Applied Deep Learning HW2
Natural Language Generation

Deadline: 2023/11/08 23:59:59

Links

NTU COOL (To be modified)

Data & Evaluation

adl-ta@csie.ntu.edu.tw

TA Hours:

Wed. 11:00~12:00 @ 德田524

Fri. 14:30~15:30 @ 德田524

Updates

- 請不要在testing code中import任何和evaluation的有關的package, 包含rouge_score和tw_rouge。
- 不開放使用mt5-small以外其他的model, finetune mt5-small即可通過baseline。
- 可以安裝protobuf。

Task Description

Chinese News Summarization (Title Generation)

- input: news content

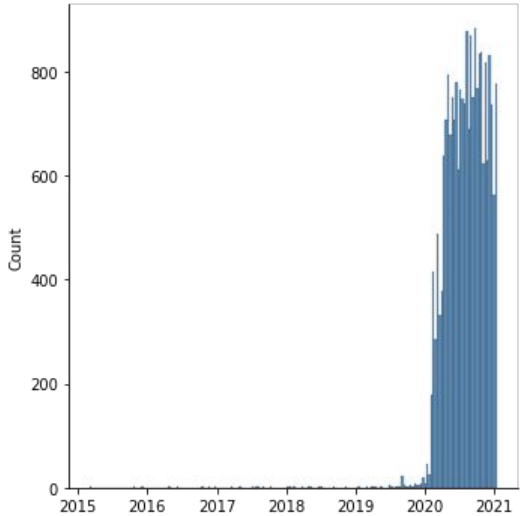
從小就很會念書的李悅寧，　在眾人殷殷期盼下，以榜首之姿進入臺大醫學院，　但始終忘不了對天文的熱情。大學四年級一場遠行後，她決心遠赴法國攻讀天文博士。　從小沒想過當老師的她，再度跌破眾人眼鏡返台任教，　.....

- output: news title

榜首進台大醫科卻休學　、27歲拿到法國天文博士　李悅寧跌破眾人眼鏡返台任教

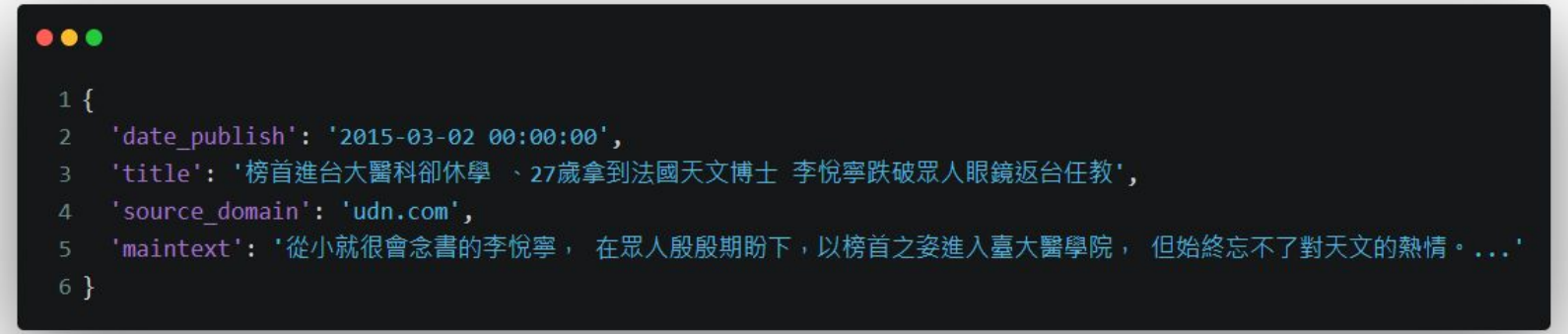
Data

- Source: news articles scraped from udn.com
  - Train: 21710 articles from 2015-03-02 to 2021-01-13
  - Public: 5494 articles from 2021-01-14 to 2021-04-10
  - Private: Not released and will include articles after deadline



Data (cont.)

