) (0.5.3)
Requirement already satisfied: tqdm>=4.27 in /usr/local/lib/python3.11/dist-packages (from transformers) (4.67.1)
Requirement already satisfied: pyarrow>=15.0.0 in /usr/local/lib/python3.11/dist-packages (from datasets) (18.1.0)
Collecting dill<0.3.9,>=0.3.0 (from datasets)
  Downloading dill-0.3.8-py3-none-any.whl.metadata (10 kB)
Requirement already satisfied: pandas in /usr/local/lib/python3.11/dist-packages (from datasets) (2.2.2)
Collecting xxhash (from datasets)
  Downloading xxhash-3.5.0-cp311-cp311-manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (12 kB)
Collecting multiprocess<0.70.17 (from datasets)
  Downloading multiprocess-0.70.16-py311-none-any.whl.metadata (7.2 kB)
Collecting fsspec<=2024.12.0,>=2023.1.0 (from fsspec[http]<=2024.12.0,>=2023.1.0->datasets)
  Downloading fsspec-2024.12.0-py3-none-any.whl.metadata (11 kB)
Requirement already satisfied: aiohttp in /usr/local/lib/python3.11/dist-packages (from datasets) (3.11.15)
Requirement already satisfied: aiohappyeyeballs>=2.3.0 in /usr/local/lib/python3.11/dist-packages (from aiohttp->datasets) (2.6.1)
Requirement already satisfied: aiosignal>=1.1.2 in /usr/local/lib/python3.11/dist-packages (from aiohttp->datasets) (1.3.2)
Requirement already satisfied: attrs>=17.3.0 in /usr/local/lib/python3.11/dist-packages (from aiohttp->datasets) (25.3.0)
Requirement already satisfied: frozenlist>=1.1.1 in /usr/local/lib/python3.11/dist-packages (from aiohttp->datasets) (1.5.0)
Requirement already satisfied: multidict<7.0,>=4.5 in /usr/local/lib/python3.11/dist-packages (from aiohttp->datasets) (6.2.0)
Requirement already satisfied: propcache>=0.2.0 in /usr/local/lib/python3.11/dist-packages (from aiohttp->datasets) (0.3.1)
Requirement already satisfied: yarl<2.0,>=1.17.0 in /usr/local/lib/python3.11/dist-packages (from aiohttp->datasets) (1.18.3)
Requirement already satisfied: typing-extensions>=3.7.4.3 in /usr/local/lib/python3.11/dist-packages (from huggingface-hub<1.0,>=0.26.0->transformers) (4.13.1)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.11/dist-packages (from requests->transformers) (3.4.1)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.11/dist-packages (from requests->transformers) (3.10)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.11/dist-packages (from requests->transformers) (2.3.0)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.11/dist-packages (from requests->transformers) (2025.1.31)
Requirement already satisfied: python-dateutil>=2.8.2 in /usr/local/lib/python3.11/dist-packages (from pandas->datasets) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.11/dist-packages (from pandas->datasets) (2025.2)
Requirement already satisfied: tzdata>=2022.7 in /usr/local/lib/python3.11/dist-packages (from pandas->datasets) (2025.2)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.11/dist-packages (from python-dateutil>=2.8.2->pandas->datasets) (1.17.0)
Downloading datasets-3.5.0-py3-none-any.whl (491 kB)
   ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 491.2/491.2 kB 12.8 MB/s eta 0:00:00
Downloading dill-0.3.8-py3-none-any.whl (116 kB)
   ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 116.3/116.3 kB 9.7 MB/s eta 0:00:00
Downloading fsspec-2024.12.0-py3-none-any.whl (183 kB)
   ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 183.9/183.9 kB 8.0 MB/s eta 0:00:00
Downloading multiprocess-0.70.16-py311-none-any.whl (143 kB)
   ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 143.5/143.5 kB 9.6 MB/s eta 0:00:00
Downloading xxhash-3.5.0-cp311-cp311-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (194 kB)
   ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 194.8/194.8 kB 7.3 MB/s eta 0:00:00
Installing collected packages: xxhash, fsspec, dill, multiprocess, datasets
  Attempting uninstall: fsspec
    Found existing installation: fsspec 2025.3.2
    Uninstalling fsspec-2025.3.2:
      Successfully uninstalled fsspec-2025.3.2
ERROR: pip's dependency resolver does not currently take into account all the packages that are installed. This behaviour is the source of the following dependency
torch 2.6.0+cu124 requires nvidia-cublas-cu12==12.4.5.8; platform_system == "Linux" and platform_machine == "x86_64", but you have nvidia-cublas-cu12 12.5.3.2 whic
```

下載微博評價資料

```
[ ] !wget https://github.com/shhuangmust/AI/raw/refs/heads/113-1/weibo_senti_100k.csv
```

```
--2025-04-09 09:07:51--  https://github.com/shhuangmust/AI/raw/refs/heads/113-1/weibo_senti_100k.csv
Resolving github.com (github.com)... 140.82.116.3
Connecting to github.com (github.com)|140.82.116.3|:443... connected.
HTTP request sent, awaiting response... 302 Found
Location: https://raw.githubusercontent.com/shhuangmust/AI/refs/heads/113-1/weibo_senti_100k.csv [following]
--2025-04-09 09:07:52--  https://raw.githubusercontent.com/shhuangmust/AI/refs/heads/113-1/weibo_senti_100k.csv
Resolving raw.githubusercontent.com (raw.githubusercontent.com)... 185.199.110.133, 185.199.111.133, 185.199.109.133, ...
Connecting to raw.githubusercontent.com (raw.githubusercontent.com)|185.199.110.133|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 19699818 (19M) [application/octet-stream]
Saving to: 'weibo_senti_100k.csv'

weibo_senti_100k.cs 100%[===================>]  18.79M  93.7MB/s    in 0.2s

2025-04-09 09:07:53 (93.7 MB/s) - 'weibo_senti_100k.csv' saved [19699818/19699818]
```

讀取Weibo資料集

- 共有119988筆資料

