NTU ADL 2023 Fall
HW1

Last updated on 10/17.

Due Date

- Kaggle leaderboard - **10/20 (Fri.) 23:59**
- Code and report (submit to NTU COOL) - **10/22 (Sun.) 23:59**
- **No late submission**.

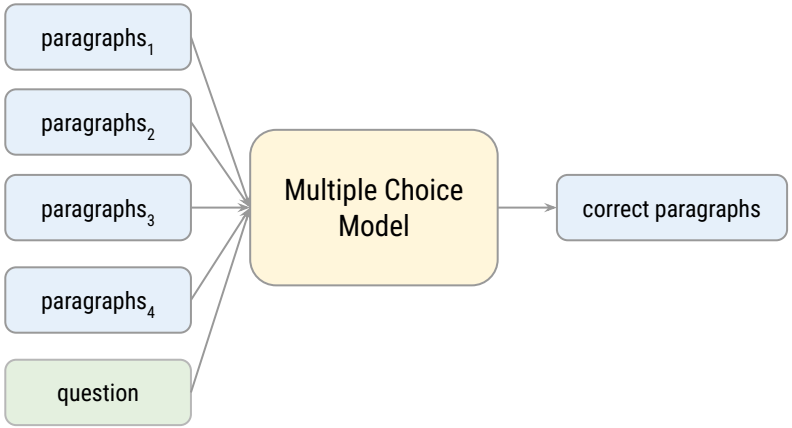
Change Logs

- [09/28] Hw1 announced.
- [09/29] Add Kaggle team name rule. – p.16
- [10/02] Add evaluate to the allowed packages - p.14 ; fix a typo - p.16.
- [10/05] Add matplotlib to the allowed packages - p.14
- [10/14] Add gdown to the allowed packages - p.14
- [10/16] Learning curves should be plotted on the validation set. - p.24
- [10/17] Learning curves can be plotted on the training set as well. - p.24

Task Description - Chinese Extractive Question Answering (QA)

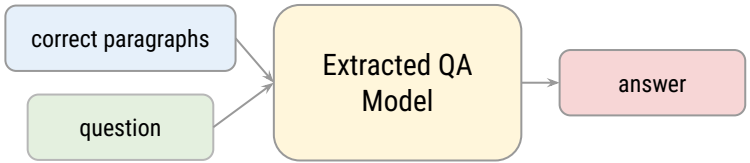
Paragraph Selection:

Determine which paragraph is relevant.



Span selection:

Determine the start and end position of the answer span.



The answer is always a **span in the correct paragraph.*

An Example

新竹縣是中華民國臺灣省的縣，位於臺灣本島西北部 … 關西鎮及峨眉鄉部分使用四縣腔客家話為主。

開發區依照產業重點的不同分為經濟開發區、經濟技術開發區、工業區等類型 … 或一個行政村範圍內劃定區域。

新竹縣人口約54萬人，居民以海陸腔客家人為主 … 內灣線因為六家線完工已於2011年11月11日恢復通車。

隨著解嚴以來政治上的自由化與民主化，以泛藍與泛綠為首 … 歐洲亦因此曾長期稱臺灣海峽為福爾摩沙海峽。

在關西鎮以什麼方言為主？

An Example (cont.)

新竹縣是中華民國臺灣省的縣，位於臺灣本島西北部 … 關西鎮及峨眉鄉部分使用四縣腔客家話為主。

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Data & Evaluation Metric

- See Kaggle page.

Guides - Paragraph Selection

- For each question, you can view a paragraph-question pair as a choice, and then ask the model to predict the correct choice.
- You can modify this huggingface example code for multiple choice (highly recommend!!!).
- By making the format of our dataset the same as the expected format of the example code, you can use the example code out-of-the-box to train the desired paragraph selection model.

Guides - Span Selection (Extractive QA)

- You can modify this huggingface example code for extractive QA (highly recommend!!!).
- By making the format of our dataset the same as the expected format of the example code, you can use the example code out-of-the-box to train the desired span selection model.
- Use the start position to identify the answer span.
    - Do not use something like `context.index("四縣腔客家話")` as you might find another appearance of the answer text, which does not appear in the context to answer the question.

