WeCNLP 2020

Simulated Multiple Reference Training (SMRT) Improves Low-Resource Machine Translation

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use target side *paraphrasing*
to overcome data sparsity
in *low-resource* settings

La tortuga ganó contra la liebre | The turtle beat the hare

Machine Translation

Khayrallah et al.

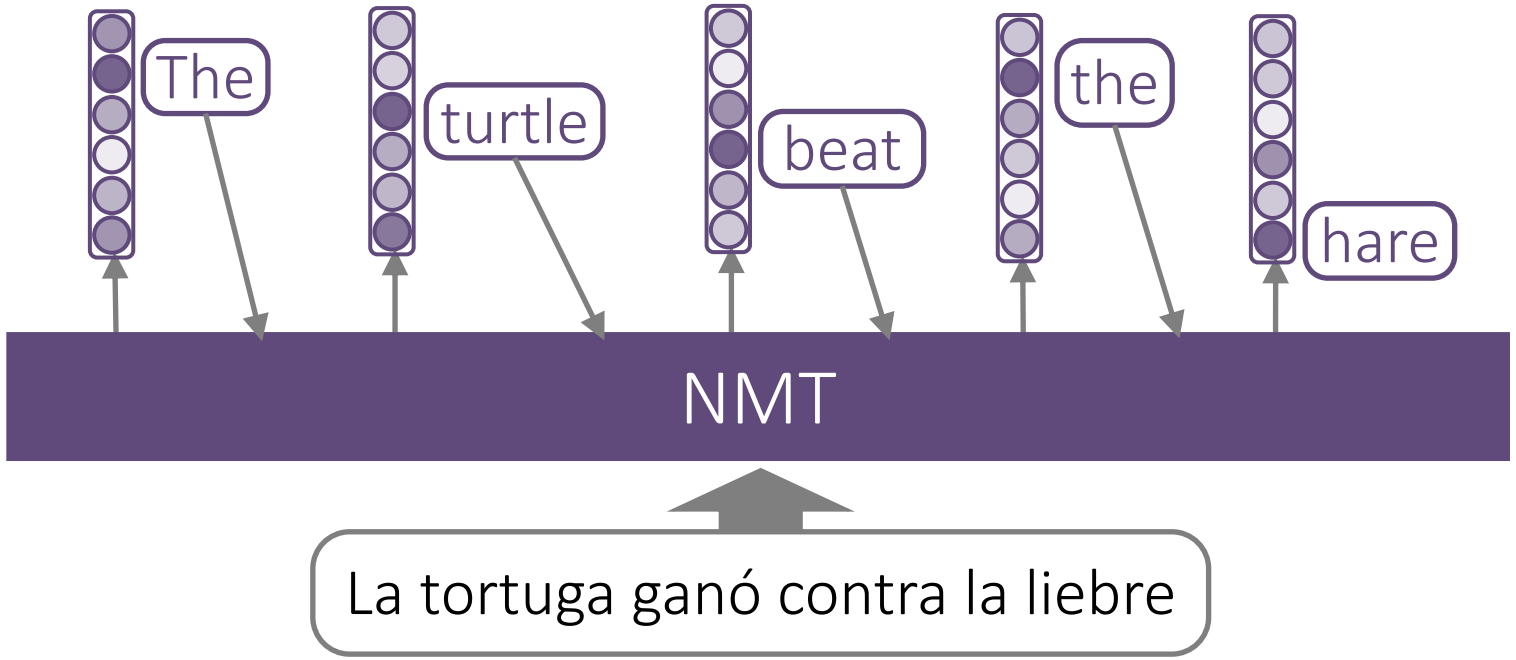
Machine Translation

Khayrallah et al.

Machine Translation

Khayrallah et al.

Machine Translation



Khayrallah et al.

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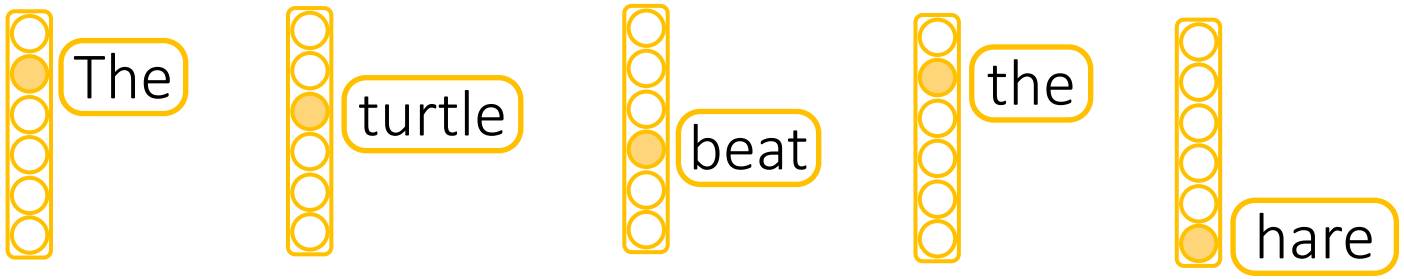
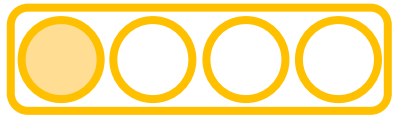
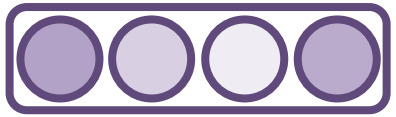


NLL Objective

$$-\sum_{v \in \mathcal{V}} \left[\mathbb{1}\{y_i = v\} \times \log p_{\mathrm{MT}}(y_i = v \mid x; y_{j<i}) \right]$$