❖ Example



```
{
  'date_publish': '2015-03-02 00:00:00',
  'title': '榜首進台大醫科卻休學 、27歲拿到法國天文博士 李悅寧跌破眾人眼鏡返台任教',
  'source_domain': 'udn.com',
  'maintext': '從小就很會念書的李悅寧， 在眾人殷殷期盼下，以榜首之姿進入臺大醫學院， 但始終忘不了對天文的熱情。...'
}
```

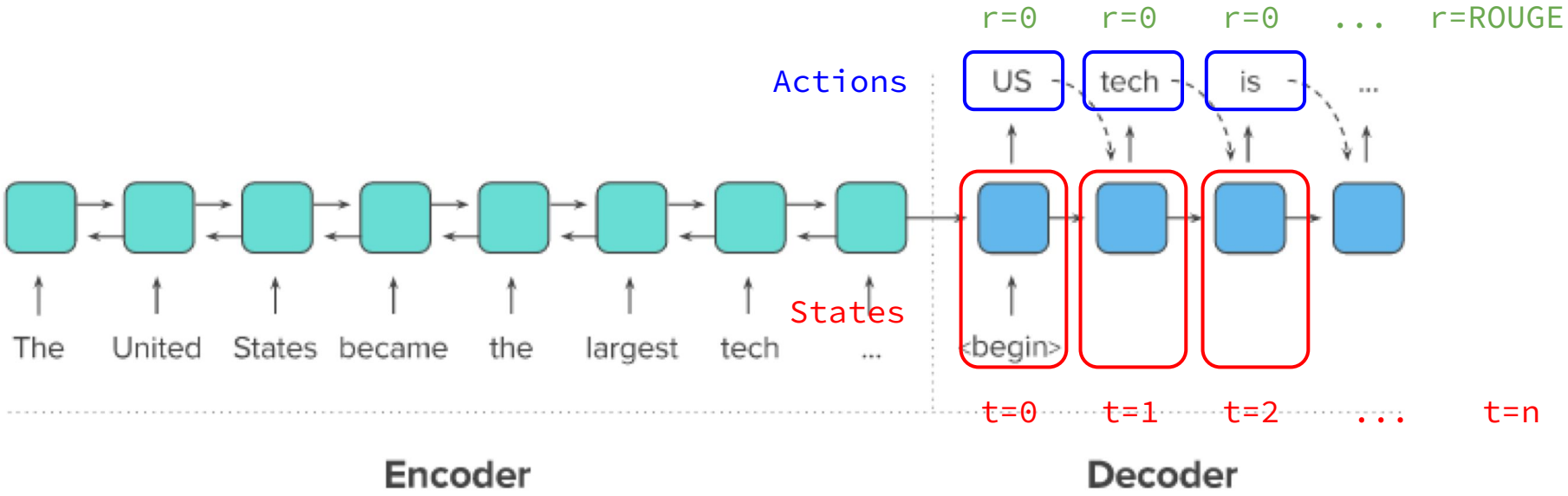
Metrics

- ROUGE score with chinese word segmentation
  - What is ROUGE score?
  - Chinese word segmentation: ckiptagger(github)
- Example
  - candiate: 我 是 人
  - reference: 我 是 一 個 人
  - rouge-1: precision=1.0, recall=0.6, f1=0.75
  - rouge-2: precision=0.5, recall=0.25, f1=0.33
  - rouge-L: precision=1.0, recall=0.6, f1=0.75

Objective

- Fine-tune a pre-trained small multilingual T5 model to pass the baselines
- Public baseline
  - rouge-1: 22.0, rouge-2: 8.5, rouge-L: 20.5 (f1-score * 100)
- Private baseline
  - Will be announced after deadline

Bonus: Applied RL on Summarization



Bonus: Applied RL on Summarization (cont.)

- You can use any RL algorithms (policy gradient, DQN and etc.)

- You can design your own reward function
  - e.g. ROUGE-L, avg(ROUGE-N) and etc.

- You can either directly add RL loss while training or fine-tune from a supervised-learning checkpoint

Report

Q1: Model (2%)

- Model (1%)
  - Describe the model architecture and how it works on text summarization.

- Preprocessing (1%)
  - Describe your preprocessing (e.g. tokenization, data cleaning and etc.)

Q2: Training (2%)

- Hyperparameter (1%)
  - Describe your hyperparameter you use and how you decide it.

