



Paraphrasing with Large Language Models

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Summary

Task :

- ▲ Paraphrasing sentences and paragraphs using Large Language models

Uses :

- ▲ Generating fresh content
- ▲ Studying LLM Representations
- ▲ Text augmentation

Method :

- ▲ Fine-tune a Language Model on a set of paraphrases
Eg. Original text >>>>> Paraphrased text
- ▲ Generate new paraphrases from the model by prompting it with "original text >>>>>"
- ▲ Take a similarity score using Universal Sentence Encoder
- ▲ Use Rouge-L and USE scores to determine the text closest in semantic meaning but most different in words

Results :

- ▲ Our model produces new paraphrases with USE and Rouge-L scores similar to the dataset

Sentence Examples

		USE	ROGUE- L	BLEU
In:	A prisoner can asphyxiate himself in 90 seconds and, after eight minutes or so, he will be brain dead.			
Out:	In 90 seconds, a prisoner can asphyxiate himself and be brain dead after eighth minutes or so.	0.9326	0.4706	0.4730
In:	The restaurant is a carved-off space up a couple of stairs to one side, dominated by faux bare-brick columns, faux-wood floors and an air of foetid despondency.			
Out:	It is carved-off space, up a couple of flights of stairs, to the other side of the restaurant, dominated by fake bare-brick columns, fake wood floors and an air of foetid despondency.	0.8954	0.5000	0.5348
In:	I signed a bill that made the problem worse, and I want to admit it, he said.			
Out:	He signed a bill that made the problem worse and he wants to admit it.	0.8363	0.4667	0.5299
In:	It said the damage to the wing provided a pathway for hot gasses to penetrate the ship's thermal armor during Columbia's ill-fated reentry.			
Out:	The document says the damage to the wing provided a pathway for hot gases to penetrate Columbia's thermal armour during its fatal re-entry.	0.9190	0.4545	0.5445

Examples of GPT-2 generated paraphrased sentences with the scores of each pair

		USE	R-L
In:	A prisoner can asphyxiate himself in 90 seconds and, after eight minutes or so, he will be brain dead.		
Out 1:	After 8 minutes, a brain fart will subdue the sufferer.	0.524	0.0
Out 2:	After 8 minutes, he will be brain-dead and his heart will stop.	0.565	0.138
Out 3:	A brain aneurysm can asphyxiate itself in 90 seconds and, after eight minutes, it will be dead.	0.721	0.412
Out 4:	After eight minutes, a brain anesthetist can asphyxiate a prisoner in 90 seconds and for several minutes after that.	0.758	0.167
Out 5:	A brain-dead prisoner can asphyxiate himself in 90 seconds and then out loud after eight minutes.	0.809	0.312
Out 6:	At asphyxiation, the prisoner canasphyxiate himself in 90 seconds and, after 8 minutes, he will be brain dead.	0.884	0.514
Out 7:	After eight minutes, a prisoner can asphyxiate himself in 90 seconds and, after that, he will be brain dead.	0.884	0.514
Out 8:*	In 90 seconds, a prisoner can asphyxiate himself and be brain dead after eight minutes or so	0.932	0.473
Out 9:	A prisoner can asphyxiate himself in 90 seconds and, after eight minutes, he will be brain dead.	0.972	0.824

Showing Candidates Selection and Scoring - *Selected Sentence

Paragraph Examples

In:	The first step in solving the problem is to prop the door open with tape. This means your cat will now be able to see through to the other side; your cat will likely begin using the kitty door immediately. Once your cat has gotten used to using the kitty door, remove the tape. Sometimes cats will continue to use the kitty door without any more prompting.
Out:	The first step in resolving the problem is to prop the gate with tape. The implies that your cat will shortly be enabled to see through to the other side; your cat will likely immediately begin using the kitty door. Remove the tape when your cat has got used to using the kitty door. Sometimes cats will continue to use the kitty gate without any more command.
Scores:	USE: 0.9835 ROUGE-L: 0.6102 BLEU: 0.6858
In:	I do well in school, and people think I am smart because of it. But its not true. In fact, three years ago I struggled in school. However, two years ago I decided to get serious about school and made a few chnges. First, I decided I would become interested in whatever was being taught, regardless of what other people thought. I also decided I would work har every day and never give up on any assignment.
Out:	I do well in school, and individuals believe that I am intelligent because of it. But it's not true. In fact, three years ago I struggled in school. I decided I would become interested in whatever was taught, regardless of what other people thoguht. I also decided I would work every day and never give up on any task.
Scores:	USE: 0.9380 ROUGE-L: 0.6929 BLEU: 0.6221
In:	There are three reasons why Canada is one of the best countries in the world. First, Canada has an excellent health care system. All Canadians have access to medical services at a reasonable price. Second, Canada has a high standard of education. Students are taught by well-trained teachers and are encouraged to continue studying at university. Finally, Canada's cities are clean and efficiently managed. Canadian cities have many parts and lots of space for people to live. As a result, Canada is a desirable place to live.
Out:	There are three main reasons why Canada is one of the finest locations in the globe. First, Canada has an excellent health care system. All Canadians have access to medical care at a reasonable cost. Second, Canada has a high standard of eduation. Students are taught by well-trained teachers and are urged to continue studying at university. Finally, Canada's cities are clean and efficiently managed with many parks and lots of room for living, as a consequence, Canada is a desirable location.
Scores:	USE: 0.9775 ROUGE-L: 0.6832 BLEU: 0.7182

Table 4: Sample paragraph pairs

Discussion

Motivation :

- ▲ Representations learnt by Large Language Models
- ▲ Fine-tuning LMs
- ▲ Downstream tasks

Qualities of Large LMs:

- ▲ Examining Large LMs representations of grammar and syntax
- ▲ Tools for conditioned text generation

Future directions

- ▲ Bigger LMs
- ▲ Multiple conditioned tasks
- ▲ Investigate the representations at various layers

Dataset	USE	R-L	BLEU
MSR_train	0.8462	0.4315	0.4593
MSR_test	0.8415	0.4202	0.4966
News dataset	0.8949	0.4686	0.5649
Paragraphs dataset	0.9208	0.4966	0.5762

Average USE, ROUGE-L, BLEU Scores of the datasets

Key References

- "Language Models are Unsupervised Multitask Learners" - Radford et al. (2018)
- "Universal Sentence Encoder" - Cer et al. (2018)
- "Rouge: A package for automatic evaluation of summaries." - Lin (2004)
- "Attention is all you need." - Vaswani et al. (2017)

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