Gold Target

MT Model output

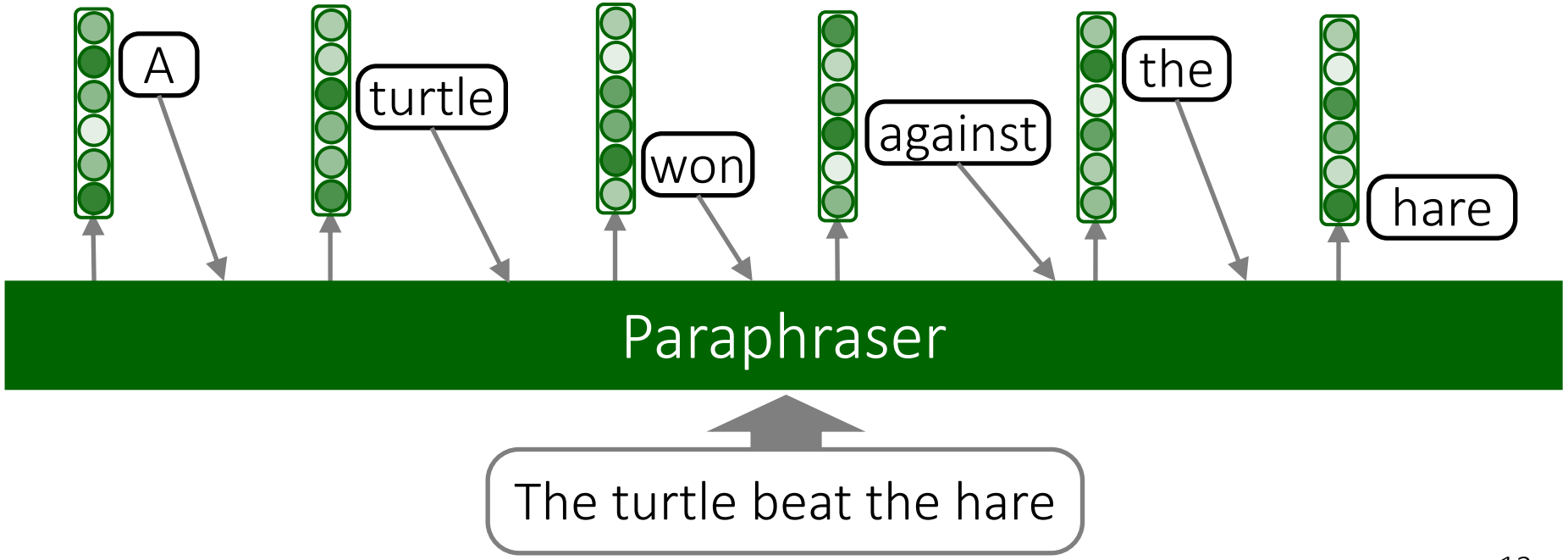
Cross Entropy( , )