- Learning Curves (1%)
  - Plot the learning curves (ROUGE versus training steps)

Q3: Generation Strategies(6%)

- Stratgies (2%)
  - Describe the detail of the following generation strategies:
    - Greedy
    - Beam Search
    - Top-k Sampling
    - Top-p Sampling
    - Temperature

- Hyperparameters (4%)
  - Try at least 2 settings of each strategies and compare the result.
  - What is your final generation strategy? (you can combine any of them)

Bonus: Applied RL on Summarization (2%)

- Algorithm (1%)
  - Describe your RL algorithms, reward function, and hyperparameters.

- Compare to Supervised Learning (1%)
  - Observe the loss, ROUGE score and output texts, what differences can you find?

Rules

What You Can Do

- Allowed packages/tools:
  - Python 3.9 and Python Standard Library
  - PyTorch 2.1.0
  - transformers (<=4.35.0.dev0), datasets==2.14.5, accelerate==0.23.0, sentencepiece==0.1.99, evaluate==0.4.0
  - rouge==1.0.1, spacy==3.7.1, nltk==3.8.1, ckiptagger==0.2.1, tqdm==4.66.1, pandas==2.1.1, jsonlines==4.0.0
  - Dependencies of above packages/tools.
  - You may use any pakages to plot the figure, but do not import them in your submitted code for testing
- If you want to use other package, mail TA.
- You can use any package you want when writing report.

What You Can NOT Do

- Use external training data
  - E.g. scrape news from the internet
- Any means of cheating or plagiarism, including but not limited to:
  - Use other classmates' published / unpublished code.., including students who took previous ML / ADL / MLDS.
  - Just copy and past any public available code without modification
  - Use package or tools not allowed.
  - Give/get trained model to/from others.
  - Give/get report answers or plots to/from others.
  - Publish your code before deadline.
- Violation may cause zero/negative score and punishment from school.

Logistics

Grading

- Model performance (10%)
  - Public baseline (5%)
  - Private baseline (5%)
- Report (10% + 2%)
  - In PDF format!
  - Score of each problem is shown in the Report section.
- Format
  - You may lose (some or all) of your model performance score if your script is at wrong location, causes any error, etc.

Submission - Format

sample_submission.jsonl

```
{'title': 'Anker新款真無線藍牙耳機Liberty Air 2 Pro 引進台灣市場', 'id': '21710'}
{'title': '藍染、客家美食、舊山線自行車 「苗栗一日遊」超人氣美食美景', 'id': '21711'}
{'title': '華碩打造對應軍規防護與2 in 1設計的15.6吋Chromebook', 'id': '21712'}
{'title': '產業發展變革 台灣的優勢與機會', 'id': '21713'}
{'title': '全球Windows 7裝置粗估至少還有1億台以上 市佔率穩穩卡在20%', 'id': '21714'}
{'title': '強勢台幣理財攻略', 'id': '21715'}
{'title': '「不需治療，只需到台灣！」 美國「哈台馬克杯」賣到缺貨', 'id': '21716'}
```

Submission - File Layout

- You are required to submit .zip file to NTU Cool
- File structure for the .zip file (case-sensitive):
  - /[student id (lower-cased)]/ (Brackets not included.)
    - download.sh
    - run.sh
    - README.md
    - report.pdf
    - code/all other files you need
- You can use **unzip -l** to check your zip file

Submission - Scripts

- **download.sh**
  - 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.
  - Do not do things more than downloading. Otherwise, your **download.sh** may be killed.
  - You can download at most 4G, and **download.sh** should finish within 1 hour. (At csie dept with maximum 10MB/s bandwidth)
  - Do not pip install ANYTHING in your download.sh, you are not allowed to modify the testing environment
- You can upload your model to Dropbox or Google Drive. (see tutorial)
- We will execute download.sh before predicting scripts.

Submission - Scripts

- **run.sh**
- Arguments:
  - ${1}: path to the input file
  - ${2}: path to the output file
- TA will predict testing data as follow:
  - bash ./download.sh
  - bash ./run.sh /path/to/input.jsonl /path/to/output.jsonl
- **Make sure your code works!**

Submissiom - Reproducibility

- All the code you used to train, predict, plot figures for the report should should be upload.
- We will remove the answers in public.jsonl when we reproduce your submission.
- README.md
  - Write down how to train your model with your code/script specifically.
  - 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.
- You will get at least - 2 penalty if you have no or empty README.md.

