HPSG/MRS-Based Sentence Generation Using Transformer

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Background

- Do we need linguistics in NLP?
- Empirical success of stochastic NLP
 - Black box problem of neural NLP
- Symbolic NLP and Grammar Engineering
 - Show high precision but narrow coverage (Bender and Emerson, 2021)

RESULTS

- BLEU score
 - BLEU measured for every 5,000 steps
 - Score peaked at 30,000 steps with 64.2 BLEU
 - 12.97 lower than Hajdik et al. (2019)
 - Score decreased after 30,000 steps with overfitting

KOREA

- Translation Samples
 - (1)

- Hajdik et al. (2019)
 - HPSG-based engineered grammar (ERG) with neural machine translation (BiLSTM + Attention) for NLG

Suggestion

(|_ unknown|mood=INDICATIVE|perf=-|sf=PROP-OR-QUES ARG-NEQ| _ (|_ and_c|num=PL|pers=3 L-INDEX-NEQ|_ (|_ _cathedral_n_1|ind=+|num=SG|pers=3 RSTR-H-of|_ (|_ _the_q|_)|_)|_ R-INDEX-NEQ|_ (|_ bazaar_n_1|ind=+|num =SG|pers=3 RSTR-H-of|_ (|_ the_q|_)|_)|_)|_

- Linearized MRS is long
- RNNs suffer from vanishing gradient problem
- RNNs have hardship processing longer sequences
- Transformer model can process longer sequence better

- L)
 - a.prediction: If I am correct, they will help you understand exactly what it is saying the Linux community of good software - and perhaps they will help you become more productive yourself.
 - b.answer: If I'm correct, they'll help you understand exactly what it is that makes the Linux community such a fountain of good software—and, perhaps, they will help you become more productive yourself.

(2)

a.prediction: The myth and the sword. b.answer: The Cathedral and the Bazaar (3) a.prediction: = = = Objectives = = = b.answer: Abstract

Error Analysis

Error	Number	Sample Prediction
No Error	47	Okay , we have card0 options .
Lexical	31	I assume there is a full salon on the shipping costs .
Punctuation	8	: * named0
Lexical & Missing Argument	5	Don 't Linger
Lexical & Syntactic	4	When ad dollars is tight , the high page cost is generally a major UNKcontributor0 for UNKadvertisers0 who want to appear regularly in a publication or not at all .
Missing Argument	3	Requesting immediately .
Syntactic	2	polite0 refund .
SUM	100	

- Attention Weight Distribution
- Applying Transformer would increase the performance by better processing longer sequences

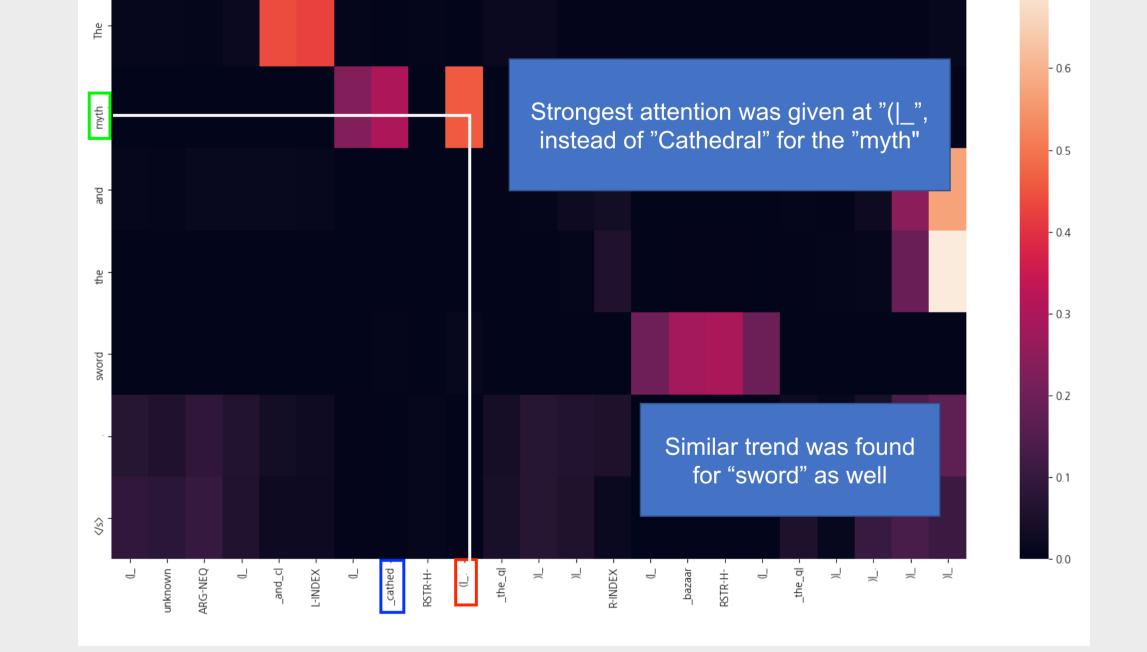
Method

Data

- Gold Dataset: Redwoods
 - Manually inspected MRS representations
- Silver Dataset: MRS with ERG with no manual inspection from Gigawords Corpus
- Total data: 984,679 MRS-sentence pairs
- Anonymized according to ERG's NER to reduce data sparsity
- Data and processor by Hajdik et al. (2019)
 Linearization: MRS – DMRS – PENMAN – Single line string

DISCUSSION

- Summary
 - Reproduced Hajdik et al. (2019) with Transformer
 - Great syntactic reconstruction, failed at lexical choices



- Model
 - Transformer
 - OpenNMT-py
 - Hyperparameters
 - From the manual (mimics the original Transformer)
 - Validation on every 5,000 steps to save model frequently
 - Evaluation: SacreBLEU

- Attention-based approach is suboptimal for MRS
- Significance of the Research
 - ERG is already a robust system, but with narrow coverage
 - Broadening ERG with neural networks

References

Hajdik, V., Buys, J., Goodman, M. W., and Bender, E. M. (2019). Neural text generation from rich semantic representations. arXiv preprint arXiv:1904.11564.

Bender, E. M. and Emerson, G. (2021). Computational linguistics and grammar engineering. Berlin: Language Science Press, prepublished version edition.