Gold Target

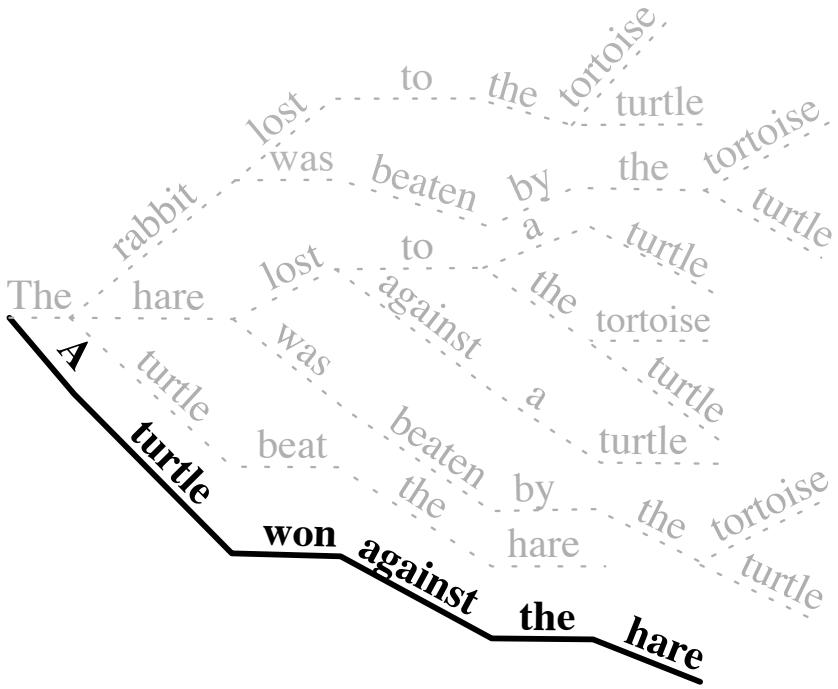
MT Model output

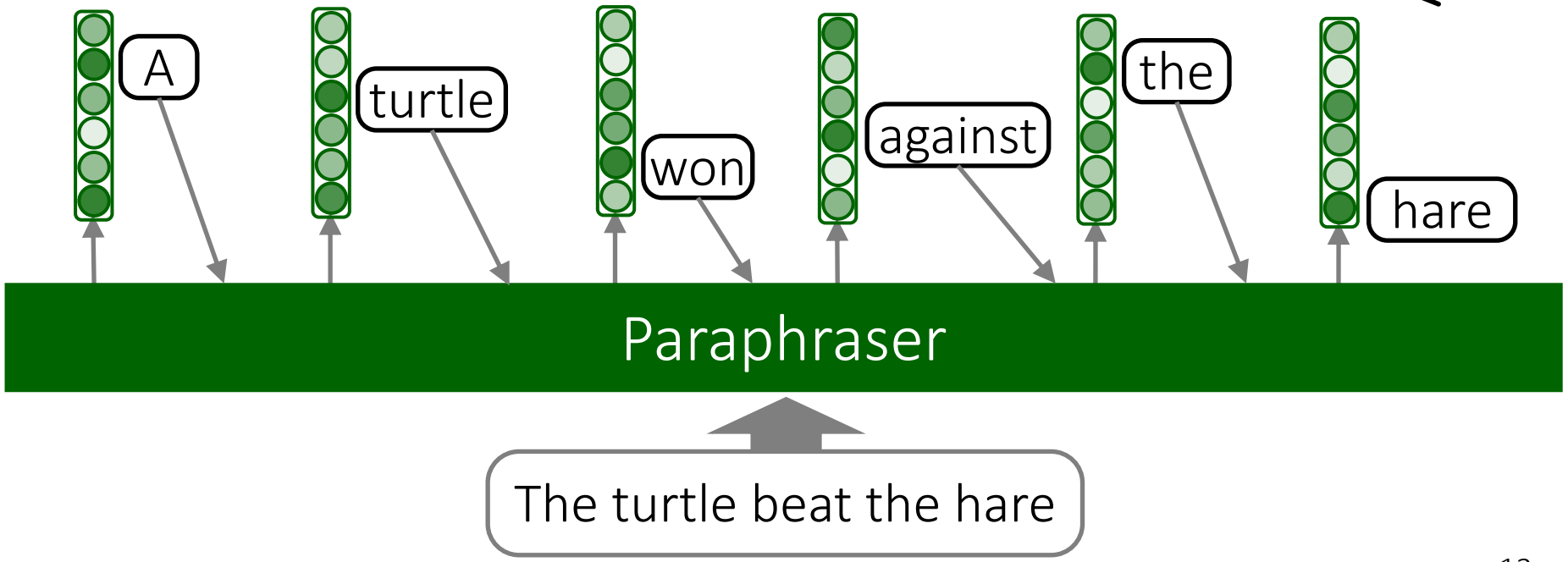
La tortuga ganó contra la liebre | The turtle beat the hare

