NTU ADL Homework 2, 2023 Fall.

Model

Model & Preprocessing

- **mT5 is a basic Encoder-Decoder transformer architecture.**

- **mT5's text summarization process involves encoding both source and target texts into continuous vectors through an embedding layer, using Byte-Pair Encoding for multilingual and character-level text. It follows a "text-to-text" approach, employing self-attention mechanisms and Transformer encoders to transform the source text into a summary. Self-supervised training minimizes differences between source and target texts, teaching the model to generate concise summaries. Post-training, the model uses a decoder to produce summaries from source text, emphasizing essential information.**

Training

Hyperparameters

- **max_source_length=256**

- **max_target_length=64**

- ***After observing the input data and TA's tips, I decide to use 256 as my max_source_length and use 64 as my max_target_length.***

- **val_max_target_length=32**

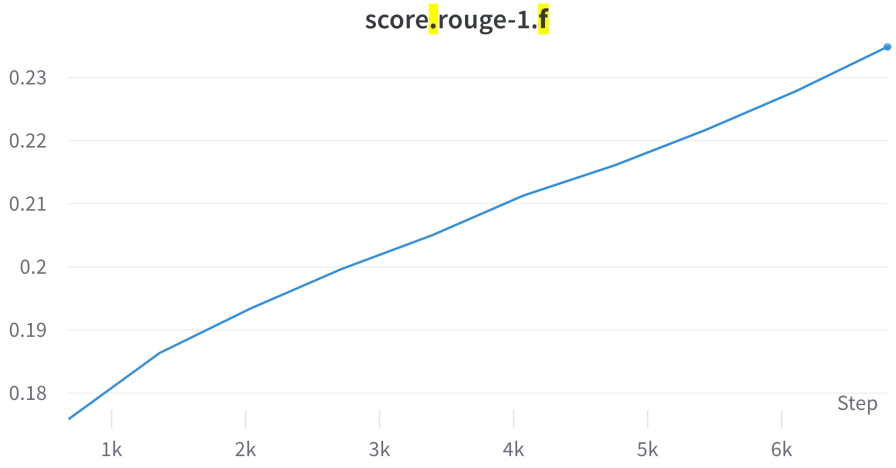
- ***However, while taking 32 as val_max_target_length, the result always include a BOS special token, after changing my val_max_target_length to 32 it fixed!***

- ***So, I choose 32 as my val_max_target_length.***

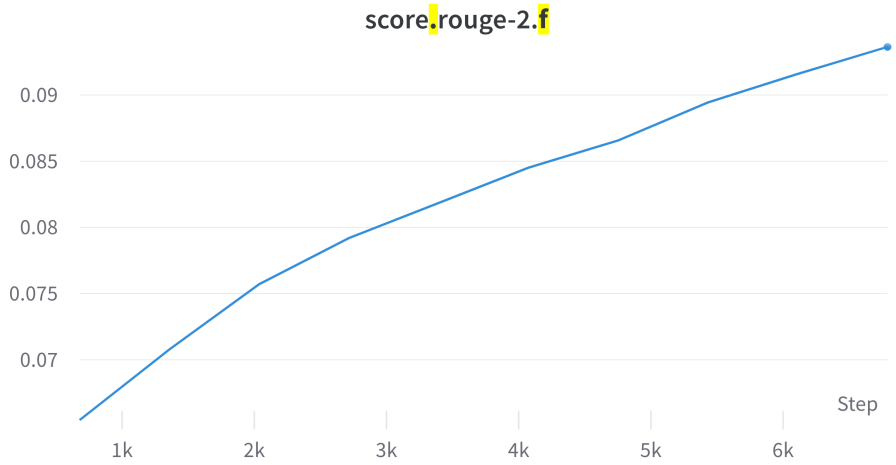
- **source_prefix="summarization: "**
- ***This is based on the offical repo of mT5, they claim that adding this prefix to the source will improve the performance.***
- **per_device_eval_batch_size=2**
- **per_device_train_batch_size=2**
- ***I've tried a lot different size, and find that 2 is the most appropriate number of it.***
- **learning_rate=5e-5,**
- **weight_decay=2e-5,**
- ***Not change, same with the original value of the official repo.***
- **epochs=10,**
- **gradient_accumulation_steps=16,**
- ***After a lot of experiment, 16 is the base number of all time.***
- **lr_scheduler_type=cosine,**
- **beams=30,**
- **seed=42**