Execution Environment

- Will be run on computer with
  - Ubuntu 20.04
  - 32 GB RAM, GTX 3070 8G VRAM, 20G disk space available.
  - the packages we allow only.
  - python 3.8 / 3.9
- Do NOT train with very large model (e.g. mt5-xl) or you will get an out of memory error on 8G VRAM.
- Time limit: 1 hours for **run.sh** in total
- You will lose (some or all) your model performance score if your script is at wrong location, or cause any error.

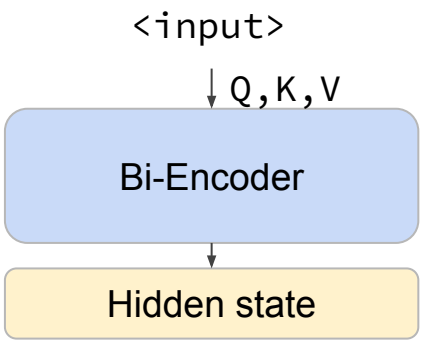
Late Submission Penalty

- Late submission of "code and report":
  - 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.

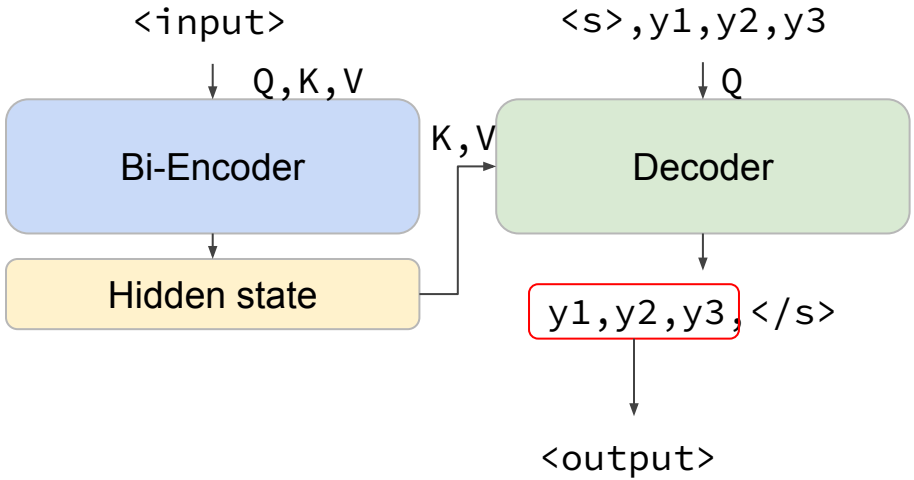
Guide

Text-to-Text Transformer (T5)

HW1: BERT



HW2: T5



Training

- Pre-trained mt5-small is very large. (300M parameters, 3x than BERT-base)
- Some tips to reduce GPU memory usage:
  - Reduce batch size + gradient accumulation
  - Truncate text length (256/64 for input/output can pass the baseline)
  - fp16 (transformers has a bug on T5 fp16 training)
  - adafactor (instead of Adam)
- For reference, you can pass the baseline within 4 hours training on single RTX 3070 8G if your code is correct.

Some Reminder

- Please check the your file structure is correct after zip
- You are not allowed to modify TA's testing environment
- You don't have to include tw_rouge neither in your code nor in the folder
- Please comment out `check_min_version("4.35.0.dev0")` before submission
- If you are using Windows, please be sure your script could be executed as well in Ubuntu. (Might encounter line encoding issue)

How to Fix T5 FP16 Training

- https://github.com/huggingface/transformers/pull/10956
- Install fixed version transformers library
  - `git clone https://github.com/huggingface/transformers.git`
  - `git checkout t5-fp16-no-nans`
  - `pip install -e .`

Documents

- T5
  - https://huggingface.co/transformers/model_doc/t5.html
  - https://huggingface.co/transformers/model_doc/mt5.html

- Generation:
  - https://huggingface.co/transformers/main_classes/model.html#generation

Q&A