Guides - For Passing the Kaggle Simple Baseline

- Paragraph selection
  - Pretrained LM: bert-base-chinese
  - Max_len: 512
  - Batch_size: 2 (per_gpu_train_batch_size 1 * gradient_accumulation_steps 2)
  - Num_train_epochs: 1
  - Learning_rate: 3e-5
  - Total running time: < 2 hours
- Resource used: Nvidia RTX 3070 with 8GB memory

Guides - For Passing the Kaggle Simple Baseline (cont.)

- Span selection
  - Pre-trained LM: bert-base-chinese
  - Max_len: 512
  - Batch_size: 2 (per_gpu_train_batch_size 1 * gradient_accumulation_steps 2)
  - Num_train_epochs: 1~3
  - Learning_rate: 3e-5
  - Total running time: < 1 hour
- Resource used: Nvidia RTX 3070 with 8GB memory

Tips

- A public score of 0.79 will have a high probability to pass private strong baseline.
- You can safely comment `check_min_version("4.24.0.dev0")` if you encounter it in huggingface transformers example code.
- Setting a longer `max_length` (e.g. 512) is likely to bring a better performance.
- Some tricks to reduce memory usage:
  - Use gradient accumulation to reduce the memory usage without changing the effective batch size (simply reducing batch size might hurt the performance).
  - Effective batch size = batch_size * gradient_accumulation_steps

Rules - What You Can Do

- Only train with the data we give you.
- Use publicly available pre-trained LMs.
- Allowed packages:
  - Python 3.9 and Python Standard Library
  - PyTorch 1.12.1, scikit-learn 1.1.2, nltk 3.7
  - tqdm, numpy, pandas
  - transformers 4.22.2, datasets 2.5.2, accelerate 0.13.0
  - evaluate, matplotlib, gdown
- Dependencies of above packages.

Rules - What You **Cannot** Do

- Any means of cheating or plagiarism, e.g., use others' github code from previous years' ADL course.
- Use the labels of the test data directly or indirectly. (Do not try to find them.)
- Use package or tools not allowed.
- Use model trained with other QA or NLI datasets, including but not limited to
  - luhua/chinese_pretrain_mrc_macbert_large, uer/roberta-base-chinese-extractive-qa, NchuNLP/Chinese-Question-Answering
  - If not sure, ask TA first.
- Give/get trained model/predictions to/from others.
- Publish your code before deadline.
- Submit to previous years's ADL Kaggle page.
- Violations may cause zero/negative score and punishment from school.

Submission

1. Kaggle leaderboard. Please set the team name as your student id (lower-cased) (ex. r11000000).
2. Zip your folder, which should be named as your student id (lower-cased) (ex. r11000000) and submit the `.zip` to NTU Cool. Your folder should contains
    - `README.md`
    - `run.sh`
    - `download.sh`
    - `report.pdf`
    - your code/script (all the code/script you used to train, predict, or plot report figures should be included).
    - Do not upload training, validation, testing data or models to COOL.

Submission - download.sh

- `download.sh` should download **your models, tokenizers** and **data**.
- You can upload your models/tokenizers/sdata to
  - Dropbox and use `wget` to download.
  - Google Drive and use `gdown` to download.
- Please make sure we have the access to download!
- Do not modify the files in download links after the deadline, this action is cosidered cheating.
- Keep the download links in download.sh valid for at least **2 weeks** after deadline.
- Do not do things more than downloading, otherwise, your download.sh may be killed.
- You can download at most **4GB**, and `download.sh` should finish within **1 hour**. (At csie dept. with maximum 10MB/s bandwidth)
- We will execute `download.sh` before running any other scripts.

Submission - run.sh

- `run.sh` should perform inference using your trained models and output predictions on `test.json`.
- 3 arguments is required:
  a. "`${1}`": path to `context.json`.
  b. "`${2}`": path to `test.json`.
  c. "`${3}`": path to the output prediction file named `prediction.csv`.
- TA will predict testing data as follow:
  a. `bash ./download.sh`
  b. `bash ./run.sh /path/to/context.json /path/to/test.json /path/to/pred/prediction.csv`
- `run.sh` should finish within **2 hour**. (See next page for environment details)
- Make sure your code works!