Paraphraser

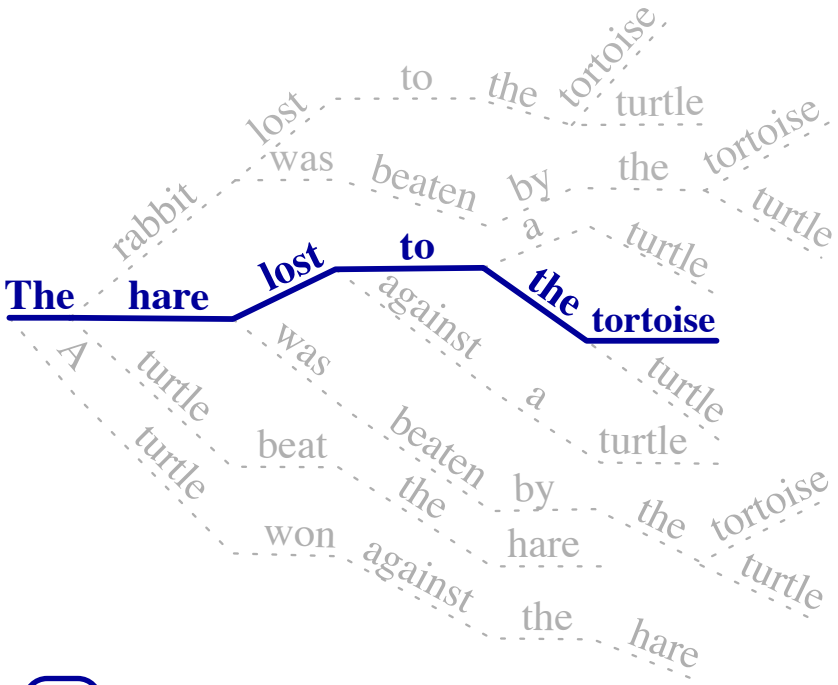


Paraphraser





Sampling


The
hare
lost
to
the
tortoise
rabbit
was
beaten
by
a
turtle
A
turtle
beat
the
hare
won
against
the
hare
was
beaten
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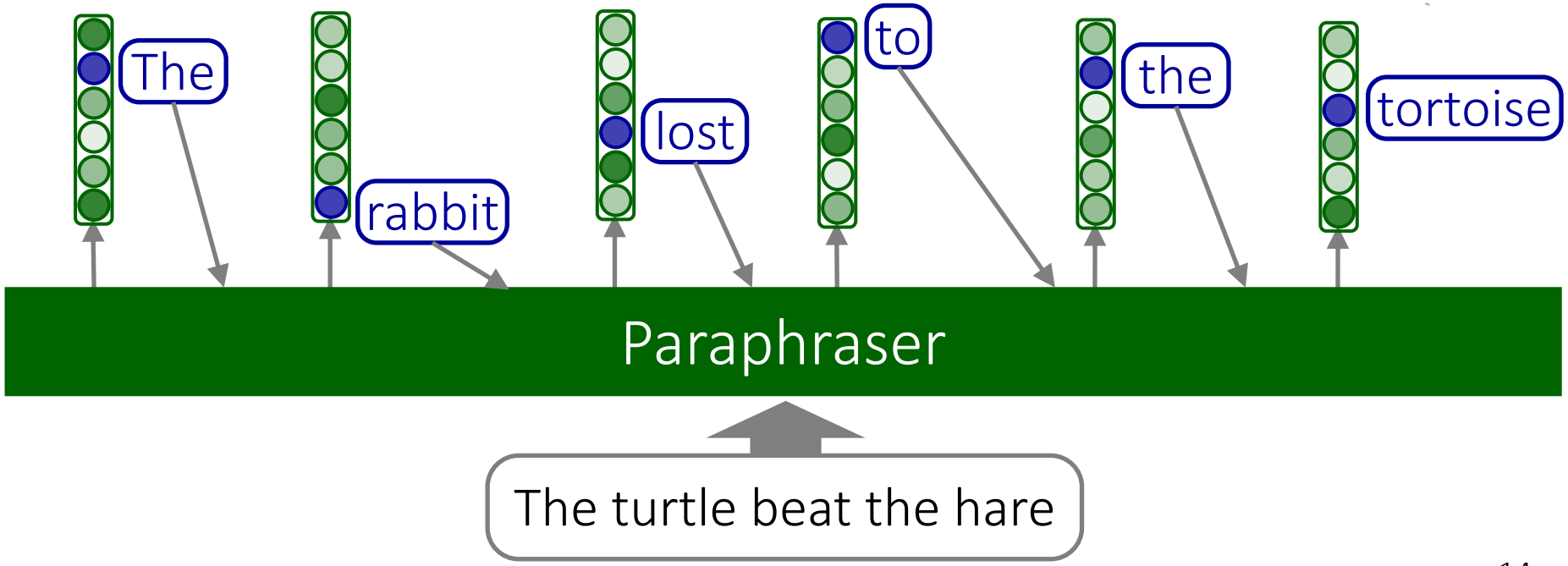
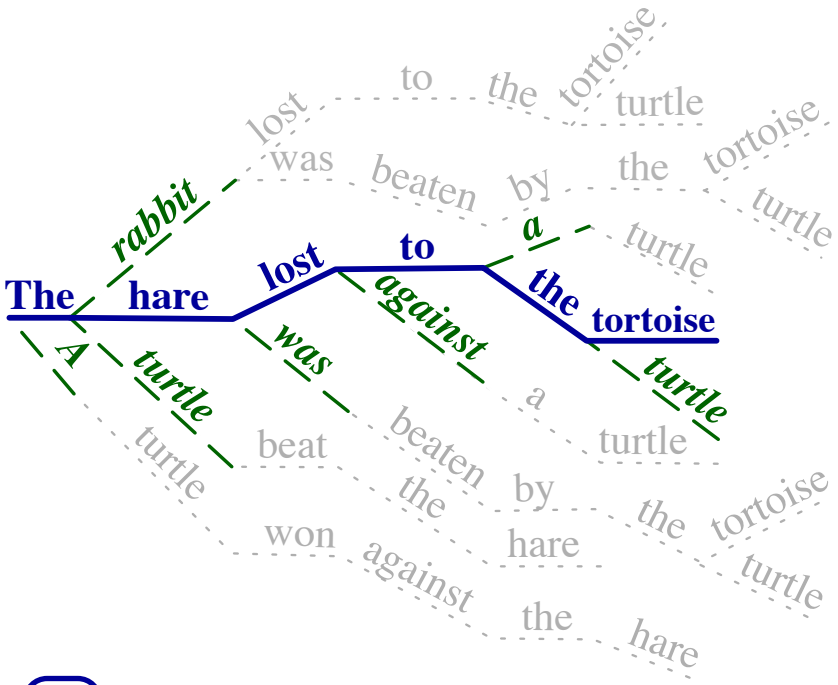
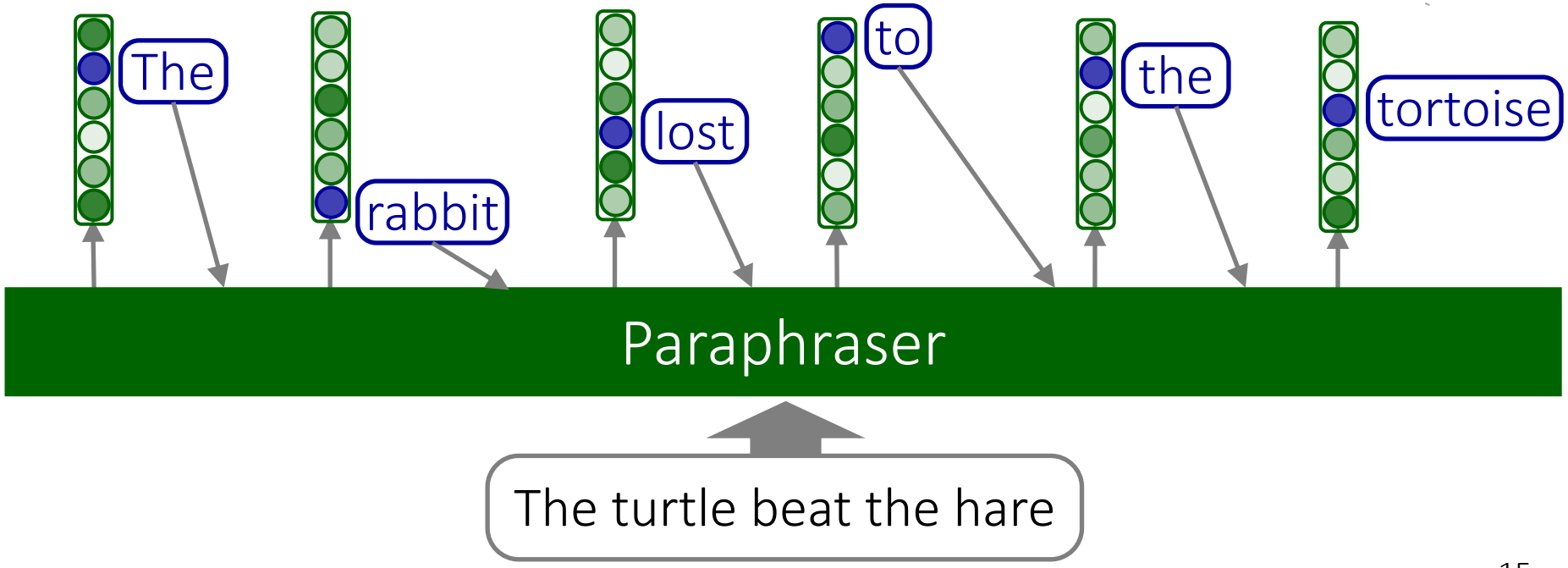
the
tortoise
turtle

