Reproducibility Report for Self-Supervised Quality Estimation for Machine Translation

Chahyon Ku, Daniel Cheng, Sherry Zhao, Shubhkarman Singh

MAIN TAKEAWAYS

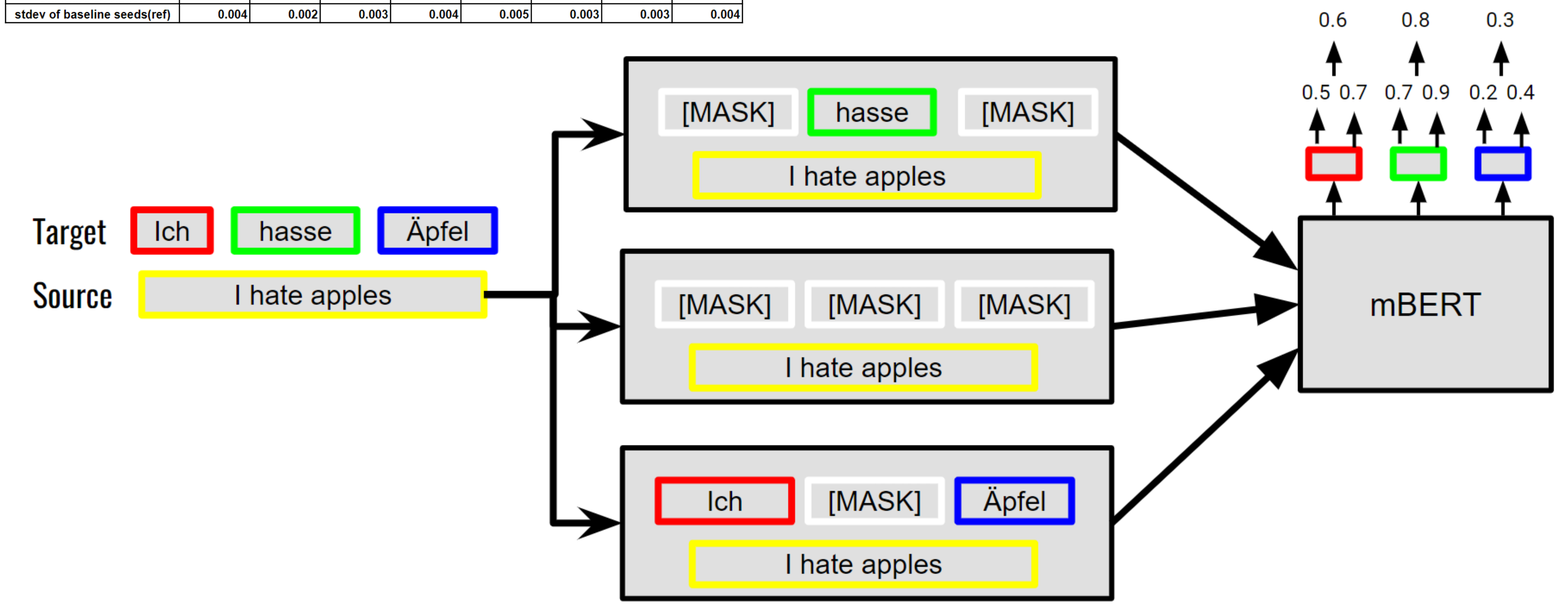
Quality estimation (QE) is the task of estimating the quality of machine translated text. While the state-of-the-art machine translation systems have achieved surprising accuracy over the past years, it is still far from perfect and often need human evaluation and post-editing to reach sufficient quality. The quality estimation task aims to **locate sentences and words that are more likely to have errors**, direct the attention of human experts to specific words or sentences, and ultimately allow human experts to fix errors more efficiently.

The authors of **Self-Supervised Quality Estimation for Machine Translation** proposes a novel self-supervised approach to solving the QE task. To specify, the authors **fine-tune cased multilingual BERT (mBERT)**, a multilingual transformer model pretrained using a masked language modelling objective, by concatenating the text of the original sentence and the translated sentence, masking out 15% of the translated sentence's words, and training on the typical masked language modeling objective, i.e. maximizing the probability of recovering the masked tokens.