Submission - Execution Environment

- Your code/script will be run on computer with
  a. Ubuntu 20.04
  b. 32GB RAM, GTX 3070 8GB VRAM, and 20GB disk space available.
- The packages we allow only.
- Python 3.9
- No network access after we run `download.sh`.

Submission - README.md

- README.md should contain step-by-step instruction on 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.

Grading

- Model Performance (11%)
  - Kaggle simple baseline: public (2%), private (3%).
  - Kaggle strong baseline: public (2%), private (3%).
  - TA can reproduce your results *without* human intervention. (1%)
  - 0 point if we cannot reproduce your submission after human intervention.
- Report (9% + 2% Bonus)
  - In PDF format.

Report - Q1: Data processing (2%)

- Tokenizer (1%):
  - Describe in detail about the tokenization algorithm you use. You need to explain what it does in your own ways.
- Answer Span (1%):
  - How did you convert the answer span start/end position on characters to position on tokens after BERT tokenization?
  - After your model predicts the probability of answer span start/end position, what rules did you apply to determine the final start/end position?

Report - Q2: Modeling with BERTs and their variants (4%)

- Describe (2%)
  - Your model.
  - The performance of your model.
  - The loss function you used.
  - The optimization algorithm (e.g. Adam), learning rate and batch size.
- Try another type of pre-trained LMs and describe (2%)
  - Your model.
  - The performance of your model.
  - The difference between pre-trained LMs (architecture, pretraining loss, etc.)
  - For example, BERT -> xlnet, or BERT -> BERT-wwm-ext. You can find these models in the huggingface's Model Hub.

Report - Q3: Curves (1%)

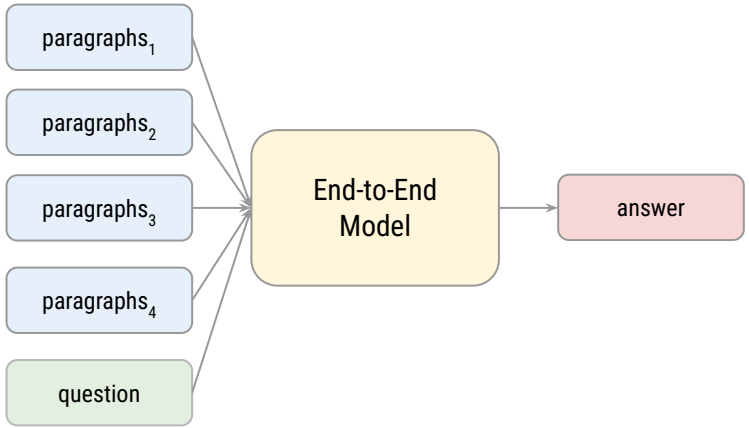
- Plot the learning curve of your span selection (extractive QA) model. **You can plot both the training and validation set or only one set.** Please make sure there are at least **5 data points** in each curve.
    - Learning curve of the loss value (0.5%)
    - Learning curve of the Exact Match metric value (0.5%)

Report - Q4: Pre-trained vs Not Pre-trained (2%)

- Train a transformer-based model (you can choose either paragraph selection or span selection) from scratch (i.e. without pretrained weights).
- Describe
  - The configuration of the model and how do you train this model (e.g., hyper-parameters).
  - The performance of this model v.s. BERT.
- Hint
  - You can use the same training code, just skip the part where you load the pretrained weights.
  - The model size configuration for BERT might be too large for this problem, if you find it hard to train a model of the same size, try to reduce model size (e.g. num_layers, hidden_dim, num_heads).

Report - Q5: Bonus (2%)

- Instead of the paragraph selection + span selection pipeline approach, train a **end-to-end** transformer-based model and describe
  - Your model.
  - The performance of your model.
  - The loss function you used.
  - The optimization algorithm (e.g. Adam), learning rate and batch size.
- Hint: Try models that can handle long input (e.g., models that have a larger context windows).



Any questions?

- COOL discussion board (Answered by both TAs and classmates, encouraged!!!)
- TAs
  - Email: adl-ta@csie.ntu.edu.tw (When sending emails, add “[ADL2023][hw1]” to the beginning of the title.)
  - Office hour: Every Tuesday 16:00~18:00 @ Lab 524