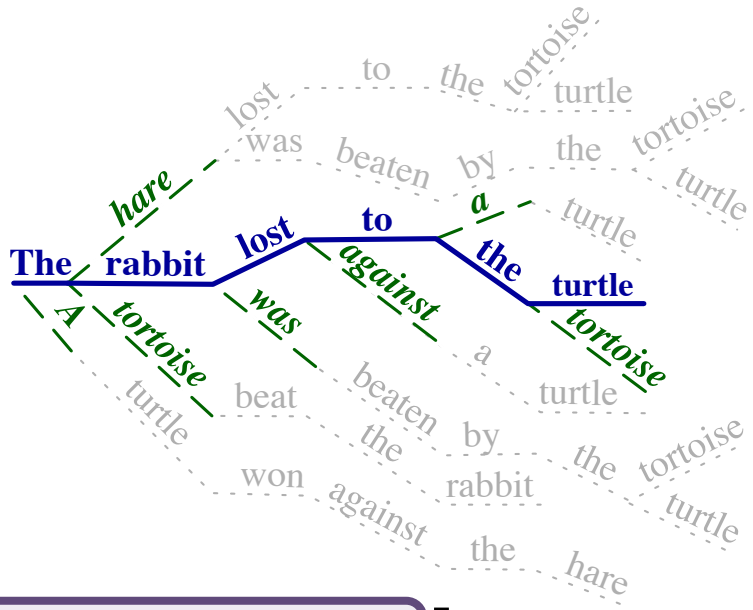

The
rabbit
lost
to
the
tortoise
Paraphraser
The turtle beat the hare

Distribution





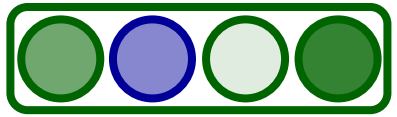
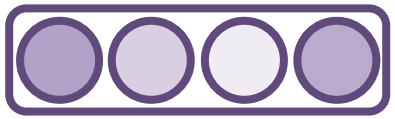
SMRT Objective



$$-\sum_{v \in \mathcal{V}} \left[\boxed{p_{\text{para}}(y'_i = v \mid y; y'_{j<i})} \times \log \boxed{p_{\text{MT}}(y'_i = v \mid x; y'_{j<i})} \right]$$

Paraphraser Output

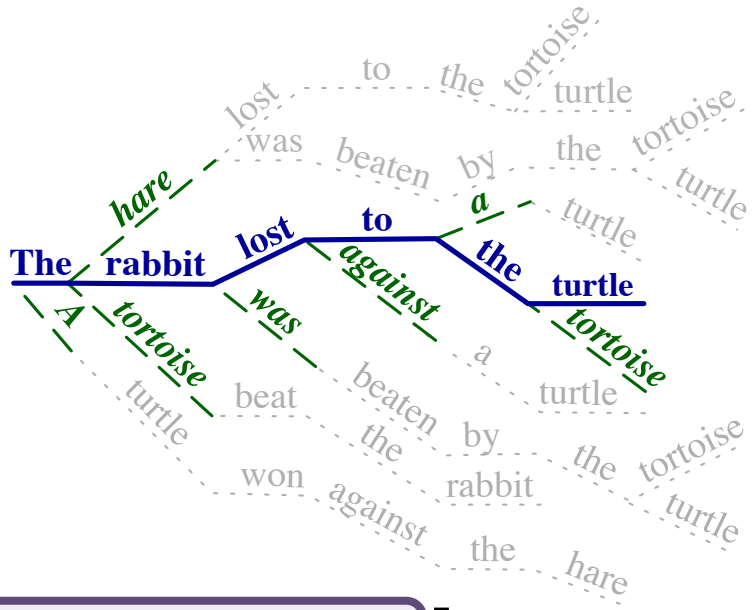
MT Model output

Cross Entropy( , )

Paraphraser Output

MT Model output

SMRT Objective



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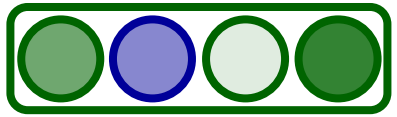
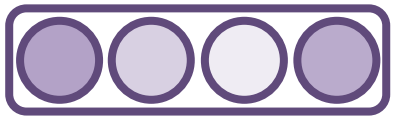
Paraphraser Output (teacher)

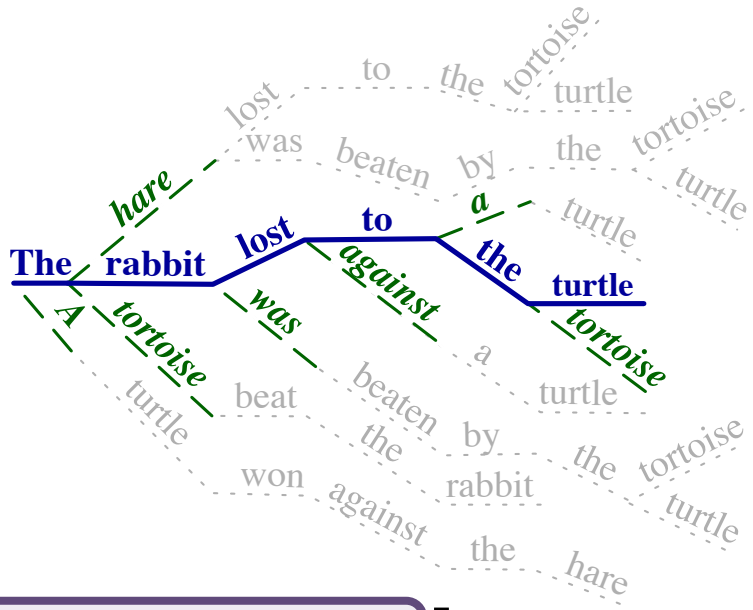
MT Model output (student)

Cross Entropy( , )

Paraphraser Output (teacher)

MT Model Output (student)

SMRT Objective



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Paraphraser Output

MT Model output

$$-\sum_{v \in \mathcal{V}} \left[\boxed{\mathbb{1}\{y_i = v\}} \times \log \boxed{p_{\text{MT}}(y_i = v \mid x; y_{j<i})} \right]$$

