Word Confidence Estimation For Speech Translation
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**Introduction**

Word Confidence Estimation for machine translation or automatic speech recognition consists in judging each word in the (MT or ASR) hypothesis as correct or incorrect by tagging it with an appropriate label. In the past, this task has been treated separately in ASR or MT contexts and we propose here a joint estimation of word confidence for a spoken language translation task involving both ASR and MT. This research work is possible because we built a specific corpus which is first presented.

**A database for WCE evaluation in spoken language translation**

Starting point : an existing MT Post-editing corpus

- For a Fr-En translation task, we used our SMT system to obtain the translation hypothesis for 10,881 source sentences taken from news corpora of the WMT evaluation campaign (2006-2010).
- Post-editings were obtained from non professional translators using a crowdsourcing platform.

| Word label setting for WCE was done using TERp-A toolkit.

- From this corpus, we extract 10,000 triplets (source reference src-ref, machine translation output tgt-mt and post-edition of translation tgt-pe) for training our WCE (for MT) system and keep the remaining 881 triplets as a test set.

| Augmenting the corpus with speech recordings and transcripts

- We record the utterances of PE corpus test to augment the corpus with speech inputs.
- Each of the 881 sentences was uttered by 3 speakers, leading to 2,643 speech recordings (5h) : 15 speakers (9 women and 6 men).

| ASR system based on KALDI toolkit with a 3-gram LM trained on the French ESTER corpus and French Gigaword (vocabulary size is 55k). SGMM acoustic models are trained on the ESTER corpus.

- Post-processing was needed at the output of the ASR system in order to match requirements of standard input for machine translation.
- The output of our ASR system, scored against the src-ref reference is 26.6% WER (these news contain a lot of foreign named entities).

- Word posterior probability.
- Alignment Context : the combinations of the target (source) word and all aligned source (target) words in the window ± 2.
- Word posterior probability.
- Pseudo-reference (Google Translate) : Does the word appear in the pseudo reference or not?

**WCE for machine translation**

We employ CRFs as our machine learning method, with WAPITI toolkit, to train the WCE model. 25 major feature types :

- Target Side : target word ; bigram (trigram) backward sequences ; number of occurrences.
- Source Side : source word(s) aligned to the target word.
- Alignment Context : the combinations of the target (source) word and all aligned source (target) words in the window ± 2.
- Word posterior probability.
- Pseudo-reference (Google Translate) : Does the word appear in the pseudo reference or not?

| Obtaining labels in order to evaluate WCE for SLT :

- The ASR output (src-asr) was translated by the SMT system (tgt-slt, a degraded version of tgt-mt).
- We re-used the post-editings obtained from the text translation task (tgt-pe), to infer the quality (GB) labels of our speech translation output tgt-sl. The word label setting for WCE is done using TERp-A toolkit between tgt-sl and tgt-pe.

| Corpus available for download on github.com/besacier/WCE-SLT-LIG.

| TABLE: Example of quintuplet with associated labels

| TABLE: Overview of our post-editing corpus for SLT

| TABLE: Example of WCE label setting using TERp-A

| Evolution of the WCE scores distribution from MT features to MT+ASR features

| Summary of word confidence estimation (WCE) results obtained on our corpus with different feature sets based on ASR, MT or both. Numbers reported are F scores for Good (G) and Bad (B) labels respectively with a common decision threshold.

| Final corpus statistics and web link for download

| Word Confidence Estimation For Speech Translation

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