INTERACTIVE MACHINE TRANSLATION

Daniela Braun
OVERVIEW

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DEFINITION INTERACTIVE MACHINE TRANSLATION (IMT)

- Sub-field of computer-aided translation
  - computer software assists human translator and attempts to predict input by taking available information into account
  - If the prediction is wrong, user provides feedback and new prediction is performed based on new information
  - Process repeats until the translation matches users expectation

- Good method when high-quality target language texts are required → need of human to correct translation
- Few commercial software implementations, work mostly restrained to academic research
RECENT WORK

• CASMACAT
  • Funded by EU Commission
  • Aimed at developing new types of assistance to human translators
  • Integrate them into workbench consisting of editor, server, analysis and visualisation tools

• TransType

• TransType 2 (TT2)
TRANSTYPE 2

Source: Human Interaction For High-Quality Machine Translation,
By Francisco Casacuberta, Jorge Civera, Elsa Cubel, Antonio L. Lagarda, Guy Lapalme, Elliott Macklovitch, Enrique Vidal
• Represent a rework of old IMT idea
• New adaptation: human interaction focuses on drafting of the target text, rather than on disambiguation of source text
• MT engine embedded in interactive editing environment and used to generate suggested completions of each target sentence being translated
  → completions may be accepted or modified by translator
  → once validated: MT uses information to produce further improved suggestions
1. System suggests translation hypothesis

2. User accepts hypothesis OR corrects error

3. Repeat until translation is satisfactory
Source Sentence in English (s)
Click OK to close the print dialog.

Target Sentence in Spanish (t)
Haga clic en ACEPTAR para cerrar el cuadro de diálogo de impresión.

Figure 1.

<table>
<thead>
<tr>
<th></th>
<th>t_p</th>
<th>λ</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITER-0</td>
<td>t_o</td>
<td>Haga clic para cerrar el diálogo de impresión</td>
</tr>
<tr>
<td></td>
<td>t_k</td>
<td>Haga clic</td>
</tr>
<tr>
<td></td>
<td>t_p</td>
<td>Haga clic en</td>
</tr>
</tbody>
</table>

| ITER-1 | t_o | Haga clic para cerrar el diálogo de impresión |
|        | t_k | Haga clic en |

| ITER-2 | t_o | ACEPTAR para cerrar el cuadro de diálogo de impresión |
|        | t_k | ACEPTAR para cerrar el cuadro |

| FINAL  | t_o | Haga clic en ACEPTAR para cerrar el cuadro de diálogo de impresión |
|        | t_k | Haga clic en ACEPTAR para cerrar el cuadro de diálogo de impresión |

System suggestions: blue italics
User input: red boldface
Typed text by user in final line: underlined
• This type of translation formalized within statistical framework for MT translations are generated on basis of statistical and information-theoretic models (trained on analysis of bilingual text corpora)

Equation: 
\[ \hat{t} = \arg\max_{t} \Pr(t \mid s) = \arg\max_{t} \Pr(s, t). \]

• Two models proposed to approach one or the other of these probabilistic distributions of translation:
  • Statistical (word or phrase-based) alignment models (SAM) for conditional distribution
  • Stochastic finite-state transducers (SFST) for joint distribution
    both are deployed in TT2
• SFST: translation of new source sentence (as given in the equation) is carried out by searching for optimal path in weighted graph with all possible translations in it
  In case of TT2 equation should look like this: 
\[ \hat{t}_s = \arg\max_{t_s} \Pr(t_s \mid s, t_p) = \arg\max_{t_s} \Pr(s, t_p t_s). \]  
t_p : validated translation prefix
EVALUATION

• Evaluation in general difficult
• Problem: no “gold standard” to which the translation can be compared

  development of evaluation metrics:

1. **Automatic**: based on bilingual corpora, useful in providing rapid and inexpensive feedback about performance of the system during development phase

2. **Manual**: usability study – determines impact of MT or CAT system on intended end-user

• Used corpora: Xerox,

  - English as source language
  - Reference Translation (French, German, Spanish) provided by company’s language service
    - for each language pair: about 50,000 sentences
    - 1,000 sentences reserved for automatic evaluation of IMT system
AUTOMATIC EVALUATION

• Compared translation of source test sentences produced by engine with corresponding target reference sentence and then computed evaluation figures

• **Aim:** estimate effort of human translator to produce correct translation using the output of TT2 system for estimation: define ratio between number of key-strokes needed to achieve reference target sentence **AND** number of characters in reference sentence

• **Key-stroke ratio on test-corpus:**
  • 20-25% using SFST-based suffix-predictive IMT system (for language pair of English and Spanish)
  • ~45% for other language pairs
HUMAN EVALUATION

• Behaviour tested under labor-controlled working conditions
  measure overall time required to translate test corpus
  measure time it takes user to read and evaluate the systems proposed translation

• Productivity results: 5 rounds of user trials (during final 18 month of TT2 project)
  ○ First Rounds: train participants on new system and let them give feedback on user interface
  ○ Last Three Rounds: production-oriented (participants working with system for 10 consecutive half-day sessions
  ○ Each Trial Round: one dry-run session – translate chapter of test corpus without help of system

• results varied, but overall productivity increased
• near end of project: substantial productivity gains – bettered dry-run productivity around 30% using IMT SFST models
Overall suffix-predictive IMT systems like TT2 can allow translators to increase productivity while maintaining high quality
THANK YOU FOR YOUR ATTENTION