```
from datasets import load_dataset, DatasetDict

ds = load_dataset("csv", data_files="weibo_senti_100k.csv")
print(ds)
```

```
Generating train split: 119988/0 [00:01<00:00, 132979.15 examples/s]
DatasetDict({
    train: Dataset({
        features: ['label', 'review'],
        num_rows: 119988
    })
})
```

分割資料集

- 80%訓練(train)資料
- 10%測試(test)資料
- 10%驗證(valid)資料

```
[ ] train_testvalid = ds['train'].train_test_split(test_size=0.2)
    test_valid = train_testvalid['test'].train_test_split(test_size=0.5)
    dataset = DatasetDict({
            'train': train_testvalid['train'],
            'test': test_valid['test'],
            'valid': test_valid['train']})
```

進行分詞

```
[ ] from transformers import AutoTokenizer

    tokenizer = AutoTokenizer.from_pretrained("google-bert/bert-base-chinese")

    def tokenize_function(examples):
        return tokenizer(examples["review"], padding="max_length", truncation=True)

    tokenized_datasets = dataset.map(tokenize_function, batched=True)
```

```
tokenizer_config.json: 100%  49.0/49.0 [00:00<00:00, 2.11kB/s]
config.json: 100%  624/624 [00:00<00:00, 13.6kB/s]
vocab.txt: 100%  110k/110k [00:00<00:00, 1.64MB/s]
tokenizer.json: 100%  269k/269k [00:00<00:00, 4.92MB/s]
Map: 100%  95990/95990 [00:47<00:00, 2138.62 examples/s]
Map: 100%  11999/11999 [00:05<00:00, 2334.60 examples/s]
Map: 100%  11999/11999 [00:06<00:00, 1867.91 examples/s]
```

為簡化訓練，挑選10000筆作為訓練與測試資料

```
[ ] small_train_dataset = tokenized_datasets["train"].shuffle(seed=42).select(range(10000))
    small_eval_dataset = tokenized_datasets["test"].shuffle(seed=42).select(range(10000))
    print(small_train_dataset)
    print(small_eval_dataset)
```

```
Dataset({
    features: ['label', 'review', 'input_ids', 'token_type_ids', 'attention_mask'],
    num_rows: 10000
})
Dataset({
    features: ['label', 'review', 'input_ids', 'token_type_ids', 'attention_mask'],
    num_rows: 10000
})
```

列印一筆資料出來看

```
[ ] tokenized_datasets["train"][100]
```

```
100,
5833,
5833,
136,
100,
8039,
4385,
5543,
1415,
1728,
809,
5166,
4528,
5961,
711,
1333,
3160,
8024,
1086,
6158,
4917,
711,
100,
5961,
5961,
136,
100,
1450,
8043,
138,
1506,
1506,
140,
102,
0,
0,
0,
0,
0,
0,
0,
0,
0,
0,
0,
0,
0,
0,
0,
0,
```

本次微調需要得到正面/負面的判斷結果，因此挑選AutoModelForSequenceClassification

- 輸出結果為正面/負面，因此num_labels=2

```
[ ] from transformers import AutoModelForSequenceClassification

    model = AutoModelForSequenceClassification.from_pretrained("google-bert/bert-base-chinese", num_labels=2)
```

```
Xet Storage is enabled for this repo, but the 'hf_xet' package is not installed. Falling back to regular HTTP download. For better performance, instal
WARNING:huggingface_hub.file_download:Xet Storage is enabled for this repo, but the 'hf_xet' package is not installed. Falling back to regular HTTP do
model.safetensors: 100%  412M/412M [00:01<00:00, 268MB/s]
Some weights of BertForSequenceClassification were not initialized from the model checkpoint at google-bert/bert-base-chinese and are newly initialize
You should probably TRAIN this model on a down-stream task to be able to use it for predictions and inference.
```

利用TrainingArguments設定微調參數

```
[ ] from transformers import TrainingArguments
    import numpy as np
    import evaluate

    metric = evaluate.load("accuracy")
    def compute_metrics(eval_pred):
        logits, labels = eval_pred
        predictions = np.argmax(logits, axis=-1)
        return metric.compute(predictions=predictions, references=labels)

    training_args = TrainingArguments(output_dir="test_trainer_chinese", evaluation_strategy="epoch")
```

```
Downloading builder script: 100% 4.20k/4.20k [00:00<00:00, 443kB/s]
/usr/local/lib/python3.11/dist-packages/transformers/training_args.py:1611: FutureWarning: `evaluation_strategy` is deprecated and will be removed in
  warnings.warn(
```

利用Trainer進行訓練

- 此處須輸入wandb key

```
[ ] from transformers import Trainer

    trainer = Trainer(
        model=model,
        args=training_args,
        train_dataset=small_train_dataset,
        eval_dataset=small_eval_dataset,
        compute_metrics=compute_metrics,
    )
    trainer.train()
```