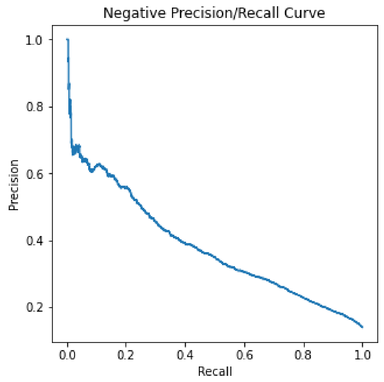
RESULTS

Models	En-De							
	Sent-Level		Word-Level					
	Dev	Test	Dev			Test		
	Pear-Cor of HTER		f1_ok	f1_bad	f1_mul	f1_ok	f1_bad	f1_mul
Paper's Single	0.504	0.463	x	x	0.381	x	x	0.383
Paper's Ensemble	0.518	0.462	x	x	0.395	x	x	0.385
SyntheticQE Baseline	0.508	0.460	x	x	0.373	x	x	0.362
Ours 1 (seed 42)	0.534	0.460	0.925	0.423	0.391	0.907	0.4	0.363
Ours 2 (seed 43)	0.541	0.460	0.921	0.414	0.381	0.904	0.397	0.358
Ours 3 (seed 44)	0.536	0.462	0.919	0.413	0.38	0.902	0.399	0.359
Ours 4 (seed 45)	0.539	0.461	0.919	0.419	0.386	0.901	0.404	0.364
Ours 5 (seed 46)	0.544	0.464	0.917	0.414	0.38	0.899	0.395	0.355
Mean	0.539	0.461	0.920	0.4166	0.3836	0.9026	0.399	0.3598
Standard Deviation	0.003962	0.001673	0.003033	0.004278	0.004827	0.003050	0.003391	0.003701
Ours Ensemble (1, 2)	0.542	0.464	0.914	0.421	0.385	0.897	0.407	0.365
Ours Ensemble (1 ~ 5)	0.546	0.468	0.899	0.413	0.371	0.881	0.413	0.364

Models	En-De							
	Sent-Level		Word-Level					
	Dev	Test	Dev			Test		
	Pear-Cor of HTER		f1_ok	f1_bad	f1_mul	f1_ok	f1_bad	f1_mul
Paper's Single	0.504	0.463	x	x	0.381	x	x	0.383
Paper's Ensemble	0.518	0.462	x	x	0.395	x	x	0.385
Ours (n = 40, m = 2)	0.525	0.439	0.921	0.406	0.374	0.902	0.396	0.357
Ours (n = 40, m = 4)	0.518	0.451	0.928	0.407	0.378	0.909	0.387	0.351
Ours (n = 40, m = 6)	0.533	0.460	0.925	0.422	0.391	0.906	0.400	0.363
Ours (n = 40, m = 8)	0.551	0.463	0.923	0.431	0.397	0.901	0.402	0.363
Ours (n = 40, m = 10)	0.544	0.487	0.923	0.435	0.402	0.905	0.417	0.378
Ours (n = 40, m = 12)	0.549	0.487	0.923	0.440	0.406	0.904	0.420	0.380
Ours (n = 40, m = 14)	0.533	0.482	0.918	0.434	0.399	0.899	0.421	0.378
Ours (n = 40, m = 16)	0.529	0.478	0.923	0.428	0.395	0.905	0.414	0.374
Ours (n = 40, m = 18)	0.523	0.475	0.911	0.430	0.392	0.893	0.425	0.379
Ours (n = 40, m = 20)	0.510	0.468	0.920	0.422	0.389	0.902	0.412	0.372
Standard Deviation	0.013	0.016	0.005	0.011	0.010	0.004	0.012	0.010
stdev of baseline seeds(ref)	0.004	0.002	0.003	0.004	0.005	0.003	0.003	0.004



EVALUATION METRICS



Label	Prediction	
	Bad	*Ok*
Bad	1114	1552
Ok	1751	14586

Negative Labels		
Precision	*Recall*	*F-Score*
38.9	41.8	40.3

Metric	Formula
Precision-OK	$\frac{TP}{TP+FP}$
Recall-OK	$\frac{TP}{TP+FN}$
Precision-BAD	$\frac{TN}{TN+FN}$
Recall-BAD	$\frac{TN}{TN+FP}$
F1-OK	Precision-OK × Recall-OK
F1-BAD	Precision-OK × Recall-OK
F1-MUL	F1-OK × F1-BAD