Curves

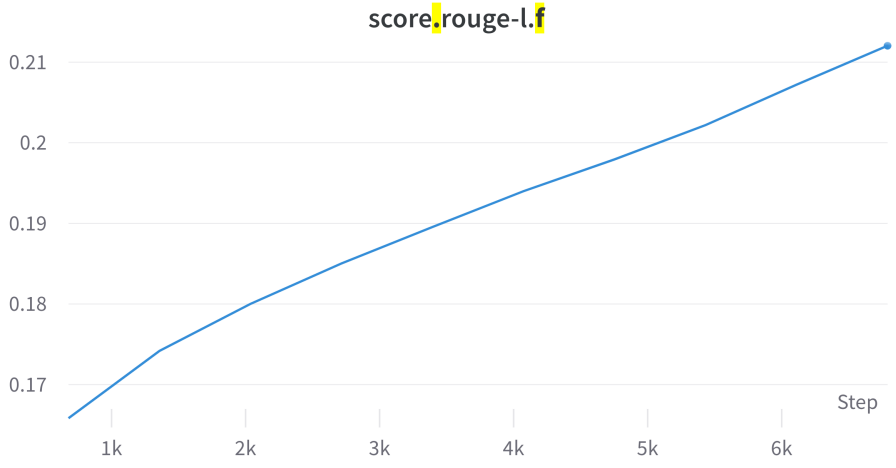
ROUGE1.F



ROUGE2.F



ROUGEL.F



- **As you can see, the score is not ending growing up in 10 epochs, so, I should increase the training epochs.**

Generation Strategies

Strategies

Greedy Generation:

- **Greedy generation is the simplest strategy where the model chooses the word with the highest probability for the next word in a sequence at each step.**

- **This strategy often leads to coherent but repetitive and predictable text, as it doesn’t explore alternative word choices.**

Beam Search:

- **Beam Search is a more advanced strategy that aims to improve the diversity and coherence of generated text.**

- **It maintains a set of multiple candidate sequences (the “beam”) and extends them by predicting the next word for each candidate. At each step, it selects the top-k candidates with the highest probabilities.**

- **This strategy explores multiple possibilities and can lead to more diverse and contextually relevant outputs.**

Top-k Sampling:

- **Top-k sampling is a probabilistic strategy where the model selects from the top-k most likely words at each generation step, based on their probabilities.**

- **It adds an element of randomness and allows for a variety of outputs, but still restricts the choices to a predefined number of words. This can help balance diversity and coherence.**

Top-p Sampling:

- **Top-p sampling, also known as nucleus sampling, is a strategy that selects words from the most**

probable words whose cumulative probability is below a certain threshold p.

- **This approach adapts to the changing distribution of word probabilities and allows for a dynamic set of candidates, which makes it more adaptable and potentially more diverse than top-k sampling.**

TEMPERATURE:

- **Temperature is a parameter that can be adjusted to control the randomness of the model's output during generation.**

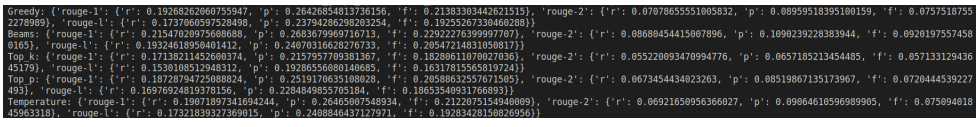
- **A higher temperature (e.g., 1.0) makes the model's predictions more random, resulting in more diverse but potentially less coherent text. A lower temperature (e.g., 0.2) makes the predictions more deterministic and focused on the most probable words, leading to more conservative and deterministic text.**

Hyperparameters:

- **I tried 2 settings of each strategy (unless greedy strategy), the hyperparameters are down below.**

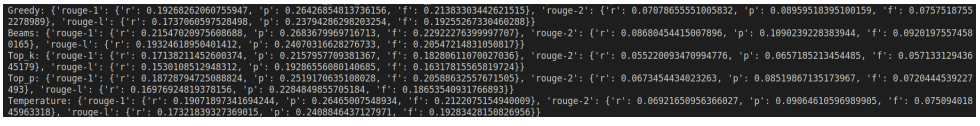
SETTING 1:

beams=10, top_k=30, top_p=0.8, temperature=0.6:



SETTING 2:

beams=20, top_k=15, top_p=0.4, temperature=0.3:



- **I choose beams as my final strategy, according to the result, it's performance is better than others.**