```
wandb: WARNING The `run_name` is currently set to the same value as `TrainingArguments.output_dir`. If this was not intended, please specify a differe
wandb: Using wandb-core as the SDK backend.  Please refer to https://wandb.me/wandb-core for more information.
wandb: Logging into wandb.ai. (Learn how to deploy a W&B server locally: https://wandb.me/wandb-server)
wandb: You can find your API key in your browser here: https://wandb.ai/authorize
wandb: Paste an API key from your profile and hit enter: ··········
wandb: WARNING If you're specifying your api key in code, ensure this code is not shared publicly.
wandb: WARNING Consider setting the WANDB_API_KEY environment variable, or running `wandb login` from the command line.
wandb: No netrc file found, creating one.
wandb: Appending key for api.wandb.ai to your netrc file: /root/.netrc
wandb: Currently logged in as: candy533520 (candy533520-must) to https://api.wandb.ai. Use `wandb login --relogin` to force relogin
Tracking run with wandb version 0.19.9
Run data is saved locally in /content/wandb/run-20250409_091019-tntzbamg
Syncing run test_trainer_chinese to Weights & Biases (docs)
View project at https://wandb.ai/candy533520-must/huggingface
View run at https://wandb.ai/candy533520-must/huggingface/runs/tntzbamg
[3750/3750 1:02:58, Epoch 3/3]
 Epoch  Training Loss  Validation Loss  Accuracy
     1       0.122000         0.120404  0.979000
     2       0.097800         0.078305  0.981400
     3       0.074900         0.066147  0.982000
TrainOutput(global_step=3750, training_loss=0.10864674352010091, metrics={'train_runtime': 3825.795, 'train_samples_per_second': 7.842,
'train_steps_per_second': 0.98, 'total_flos': 7893331660800000.0, 'train_loss': 0.10864674352010091, 'epoch': 3.0})
```

利用pipeline進行測試

- LABEL_0：負面
- LABEL_1：正面

```
[ ] from transformers import pipeline
    pipe = pipeline("sentiment-analysis", model='test_trainer_chinese/checkpoint-1500', tokenizer=tokenizer)
```

```
Device set to use cuda:0
```

```
[ ] pipe("我喜歡這個產品")
```

```
[{'label': 'LABEL_1', 'score': 0.9995720982551575}]
```

Colab 付費產品 - 按這裡取消合約

PEFT_SFTTrainer.ipynb

使用QLORA訓練白話文和文言文互轉的模型(台大資工所2024年應用深度學習作業3)

1. 作業目標

- 本次作業目標是使用QLORA訓練一個白話文和文言文互轉的模型。
- 使用的基礎模型是 `zake7749/gemma-2-2b-it-chinese-kyara-dpo`，這是一個Google Gemma2經過Instrunction Tuned及DPO之後的模型。
- 本次作業的資料集是台大資工作業提供的，並沒有經過資料清理，是用簡體硬轉成繁體的，資料集問題很多，這是一個包含白話文和文言文的資料集。

2. 作業步驟

- 本次作業的步驟如下：
  1. 資料前處理
  2. 使用QLORA訓練模型
  3. 模型測試

3. 訓練監控

- 本次作業的訓練監控如下：
  1. 訓練過程中的loss
  2. 使用wandb記錄訓練過程
  3. 調整各種參數觀察訓練結果

[ ]
```
!pip install transformers datasets torch bitsandbytes peft wandb trl flash-attn nvidia-ml-py3
```