Gold Target

MT Model output

Experimental Details

- transformer model in fairseq (Ott et al., 2019)
- Global Voices corpora (Tiedemann, 2012)
  - (+ MATERIAL corpora in paper)
- Use SMRT w/ 50% probability, NLL otherwise
- English Paraphraser trained on ParaBank2 (Hu et al., 2019)
- 4k SentencePiece vocab (Kudo & Richardson 2018)
- Code, Global Voices Data splits & paraphraser released: data.statmt.org/SMRT

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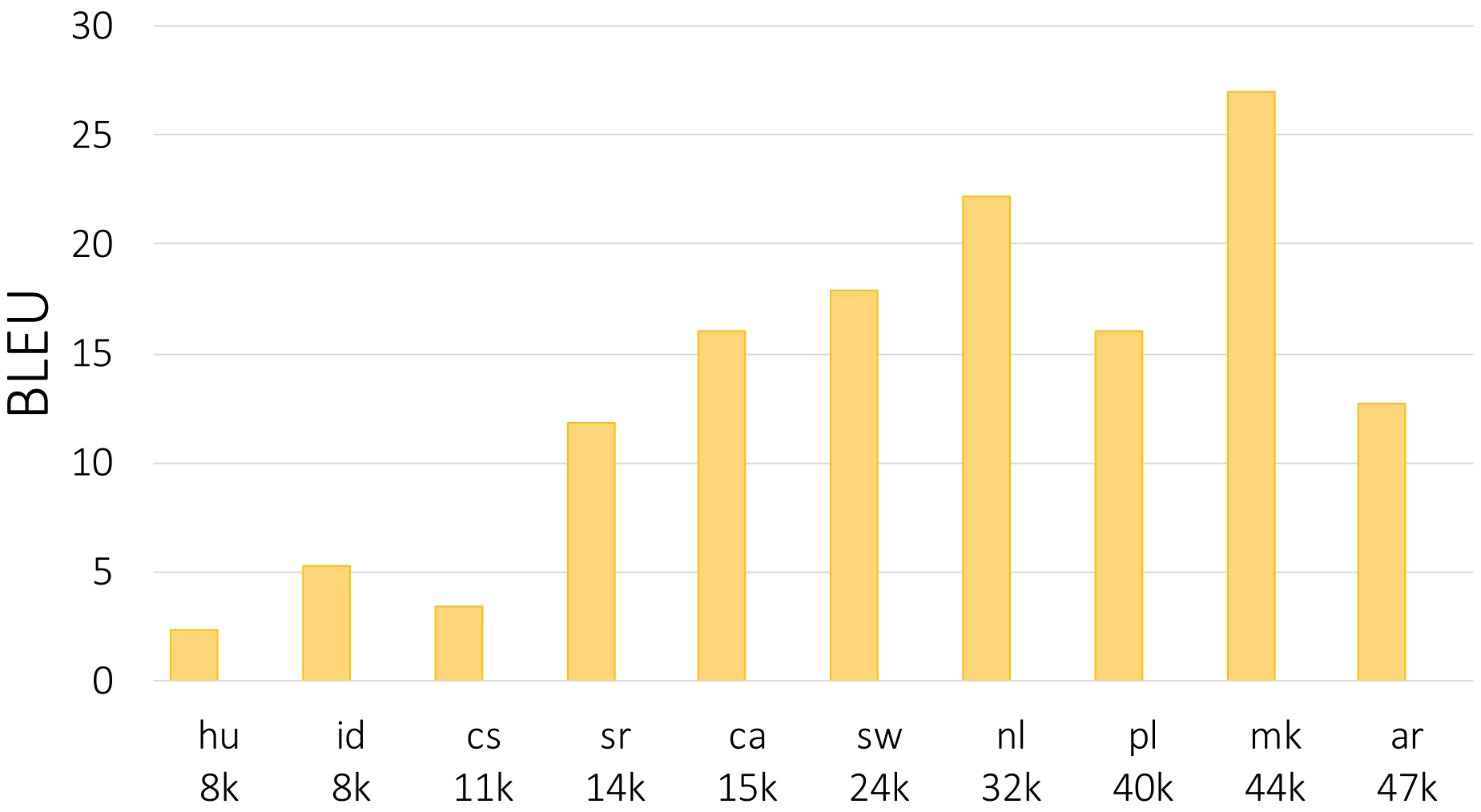
Results



