Disentangling ASR and MT Errors in Speech Translation
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Abstract
Investigating automatic detection of SLT errors that can be due to transcription (ASR) or to translation (MT) modules.
Using robust word confidence measures (from both ASR and MT) to disentangle ASR and MT errors in the speech translation output.

Introduction
- Context
  • Automatic quality assessment of spoken language translation (SLT), called confidence estimation (CE)
  • Pointing out correct parts and errors in a speech translated output
- Useful for
  • Interactive speech to speech translation
  • Computer-assisted translation (from speech or text)
- Claim
  • An accurate CE can also help to disentangle ASR and MT errors in the speech translation output.

Disentanglement: Subtraction between SLT and MT Errors
Motivation: differences between SLT hypothesis ($\theta_{HypSLT}$) and MT hypothesis ($\theta_{HypMT}$)

```
for each sentence $e_i \in \theta_{Hyp}$ do
  list_labels_sent = empty_list
  dev set
  list_labels_sent = empty_list
  if label($e_i$) = 'G' then
    add G to list_labels_sent
  else
    if NameOfWordAlignment($e_i$) is Insertion OR Substitution then
      add B_MT to list_labels_sent
    else
      add B_ASR to list_labels_sent
  end if
  end for
  list_labels_sent = to list_labels_result
end for
```

Example with 3-label Setting

<table>
<thead>
<tr>
<th>Task</th>
<th>$\theta_{HypSLT}$</th>
<th>$\theta_{HypMT}$</th>
<th>$\theta_{HypSLT}$</th>
<th>$\theta_{HypMT}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypothesis</td>
<td>G</td>
<td>G</td>
<td>G</td>
<td>G</td>
</tr>
<tr>
<td>Labels</td>
<td>B</td>
<td>G</td>
<td>B</td>
<td>G</td>
</tr>
<tr>
<td>SLT (Method 1)</td>
<td>G</td>
<td>G</td>
<td>B</td>
<td>G</td>
</tr>
<tr>
<td>SLT (Method 2)</td>
<td>G</td>
<td>B</td>
<td>G</td>
<td>B</td>
</tr>
<tr>
<td>SLT (Combined)</td>
<td>G</td>
<td>B</td>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>SLT (Method 3)</td>
<td>G</td>
<td>B</td>
<td>B</td>
<td>B</td>
</tr>
</tbody>
</table>

Statistics with 3-label Setting on the Whole Corpus

<table>
<thead>
<tr>
<th>Task - ASR1</th>
<th>dev set</th>
<th>$%_G$</th>
<th>$%_B_ASR$</th>
<th>$%_B_MT$</th>
</tr>
</thead>
<tbody>
<tr>
<td>label/m1</td>
<td>62.03</td>
<td>12.97</td>
<td>6.18</td>
<td>65.90</td>
</tr>
<tr>
<td>label/m2</td>
<td>62.03</td>
<td>12.97</td>
<td>6.18</td>
<td>65.90</td>
</tr>
</tbody>
</table>

Experiments on 3-class Error Detection

<table>
<thead>
<tr>
<th>Task</th>
<th>Full Corpus</th>
<th>Intersection Corpus (m1, m2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASR1</td>
<td>One-Step</td>
<td>Two-Step</td>
</tr>
<tr>
<td>F_p</td>
<td>61.79</td>
<td>83.13</td>
</tr>
<tr>
<td>F_p</td>
<td>61.79</td>
<td>83.13</td>
</tr>
</tbody>
</table>

Conclusions
- Proposed 2 methods for the non trivial label setting to disentangle ASR and MT errors in speech translation
- Recasting the binary error detection problem to 3-class labeling problem (good, asr-error, mt-error)
- Using joint ASR and MT features, automatic detection of error types was evaluated and encouraging results were displayed on a French-Spanish speech translation task
- Providing further support for building better informed speech translation systems, especially in interactive speech translation use cases