

# An Empirical Study of Mini-Batch Creation Strategies for Neural Machine Translation



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#### Abstract

- There are a lot of different mini-batch creation strategies
- We did the experiments to survey the effect of mini-batch creation strategies
- The choice of a mini-batch creation strategy has a large effect on NMT training
- Our results suggest that we should:
- Use larger mini-batch size
- For Adam: sort the corpus based on the source sentence length or just shuffle before making mini-batches
- For SGD: sort using the target sentence length, break ties by sorting by source sentence length

## **Experimental Settings**

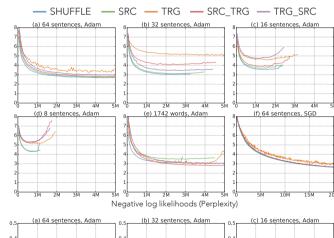
- 1 Layer LSTM with 512 Units
- Dropout 30% for all vertical connections
- Parameters are identically initialized between experiments
- Optimization function
- Adam ( $\alpha = 0.001$ )
- SGD ( $\eta$  =0.1)
- Corpus
- ASPEC (English-Japanese)
- WMT 2016 (English-German)

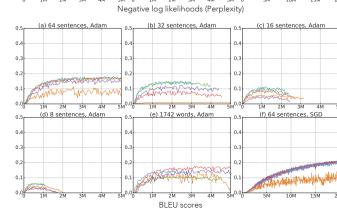
### Corpus Sorting Method

- SHUFFLE: shuffle the corpus randomly before creating mini-batches, with no sorting
- SRC: sort based on the source sentence length
- TRG: sort based on the target sentence length
- SRC\_TRG: sort using the source sentence length, break ties by sorting by target sentence length
- TRG\_SRC: converse of SRC\_TRG

# Effect of Corpus Sorting Method -

- O Should we sort the corpus?
- A Sometimes, not.
- Hypothesis
- If the sentence length varies in the mini-batch, we need to pad the tokens to adjust their length to the length of the longest one.
- Many NMT toolkits implement length-based sorting for reducing the amount of padding required.
- Experimental Result
- When using Adam, the TRG and TRG\_SRC sorting methods, do not always work well, use SHUFFLE or SRC sorting method.
- When using SGD, use TRG\_SRC (it process one iteration faster.)





## Effect of Mini-Batch Size -



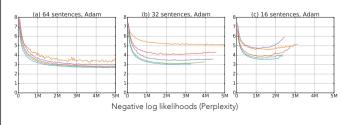


### Hypothesis

- Larger mini-batches make the gradients more stable.
- They also increase efficiency with parallel computation.

## Experimental Result

- Mini-batch size can affect the final accuracy
- The larger mini-batch size seems to be better.





# Effect of Mini-Batch Unit

O Is there any differences by mini-batch units?



- Hypothesis
- Most NMT toolkits create mini-batches with a constant number of sentences.
- This leads to vary the scale of the losses since the loss function for the mini-batch is the sum of the word level losses.
- Creating mini-batches by keeping the number of target words may lead to more stable convergence.
- · Experimental Result
- Mini-batch units do not effect to the training process