```
Requirement already satisfied: transformers in /usr/local/lib/python3.11/dist-packages (4.50.3)
Collecting datasets
  Downloading datasets-3.5.0-py3-none-any.whl.metadata (19 kB)
Requirement already satisfied: torch in /usr/local/lib/python3.11/dist-packages (2.6.0+cu124)
Collecting bitsandbytes
  Downloading bitsandbytes-0.45.5-py3-none-manylinux_2_24_x86_64.whl.metadata (5.0 kB)
Requirement already satisfied: peft in /usr/local/lib/python3.11/dist-packages (0.14.0)
Requirement already satisfied: wandb in /usr/local/lib/python3.11/dist-packages (0.19.9)
Collecting trl
  Downloading trl-0.16.1-py3-none-any.whl.metadata (12 kB)
Collecting flash-attn
  Downloading flash_attn-2.7.4.post1.tar.gz (6.0 MB)
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 6.0/6.0 MB 31.3 MB/s eta 0:00:00
  Preparing metadata (setup.py) ... done
Collecting nvidia-ml-py3
  Downloading nvidia-ml-py3-7.352.0.tar.gz (19 kB)
  Preparing metadata (setup.py) ... done
Requirement already satisfied: filelock in /usr/local/lib/python3.11/dist-packages (from transformers) (3.18.0)
Requirement already satisfied: huggingface-hub<1.0,>=0.26.0 in /usr/local/lib/python3.11/dist-packages (from transformers) (0.30.1)
Requirement already satisfied: numpy>=1.17 in /usr/local/lib/python3.11/dist-packages (from transformers) (2.0.2)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.11/dist-packages (from transformers) (24.2)
Requirement already satisfied: pyyaml>=5.1 in /usr/local/lib/python3.11/dist-packages (from transformers) (6.0.2)
Requirement already satisfied: regex!=2019.12.17 in /usr/local/lib/python3.11/dist-packages (from transformers) (2024.11.6)
Requirement already satisfied: tokenizers<0.22,>=0.21 in /usr/local/lib/python3.11/dist-packages (from transformers) (0.21.1)
Requirement already satisfied: safetensors>=0.4.3 in /usr/local/lib/python3.11/dist-packages (from transformers) (0.5.3)
Requirement already satisfied: tqdm>=4.27 in /usr/local/lib/python3.11/dist-packages (from transformers) (4.67.1)
Requirement already satisfied: pyarrow>=15.0.0 in /usr/local/lib/python3.11/dist-packages (from datasets) (18.1.0)
Collecting dill<0.3.9,>=0.3.0 (from datasets)
  Downloading dill-0.3.8-py3-none-any.whl.metadata (10 kB)
Requirement already satisfied: pandas in /usr/local/lib/python3.11/dist-packages (from datasets) (2.2.2)
Collecting xxhash (from datasets)
  Downloading xxhash-3.5.0-cp311-cp311-manylinux_2_17_x86_64.manylinux2014_x86_64.whl.metadata (12 kB)
Collecting multiprocess<0.70.17 (from datasets)
  Downloading multiprocess-0.70.16-py311-none-any.whl.metadata (7.2 kB)
Collecting fsspec<=2024.12.0,>=2023.1.0 (from fsspec[http]<=2024.12.0,>=2023.1.0->datasets)
  Downloading fsspec-2024.12.0-py3-none-any.whl.metadata (11 kB)
Requirement already satisfied: aiohttp in /usr/local/lib/python3.11/dist-packages (from datasets) (3.11.15)
Requirement already satisfied: typing-extensions>=4.10.0 in /usr/local/lib/python3.11/dist-packages (from torch) (4.13.1)
Requirement already satisfied: networkx in /usr/local/lib/python3.11/dist-packages (from torch) (3.4.2)
Requirement already satisfied: jinja2 in /usr/local/lib/python3.11/dist-packages (from torch) (3.1.6)
Collecting nvidia-cuda-nvrtc-cu12==12.4.127 (from torch)
  Downloading nvidia_cuda_nvrtc_cu12-12.4.127-py3-none-manylinux2014_x86_64.whl.metadata (1.5 kB)
Collecting nvidia-cuda-runtime-cu12==12.4.127 (from torch)
  Downloading nvidia_cuda_runtime_cu12-12.4.127-py3-none-manylinux2014_x86_64.whl.metadata (1.5 kB)
Collecting nvidia-cuda-cupti-cu12==12.4.127 (from torch)
  Downloading nvidia_cuda_cupti_cu12-12.4.127-py3-none-manylinux2014_x86_64.whl.metadata (1.6 kB)
Collecting nvidia-cudnn-cu12==9.1.0.70 (from torch)
  Downloading nvidia_cudnn_cu12-9.1.0.70-py3-none-manylinux2014_x86_64.whl.metadata (1.6 kB)
Collecting nvidia-cublas-cu12==12.4.5.8 (from torch)
  Downloading nvidia_cublas_cu12-12.4.5.8-py3-none-manylinux2014_x86_64.whl.metadata (1.5 kB)
Collecting nvidia-cufft-cu12==11.2.1.3 (from torch)
  Downloading nvidia_cufft_cu12-11.2.1.3-py3-none-manylinux2014_x86_64.whl.metadata (1.5 kB)
Collecting nvidia-curand-cu12==10.3.5.147 (from torch)
  Downloading nvidia_curand_cu12-10.3.5.147-py3-none-manylinux2014_x86_64.whl.metadata (1.5 kB)
Collecting nvidia-cusolver-cu12==11.6.1.9 (from torch)
  Downloading nvidia_cusolver_cu12-11.6.1.9-py3-none-manylinux2014_x86_64.whl.metadata (1.6 kB)
```

抓取訓練資料，裡面包含五萬筆白話文->文言文資料

```
[ ] !wget https://github.com/shhuangmust/AI/raw/refs/heads/master/train.json
```

```
--2025-04-10 11:21:10--  https://github.com/shhuangmust/AI/raw/refs/heads/master/train.json
Resolving github.com (github.com)... 140.82.112.3
Connecting to github.com (github.com)|140.82.112.3|:443... connected.
HTTP request sent, awaiting response... 302 Found
Location: https://raw.githubusercontent.com/shhuangmust/AI/refs/heads/master/train.json [following]
--2025-04-10 11:21:10--  https://raw.githubusercontent.com/shhuangmust/AI/refs/heads/master/train.json
Resolving raw.githubusercontent.com (raw.githubusercontent.com)... 185.199.108.133, 185.199.109.133, 185.199.110.133, ...
Connecting to raw.githubusercontent.com (raw.githubusercontent.com)|185.199.108.133|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 2940614 (2.8M) [application/octet-stream]
Saving to: 'train.json'

train.json          100%[===================>]   2.80M  --.-KB/s    in 0.05s

2025-04-10 11:21:11 (59.6 MB/s) - 'train.json' saved [2940614/2940614]
```

- 採用gemma-2-2b-it-chinese-kyara-dpo基礎模型
- 4bit的量化模型來節省訓練記憶體
- 要產生文言文，因此採用AutoModelForCausalLM

```
[ ] import torch
    from transformers import AutoTokenizer, AutoModelForCausalLM, BitsAndBytesConfig

    bnb_config = BitsAndBytesConfig(
            load_in_4bit=True,
            bnb_4bit_use_double_quant=True,
            bnb_4bit_quant_type="nf4",
            bnb_4bit_compute_dtype=torch.bfloat16
    )
    model_id = "zake7749/gemma-2-2b-it-chinese-kyara-dpo"



    model = AutoModelForCausalLM.from_pretrained(model_id, quantization_config=bnb_config,
                                                 attn_implementation='eager',
                                                 cache_implementation=None,
                                                 use_cache=False,)

    tokenizer = AutoTokenizer.from_pretrained(model_id, add_eos_token=True)
    model.to('cuda')
```