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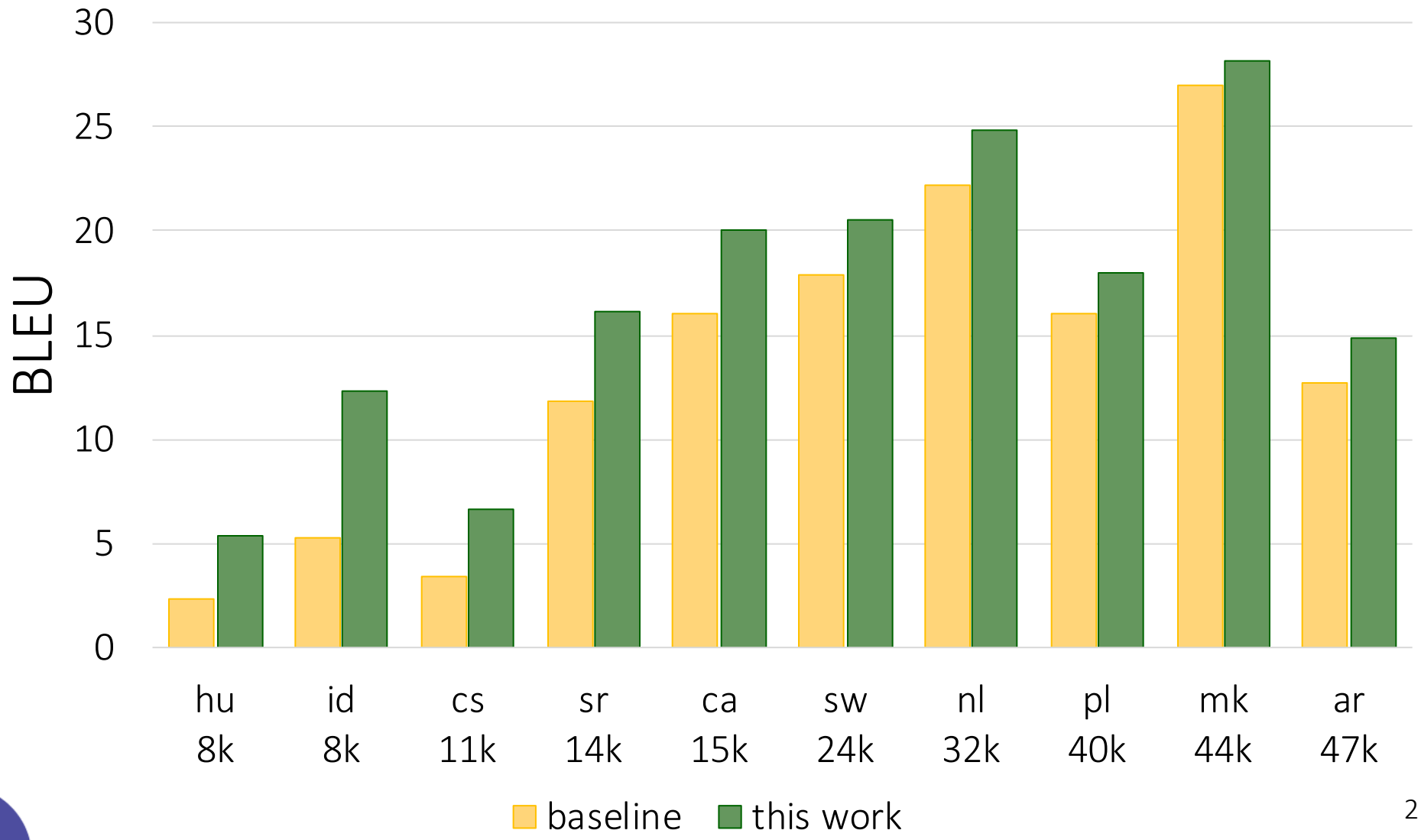
Results



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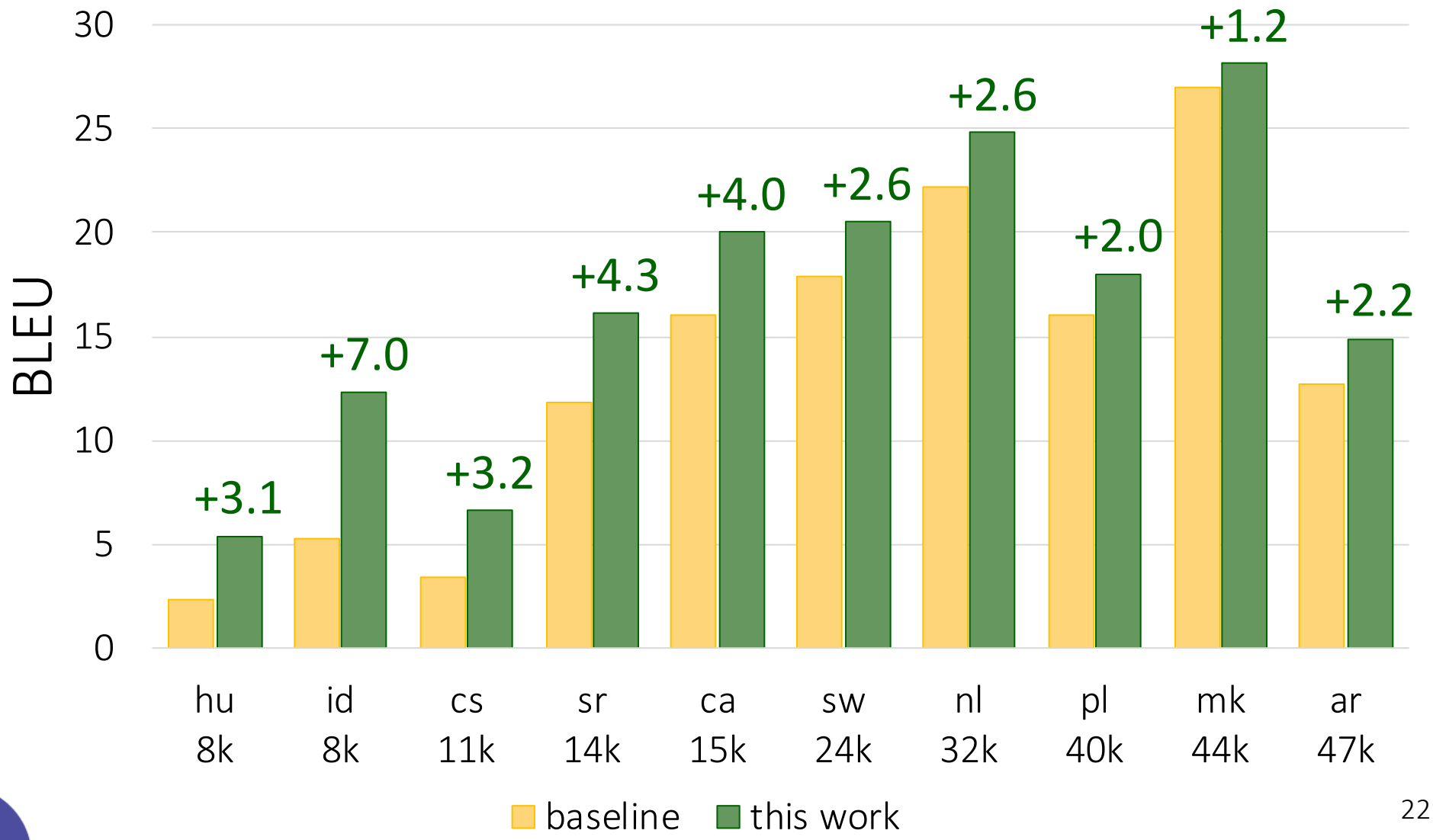
Results



