Predicting Machine Translation Adequacy from Document Embeddings Regression

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Introduction

Source (DE):
Auch der Aussenhandel bremste die Konjunktur.

Phrase-based MT:
The foreign trade braked the economy.

Neural MT:
External trade also slowed the economy.

Reference (EN):
Foreign goods trade had slowed, too.

- MT metric should penalize *poor lexical choice*, e.g. *braked*, and reward *semantically similar translations*, e.g. *external trade*
- We propose a *semantically grounded metric* using *Semantic Textual Similarity* (Agirre et al. 2014) regression model trained on document embeddings similarities (ZWICKEL + COMET)

Approach

Training

- Train a document embedding model

$$v(doc) = \frac{\sum_i^n v(w_i)}{n}; \quad doc = \{w_1, ..., w_n\} \quad (1)$$

- Calculate cosine similarity between *hyp* and *ref*

$$sim(hyp, ref) = v(hyp) \cdot v(ref) \quad (2)$$

- Compute the METEOR between *hyp* and *ref*
- Train a regressor where $X = \{sim(hyp_i, ref_i)\}$ and $Y = \{METEOR(hyp_i, ref_i)\}$
- N is the Gaussian prior, w and α are parameters estimated from the data.

$$p(y|X, w, \alpha) = N(y|X, w, \alpha) \quad (3)$$

Testing

- When testing, calculate $sim(hyp_{test}, ref_{test})$ and predict the METEOR score with the regressor (ZWICKEL)
- **Hack**: If METEOR scores 1.0 or 0.0 use METEOR instead of the regressor outputs to handles regression outliers (COMET)

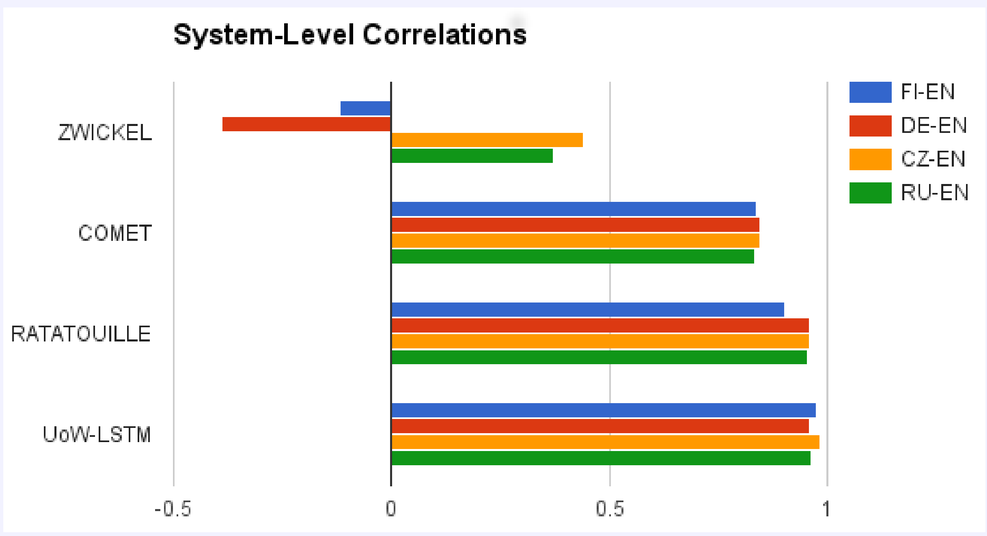
Results @ WMT15

Language pair / Averages	ZWICKEL	COMET
Finnish-English	-0.119 ± 0.037	0.836 ± 0.021
German-English	-0.389 ± 0.034	0.844 ± 0.020
Czech-English	0.441 ± 0.016	0.844 ± 0.010
Russian-English	0.371 ± 0.035	0.825 ± 0.021
Average	0.076 ± 0.031	0.819 ± 0.028
Pre-Trueskill Avg.	0.076 ± 0.031	0.837 ± 0.018
Spearman's Avg.	0.038 ± 0.076	0.718 ± 0.049

Table 1: Our System-level Correlations

Language pair / Averages	RATATOUILLE	UoW-LSTM
Finnish-English	0.902 ± 0.016	0.976 ± 0.008
German-English	0.958 ± 0.011	0.960 ± 0.010
Czech-English	0.961 ± 0.005	0.983 ± 0.003
Russian-English	0.955 ± 0.011	0.963 ± 0.009
Average	0.952 ± 0.010	0.976 ± 0.007
Pre-Trueskill Avg.	0.956 ± 0.014	0.976 ± 0.011
Spearman's Avg.	0.919 ± 0.039	0.916 ± 0.038

Table 2: Best System-level Correlations



Conclusion

- An experiment to find language independent alternatives to semantically grounded METEOR-like metrics

References

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