```
config.json: 100%  818/818 [00:00<00:00, 39.4kB/s]
`low_cpu_mem_usage` was None, now default to True since model is quantized.
model.safetensors.index.json: 100%  24.2k/24.2k [00:00<00:00, 2.18MB/s]
Fetching 3 files: 100%  3/3 [02:38<00:00, 158.86s/it]
model-00002-of-00003.safetensors: 100%  4.98G/4.98G [02:37<00:00, 130MB/s]
model-00001-of-00003.safetensors: 100%  4.99G/4.99G [02:38<00:00, 196MB/s]
model-00003-of-00003.safetensors: 100%  481M/481M [00:41<00:00, 13.2MB/s]
Loading checkpoint shards: 100%  3/3 [00:49<00:00, 13.77s/it]
generation_config.json: 100%  208/208 [00:00<00:00, 10.7kB/s]
tokenizer_config.json: 100%  47.1k/47.1k [00:00<00:00, 2.59MB/s]
tokenizer.json: 100%  34.4M/34.4M [00:00<00:00, 93.3MB/s]
special_tokens_map.json: 100%  636/636 [00:00<00:00, 54.6kB/s]
Gemma2ForCausalLM(
  (model): Gemma2Model(
    (embed_tokens): Embedding(256000, 2304, padding_idx=0)
    (layers): ModuleList(
      (0-25): 26 x Gemma2DecoderLayer(
        (self_attn): Gemma2Attention(
          (q_proj): Linear4bit(in_features=2304, out_features=2048, bias=False)
          (k_proj): Linear4bit(in_features=2304, out_features=1024, bias=False)
          (v_proj): Linear4bit(in_features=2304, out_features=1024, bias=False)
          (o_proj): Linear4bit(in_features=2048, out_features=2304, bias=False)
        )
        (mlp): Gemma2MLP(
          (gate_proj): Linear4bit(in_features=2304, out_features=9216, bias=False)
          (up_proj): Linear4bit(in_features=2304, out_features=9216, bias=False)
          (down_proj): Linear4bit(in_features=9216, out_features=2304, bias=False)
          (act_fn): PytorchGELUTanh()
        )
        (input_layernorm): Gemma2RMSNorm((2304,), eps=1e-06)
        (post_attention_layernorm): Gemma2RMSNorm((2304,), eps=1e-06)
        (pre_feedforward_layernorm): Gemma2RMSNorm((2304,), eps=1e-06)
        (post_feedforward_layernorm): Gemma2RMSNorm((2304,), eps=1e-06)
      )
    )
    (norm): Gemma2RMSNorm((2304,), eps=1e-06)
    (rotary_emb): Gemma2RotaryEmbedding()
  )
  (lm_head): Linear(in_features=2304, out_features=256000, bias=False)
)
```

```
[ ] print(model)
```

```
Gemma2ForCausalLM(
  (model): Gemma2Model(
    (embed_tokens): Embedding(256000, 2304, padding_idx=0)
    (layers): ModuleList(
      (0-25): 26 x Gemma2DecoderLayer(
        (self_attn): Gemma2Attention(
          (q_proj): Linear4bit(in_features=2304, out_features=2048, bias=False)
          (k_proj): Linear4bit(in_features=2304, out_features=1024, bias=False)
          (v_proj): Linear4bit(in_features=2304, out_features=1024, bias=False)
          (o_proj): Linear4bit(in_features=2048, out_features=2304, bias=False)
        )
        (mlp): Gemma2MLP(
          (gate_proj): Linear4bit(in_features=2304, out_features=9216, bias=False)
          (up_proj): Linear4bit(in_features=2304, out_features=9216, bias=False)
          (down_proj): Linear4bit(in_features=9216, out_features=2304, bias=False)
          (act_fn): PytorchGELUTanh()
        )
        (input_layernorm): Gemma2RMSNorm((2304,), eps=1e-06)
        (post_attention_layernorm): Gemma2RMSNorm((2304,), eps=1e-06)
        (pre_feedforward_layernorm): Gemma2RMSNorm((2304,), eps=1e-06)
        (post_feedforward_layernorm): Gemma2RMSNorm((2304,), eps=1e-06)
      )
    )
    (norm): Gemma2RMSNorm((2304,), eps=1e-06)
  )
  (lm_head): Linear(in_features=2304, out_features=256000, bias=False)
)
```

讀取資料

- 將資料轉換成gemma2的讀取格式

```
[ ] from datasets import load_dataset
    dataset = load_dataset('json', data_files="train.json", split="train").shuffle(seed=42)

    def generate_prompt(data_point):
        prefix_text = '你是一個使用繁體中文的人工智慧助理，下面是問題的描述，以及對應的答案，請照著問題並且回答答案。\n\n'
        text = f"<start_of_turn>user {prefix_text} {data_point['instruction']} <end_of_turn>\n<start_of_turn>model {data_point['output']} <end_of_turn>"
        return text
    # Add the 'prompt' column to the dataset
    text_column = [generate_prompt(data_point) for data_point in dataset]
    dataset = dataset.add_column("prompt", text_column)
    # Tokenize the dataset
    dataset = dataset.shuffle(seed=1234)
    dataset = dataset.map(lambda samples: tokenizer(samples["prompt"]), batched=True)
    # Split the dataset into training and testing
    dataset = dataset.train_test_split(test_size=0.2)
    train_data = dataset["train"]
    test_data = dataset["test"]
```

```
Generating train split: 10000/0 [00:00<00:00, 71395.69 examples/s]
Flattening the indices: 100% 10000/10000 [00:00<00:00, 41595.10 examples/s]
Map: 100% 10000/10000 [00:02<00:00, 5324.75 examples/s]
```

```
[ ] print(train_data[200])
```

```
{'id': '80cb6256-c2a3-4dc9-b381-89e78e067014', 'instruction': '萬方來賀，華夷充庭。\n翻譯成現代文：', 'output': '萬方諸侯前來慶賀，華夏蠻夷擠滿庭院。', 'prompt': '<sta
```

找出所有可以進行QLora訓練的層

