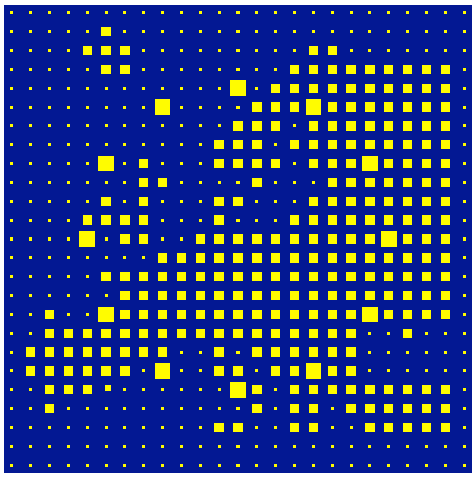
Evaluating Translation Quality



EuroMatrix

MT Marathon

Chris Callison-Burch

Evaluating MT Quality

- Why do we want to do it?
  - Want to rank systems
  - Want to evaluate incremental changes
- How not to do it
  - ``Back translation''
  - The vodka is *not* good

Evaluating Human Translation Quality

- Why?
  - Quality control
  - Decide whether to re-hire freelance translators
  - Career promotion

DLPT-CRT

- Defense Language Proficiency Test/ Constructed Response Test
- Read texts of varying difficulty, take test
- Structure of test
  - Limited responses for questions
  - Not multiple choice, not completely open
  - Test progresses in difficulty
  - Designed to assign level at which examinee fails to sustain proficiency

DLPT-CRT

- Level 1: Contains short, discrete, simple sentences. Newspaper announcements.
- Level 2: States facts with purpose of conveying information. Newswire stories.
- Level 3: Has denser syntax, convey opinions with implications. Editorial articles / opinion.
- Level 4: Often has highly specialized terminology. Professional journal articles.

Human Evaluation of Machine Translation

- One group has tried applying DLPT-CRT to machine translation
  - Translate texts using MT system
  - Have monolingual individuals take test
  - See what level they perform at
- Much more common to have human evaluators simply assign a scale directly using fluency / adequacy scales

Fluency

- 5 point scale
- 5) Flawless English
  4) Good English
  3) Non-native English
  2) Disfluent
  1) Incomprehensible

Adequacy

- This text contains how much of the information in the reference translation:
- 5) All
  4) Most
  3) Much
  2) Little
  1) None

Human Evaluation of MT v. Automatic Evaluation

- Human evaluation is
  - Ultimately what we're interested in, *but*
  - Very time consuming
  - Not re-usable
- Automatic evaluation is
  - Cheap and reusable, *but*
  - Not necessarily reliable

Goals for Automatic Evaluation

- No cost evaluation for incremental changes
- Ability to rank systems
- Ability to identify which sentences we're doing poorly on, and categorize errors
- Correlation with human judgments
- Interpretability of the score

Methodology

- Comparison against reference translations
- Intuition: closer we get to human translations, the better we're doing
- Could use WER like in speech recognition

Word Error Rate

- Levenshtein Distance (also "edit distance")
- Minimum number of insertions, substitutions, and deletions needed to transform one string into another
- Useful measure in speech recognition
  - *Shows how easy it is to recognize speech*
  - *Shows how easy it is to wreck a nice beach*

Problems with WER

- Unlike speech recognition we don't have the assumptions of
  - linearity
  - exact match against the reference
- In machine translation there can be many possible (and equally valid) ways of translating a sentence
- Also, clauses can move around, since we're not doing transcription

Solutions

- Compare against lots of test sentences
- Use multiple reference translations for each test sentence
- Look for phrase / n-gram matches, allow movement

Metrics

- Exact sentence match
- WER
- PI-WER
- Bleu
- Precision / Recall
- Meteor

Bleu

- Use multiple reference translations
- Look for n-grams that occur anywhere in the sentence
- Also has ``brevity penalty"
- Goal: Distinguish which system has better quality (correlation with human judgments)

Example Bleu

R1: It is a guide to action that ensures that the military will forever heed Party commands.
R2: It is the Guiding Principle which guarantees the military forces always being under the command of the Party.
R3: It is the practical guide for the army always to heed the directions of the party.

C1: It is to insure the troops forever hearing the activity guidebook that party direct.
C2: It is a guide to action which ensures that the military always obeys the command of the party.

Example Bleu

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R3: It is the practical guide for the army always to heed the directions of the party.

C2: It is a guide to action which ensures that the military always obeys the command of the party.

Automated evaluation

- Because **C2** has more n-grams and longer n-grams than **C1** it receives a higher score
- Bleu has been shown to correlate with human judgments of translation quality
- Bleu has been adopted by DARPA in its annual machine translation evaluation

Interpretability of the score

- How many errors are we making?
- How much better is one system compared to another?
- How useful is it?
- How much would we have to improve to be useful?

Evaluating an evaluation metric

- How well does it correlate with human judgments?
  - On a system level
  - On a per sentence level
- Data for testing correlation with human judgments of translation quality

NIST MT Evaluation

- Annual Arabic-English and Chinese-English competitions
- 10 systems
- 1000+ sentences each
- Scored by Bleu and human judgments
- Human judgments for translations produced by each system

Final thoughts on Evaluation

When writing a paper

- If you're writing a paper that claims that
  - one approach to machine translation is better than another, or that
  - some modification you've made to a system has improved translation quality
- Then you need to back up that claim
- Evaluation metrics can help, but good experimental design is also critical

Experimental Design

- Importance of separating out training / test / development sets
- Importance of standardized data sets
- Importance of standardized evaluation metric
- Error analysis
- Statistical significance tests for differences between systems

Invent your own evaluation metric

- If you think that Bleu is inadequate then invent your own automatic evaluation metric
- Can it be applied automatically?
- Does it correlate better with human judgment?
- Does it give a finer grained analysis of mistakes?

Evaluation drives MT research

- Metrics can drive the research for the topics that they evaluate
- NIST MT Eval / DARPA Sponsorship
- Bleu has lead to a focus on phrase-based translation
- Minimum error rate training
- Other metrics may similarly change the community's focus

Afternoon Exercise

- Evaluation exercise this afternoon
- Examine translations from state-of-the-art systems (in the language of your choice!)
- Manually evaluate quality!
- Perform error analysis!
- Develop ideas about how to improve SMT!