But wait, there's more! (in the paper)

- Comparison to back-translation
  - Both work, SMRT is better than BT in very low resource
  - Can combine for larger improvement
- Data ablation
  - Larger improvements in lower resource settings
- Method ablation
  - Both sampling and the distribution in the loss are helpful
- Sequence-Level Paraphrastic Augmentation
  - It works; SMRT is better

But wait, there's more! (other papers)

- Thompson & Post have a new multilingual paraphraser (Prism) that works for 39 languages and is a great MT metric (@EMNLP)
- Khayrallah & Sedoc apply SMRT + Prism to Chatbots (@EMNLP findings)
- This work will be published @EMNLP

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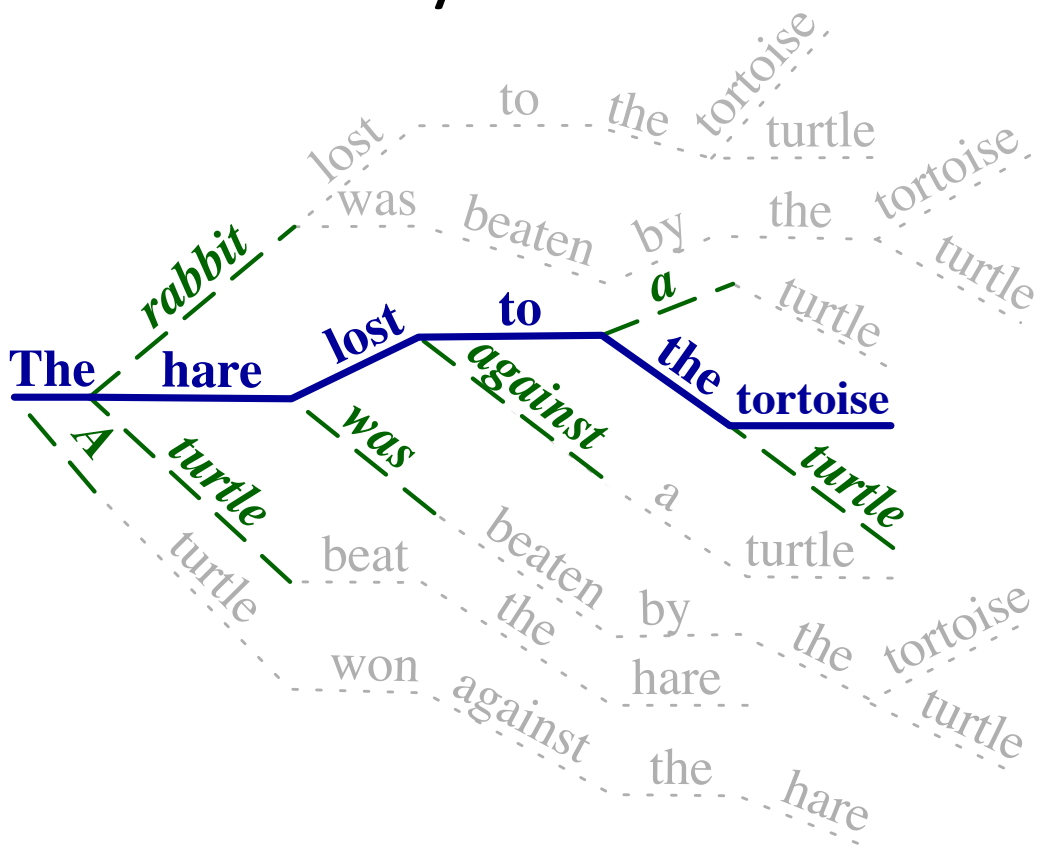
Summary



Questions? Hiring?
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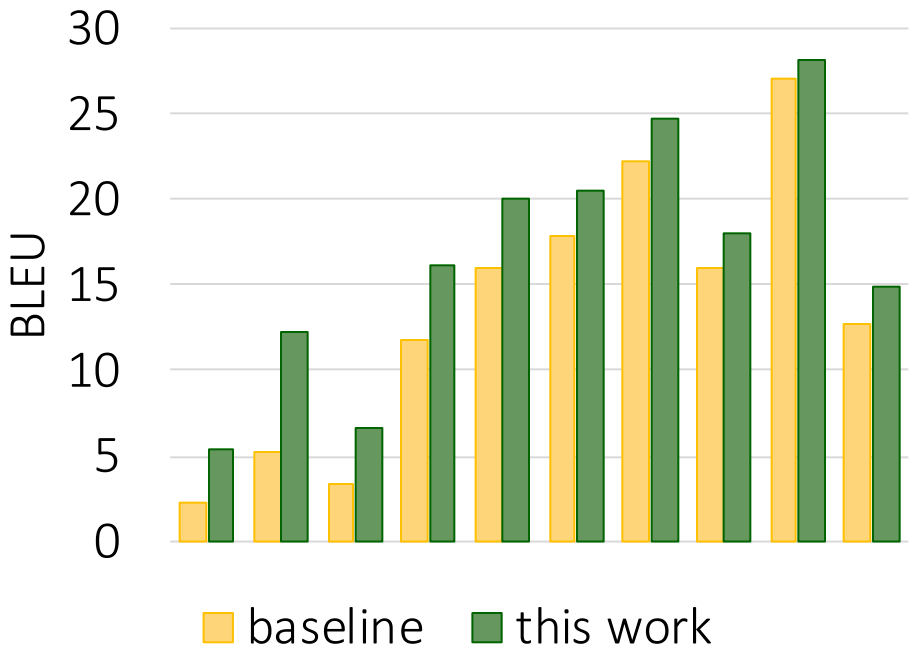

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