```
[ ] def find_all_linear_names(peft_model, int4=False, int8=False):
        """Find all linear layer names in the model. reference from qlora paper."""
        cls = torch.nn.Linear
        if int4 or int8:
            import bitsandbytes as bnb
            if int4:
                cls = bnb.nn.Linear4bit
            elif int8:
                cls = bnb.nn.Linear8bitLt
        lora_module_names = set()
        for name, module in peft_model.named_modules():
            if isinstance(module, cls):
                # last layer is not add to lora_module_names
                if 'lm_head' in name:
                    continue
                if 'output_layer' in name:
                    continue
                names = name.split('.')
                lora_module_names.add(names[0] if len(names) == 1 else names[-1])
        return sorted(lora_module_names)
```

```
[ ] from peft import LoraConfig, PeftModel, prepare_model_for_kbit_training, get_peft_model

    model.enable_input_require_grads()
    model.gradient_checkpointing_enable()

    model = prepare_model_for_kbit_training(model)
    modules = find_all_linear_names(model)   # Get modules to apply LoRA to
    lora_config = LoRAConfig(
            r=64,
            lora_alpha=32,
            target_modules=modules,
            lora_dropout=0.05,
            bias="none",
            task_type="CAUSAL_LM"
    )
    peft_model = get_peft_model(model, lora_config)
```

```
[ ] print(peft_model)
```

```
                (lora_dropout): ModuleDict(
                  (default): Dropout(p=0.05, inplace=False)
                )
                (lora_A): ModuleDict(
                  (default): Linear(in_features=2304, out_features=64, bias=False)
                )
                (lora_B): ModuleDict(
                  (default): Linear(in_features=64, out_features=9216, bias=False)
                )
                (lora_embedding_A): ParameterDict()
                (lora_embedding_B): ParameterDict()
                (lora_magnitude_vector): ModuleDict()
              )
              (up_proj): lora.Linear4bit(
                (base_layer): Linear4bit(in_features=2304, out_features=9216, bias=False)
                (lora_dropout): ModuleDict(
                  (default): Dropout(p=0.05, inplace=False)
                )
                (lora_A): ModuleDict(
                  (default): Linear(in_features=2304, out_features=64, bias=False)
                )
                (lora_B): ModuleDict(
                  (default): Linear(in_features=64, out_features=9216, bias=False)
                )
                (lora_embedding_A): ParameterDict()
                (lora_embedding_B): ParameterDict()
                (lora_magnitude_vector): ModuleDict()
              )
              (down_proj): lora.Linear4bit(
                (base_layer): Linear4bit(in_features=9216, out_features=2304, bias=False)
                (lora_dropout): ModuleDict(
                  (default): Dropout(p=0.05, inplace=False)
                )
                (lora_A): ModuleDict(
                  (default): Linear(in_features=9216, out_features=64, bias=False)
                )
                (lora_B): ModuleDict(
                  (default): Linear(in_features=64, out_features=2304, bias=False)
                )
                (lora_embedding_A): ParameterDict()
                (lora_embedding_B): ParameterDict()
                (lora_magnitude_vector): ModuleDict()
              )
              (act_fn): PytorchGELUTanh()
            )
            (input_layernorm): Gemma2RMSNorm((2304,), eps=1e-06)
            (post_attention_layernorm): Gemma2RMSNorm((2304,), eps=1e-06)
            (pre_feedforward_layernorm): Gemma2RMSNorm((2304,), eps=1e-06)
            (post_feedforward_layernorm): Gemma2RMSNorm((2304,), eps=1e-06)
          )
        )
        (norm): Gemma2RMSNorm((2304,), eps=1e-06)
        (rotary_emb): Gemma2RotaryEmbedding()
      )
      (lm_head): Linear(in_features=2304, out_features=256000, bias=False)
    )
  )
)
```

列出可訓練的參數數目跟比例

```
[ ] peft_model.print_trainable_parameters()
```

```
trainable params: 83,066,880 || all params: 2,697,408,768 || trainable%: 3.0795
```

```
[ ] print(modules)
```

```
['down_proj', 'gate_proj', 'k_proj', 'o_proj', 'q_proj', 'up_proj', 'v_proj']
```

進行PEFT訓練

- 採用trl套件
- 可修改max_steps以調整訓練次數

```
[ ] from trl import SFTConfig
    import transformers
    from trl import SFTTrainer

    trainer = SFTTrainer(
            model=peft_model,
            train_dataset=train_data,
            eval_dataset=test_data,
            peft_config=lora_config,
            args=SFTConfig(
                    per_device_train_batch_size=2,
                    gradient_accumulation_steps=4,
                    max_steps=100,
                    learning_rate=2e-4,
                    output_dir="output1",
                    # dataset_text_field="prompt",
                    optim="paged_adamw_32bit",
                    save_strategy="steps",
                    report_to=None,
                    #report_to="wandb",
                    logging_steps=1,
                    packing=False,
                    gradient_checkpointing=True,
            ),
            data_collator=transformers.DataCollatorForLanguageModeling(tokenizer, mlm=False),
    )
    trainer.train()
```

71	2.016500
72	2.020200
73	1.812900
74	1.588600
75	1.479000
76	1.862100
77	1.843200
78	1.805000
79	1.866400
80	1.845500
81	2.266200
82	2.338500
83	2.118100
84	1.911900
85	1.979000
86	1.921500
87	1.774000
88	1.682600
89	2.122100
90	1.365000
91	2.197200
92	1.917200
93	1.983500
94	2.375900
95	1.651800
96	1.760300
97	1.690700
98	1.804000
99	1.967800
100	1.818400

```
TrainOutput(global_step=100, training_loss=2.130471661090851, metrics={'train_runtime': 1308.1776, 'train_samples_per_second': 0.612, 'train_steps_per_second': 0.076,
'total_flos': 1222567772221440.0, 'train_loss': 2.130471661090851})
```

儲存Adapter

- Huggingface的Token，一定要包含『write』權限
- ?????????/peft-model-repo，????????請輸入自己在huggingface的帳號

