Investigating Why BLEU Penalizes Non-Statistical Systems

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Observation

- In DARPA’s GALE program, Program manager Joe Olive is worried by this fact:
  BLEU (and similar automated evaluation systems) have a tendency to penalize non-statistical MT engines unfairly as the quality goes up:
  - for better translation, the BLEU score for statistical systems more or less correlates with humans’ intuitive judgments,
  - but the BLEU score on rule-based MT systems is artificially low
Possible reasons

1. Degree of divergence from input word order:
   • ngram-based systems follow the input text word sequence rather slavishly; rule-based systems do not
   • The rearrangements (relativization, passiviation, clause reordering, etc.) may not be wrong, but may not be what the gold standard contains
   • So, the more flexible systems are penalized by BLEU

2. Generality of output formulation:
   • Human rule-writers create rules that produce somewhat general outputs to cover multiple closely-related input variations (this reduces their work), while statistical systems learn every little variation separately, in its own peculiarities
   • BLEU scores lower the more general (but not incorrect) translation against the gold-standard texts that are probably more specific, BLEU scores higher the statistical systems' outputs, which are more specific
   • But the rule-based output reads fine, and in some cases better even than the statistical output
Action

• Joe convened a meeting in May 2007
  – Liz Boschee (BBN), Marjorie Freedman (BBN), Eduard Hovy (ISI), Kevin Knight (ISI), Daniel Marcu (ISI), Mitch Marcus (UPenn), Ralph Weischedel (BBN)

• Question: Can we somehow use more-flexible (syntactic, even semantic) information to recognize correctness of less literal translations?
  – How to encode ‘equivalent’ syntactic transformations?
  – How to obtain semantic version of input?
  – What are ‘equivalent’ semantic transformations?
Decision

- BBN will use its Distillation engine to score system outputs against gold standard fragments
- Distillation engine:
  - Runs after IR has located potentially relevant text passages to answer input question
  - Purpose: identify redundancies and irrelevant fragments and produce ranked list of most-relevant fragments
- Distillation engine operation:
  - Produces parse trees and/or fragments
  - Compares them, accepting certain tree transformations
  - Includes some simple paraphrase matching

All work done by Liz Boschee, BBN
Experiment

• Data: GALE 2006 AGILE HTER texts (4762 sentences)
  – For each document: hypothesis (system output from the AGILE MT system), reference translation, HTER-reference translation (the translation generated during the HTER scoring process)
  – For each sentence: TER and HTER scores

• Matches:
  – **full match**: how well tree A instantiates into tree B
  – **subtree match**: how well the subtrees of tree A instantiate into tree B
  – **node match**: how well the nodes of tree A instantiate into tree B

• For each pair of reference and hypothesis sentences, 6 scores:
  – full match: hyp $\rightarrow$ ref and ref $\rightarrow$ hyp
  – subtree match: hyp $\rightarrow$ ref and ref $\rightarrow$ hyp
  – node match: hyp $\rightarrow$ ref and ref $\rightarrow$ hyp

• Scoring: 4 averages:
  – full match / subtree match / node match / all match average
Checking validity

• Pearson's r score for the correlation of each measure with the HTER scores:
  – full match average: -0.29
  – subtree match average: -0.47
  – node match average: -0.54
  – all match average: -0.50
  – (TER: 0.53)
  – (TER + parser proptrees: -.061)
Findings 1

HTER vs TER

HTER vs average
Findings 2

HTER vs nodes

HTER vs full tree
Next steps

• Verify statistics of significance, etc.
• What do the results show? — Draw conclusions and implications
• Define additional eval system parallel to BLEU (??)