```
[ ] peft_model.save_pretrained("peft_model")
    repo_name = "Candy04/peft-model-repo"    # 替換為你的 repository 名稱
    save_directory = "./peft_model"                          # 模型儲存的本地路徑

    # 上傳模型到 Hugging Face
    peft_model.push_to_hub(repo_name)
```

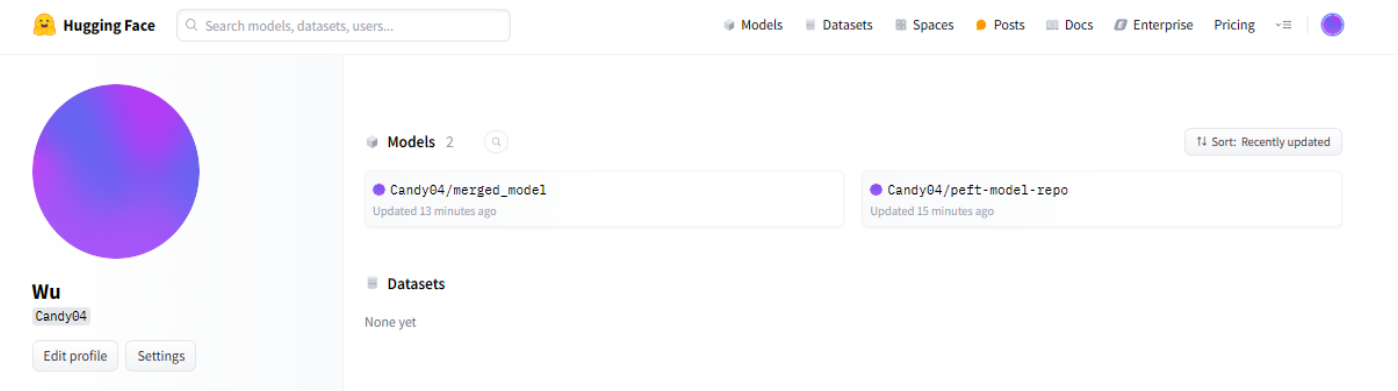
```
adapter_model.safetensors: 100% ▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰ 332M/332M [00:12<00:00, 32.3MB/s]
CommitInfo(commit_url='https://huggingface.co/Candy04/peft-model-repo/commit/28308f628031b26282a01314d16b2227dddd5116', commit_message='Upload model',
commit_description='', oid='28308f628031b26282a01314d16b2227dddd5116', pr_url=None, repo_url=RepoUrl('https://huggingface.co/Candy04/peft-model-repo',
endpoint='https://huggingface.co', repo_type='model', repo_id='Candy04/peft-model-repo'), pr_revision=None, pr_num=None)
```

```
base_model = AutoModelForCausalLM.from_pretrained(
        model_id,
        low_cpu_mem_usage=True,
        return_dict=True,
        torch_dtype=torch.float16,
        device_map="auto",
)
merged_model = PeftModel.from_pretrained(base_model, "output1/checkpoint-100")
merged_model = merged_model.merge_and_unload()
```

```
Loading checkpoint shards: 100% ▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰▰ 3/3 [00:46<00:00, 13.12s/it]
WARNING:accelerate.big_modeling:Some parameters are on the meta device because they were offloaded to the cpu.
```

一般來說只需要上傳Adapter即可，要使用LLM時，Adapter+基礎模型即可。這邊直接把兩者合併為(merged_model)

```
[35] merged_model.save_pretrained("merged_model", safe_serialization=True, push_to_hub=True)
     tokenizer.save_pretrained("merged_model", push_to_hub=True)
```



Pipeline_with_Deepseek_R1.ipynb

```
!pip install transformers torch
```

```
Requirement already satisfied: transformers in /usr/local/lib/python3.11/dist-packages (4.50.3)
Requirement already satisfied: torch in /usr/local/lib/python3.11/dist-packages (2.6.0+cu124)
Requirement already satisfied: filelock in /usr/local/lib/python3.11/dist-packages (from transformers) (3.18.0)
Requirement already satisfied: huggingface-hub<1.0,>=0.26.0 in /usr/local/lib/python3.11/dist-packages (from transformers) (0.30.1)
Requirement already satisfied: numpy>=1.17 in /usr/local/lib/python3.11/dist-packages (from transformers) (2.0.2)
Requirement already satisfied: packaging>=20.0 in /usr/local/lib/python3.11/dist-packages (from transformers) (24.2)
Requirement already satisfied: pyyaml>=5.1 in /usr/local/lib/python3.11/dist-packages (from transformers) (6.0.2)
Requirement already satisfied: regex!=2019.12.17 in /usr/local/lib/python3.11/dist-packages (from transformers) (2024.11.6)
Requirement already satisfied: requests in /usr/local/lib/python3.11/dist-packages (from transformers) (2.32.3)
Requirement already satisfied: tokenizers<0.22,>=0.21 in /usr/local/lib/python3.11/dist-packages (from transformers) (0.21.1)
Requirement already satisfied: safetensors>=0.4.3 in /usr/local/lib/python3.11/dist-packages (from transformers) (0.5.3)
Requirement already satisfied: tqdm>=4.27 in /usr/local/lib/python3.11/dist-packages (from transformers) (4.67.1)
Requirement already satisfied: typing-extensions>=4.10.0 in /usr/local/lib/python3.11/dist-packages (from torch) (4.13.1)
Requirement already satisfied: networkx in /usr/local/lib/python3.11/dist-packages (from torch) (3.4.2)
Requirement already satisfied: jinja2 in /usr/local/lib/python3.11/dist-packages (from torch) (3.1.6)
Requirement already satisfied: fsspec in /usr/local/lib/python3.11/dist-packages (from torch) (2025.3.2)
Collecting nvidia-cuda-nvrtc-cu12==12.4.127 (from torch)
  Downloading nvidia_cuda_nvrtc_cu12-12.4.127-py3-none-manylinux2014_x86_64.whl.metadata (1.5 kB)
Collecting nvidia-cuda-runtime-cu12==12.4.127 (from torch)
  Downloading nvidia_cuda_runtime_cu12-12.4.127-py3-none-manylinux2014_x86_64.whl.metadata (1.5 kB)
Collecting nvidia-cuda-cupti-cu12==12.4.127 (from torch)
  Downloading nvidia_cuda_cupti_cu12-12.4.127-py3-none-manylinux2014_x86_64.whl.metadata (1.6 kB)
Collecting nvidia-cudnn-cu12==9.1.0.70 (from torch)
  Downloading nvidia_cudnn_cu12-9.1.0.70-py3-none-manylinux2014_x86_64.whl.metadata (1.6 kB)
Collecting nvidia-cublas-cu12==12.4.5.8 (from torch)
  Downloading nvidia_cublas_cu12-12.4.5.8-py3-none-manylinux2014_x86_64.whl.metadata (1.5 kB)
Collecting nvidia-cufft-cu12==11.2.1.3 (from torch)
  Downloading nvidia_cufft_cu12-11.2.1.3-py3-none-manylinux2014_x86_64.whl.metadata (1.5 kB)
Collecting nvidia-curand-cu12==10.3.5.147 (from torch)
  Downloading nvidia_curand_cu12-10.3.5.147-py3-none-manylinux2014_x86_64.whl.metadata (1.5 kB)
Collecting nvidia-cusolver-cu12==11.6.1.9 (from torch)
  Downloading nvidia_cusolver_cu12-11.6.1.9-py3-none-manylinux2014_x86_64.whl.metadata (1.6 kB)
Collecting nvidia-cusparse-cu12==12.3.1.170 (from torch)
  Downloading nvidia_cusparse_cu12-12.3.1.170-py3-none-manylinux2014_x86_64.whl.metadata (1.6 kB)
Requirement already satisfied: nvidia-cusparselt-cu12==0.6.2 in /usr/local/lib/python3.11/dist-packages (from torch) (0.6.2)
Requirement already satisfied: nvidia-nccl-cu12==2.21.5 in /usr/local/lib/python3.11/dist-packages (from torch) (2.21.5)
Requirement already satisfied: nvidia-nvtx-cu12==12.4.127 in /usr/local/lib/python3.11/dist-packages (from torch) (12.4.127)
Collecting nvidia-nvjitlink-cu12==12.4.127 (from torch)
  Downloading nvidia_nvjitlink_cu12-12.4.127-py3-none-manylinux2014_x86_64.whl.metadata (1.5 kB)
Requirement already satisfied: triton==3.2.0 in /usr/local/lib/python3.11/dist-packages (from torch) (3.2.0)
Requirement already satisfied: sympy==1.13.1 in /usr/local/lib/python3.11/dist-packages (from torch) (1.13.1)
Requirement already satisfied: mpmath<1.4,>=1.1.0 in /usr/local/lib/python3.11/dist-packages (from sympy==1.13.1->torch) (1.3.0)
Requirement already satisfied: MarkupSafe>=2.0 in /usr/local/lib/python3.11/dist-packages (from jinja2->torch) (3.0.2)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.11/dist-packages (from requests->transformers) (3.4.1)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.11/dist-packages (from requests->transformers) (3.10)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.11/dist-packages (from requests->transformers) (2.3.0)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.11/dist-packages (from requests->transformers) (2025.1.31)
Downloading nvidia_cublas_cu12-12.4.5.8-py3-none-manylinux2014_x86_64.whl (363.4 MB)
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Downloading nvidia_cuda_cupti_cu12-12.4.127-py3-none-manylinux2014_x86_64.whl (13.8 MB)
   ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 13.8/13.8 MB 24.8 MB/s eta 0:00:00
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Downloading nvidia_cudnn_cu12-9.1.0.70-py3-none-manylinux2014_x86_64.whl (664.8 MB)
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```

```
from transformers import pipeline

generator = pipeline("text-generation", model="deepseek-ai/DeepSeek-R1-Distill-Qwen-1.5B", device_map="auto")

result=generator(
        "一個農場有雞跟兔，共有5個頭16隻腳，請問雞跟兔各有幾隻?請用繁體中文回答",
        truncation=True,
        max_length=30000,
        num_return_sequences=1,
)

print(result)
```

```
config.json: 100%  679/679 [00:00<00:00, 55.4kB/s]
model.safetensors: 100%  3.55G/3.55G [00:30<00:00, 184MB/s]
Sliding Window Attention is enabled but not implemented for `sdpa`; unexpected results may be encountered.
generation_config.json: 100%  181/181 [00:00<00:00, 9.98kB/s]
tokenizer_config.json: 100%  3.07k/3.07k [00:00<00:00, 224kB/s]
tokenizer.json: 100%  7.03M/7.03M [00:00<00:00, 34.9MB/s]
Device set to use cpu
[{'generated_text': '一個農場有雞跟兔，共有5個頭16隻腳，請問雞跟兔各有幾隻?請用繁體中文回答。\n\n要解這道題，首先我需要了解雞和兔的頭和腳的數量 relation。已知每个雞有1個頭，2只腳；每
```

[2] 開始使用 AI 編寫或生成程式碼。