Introduction to Computational Linguistics

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How to Choose the Best MT Strategy

- If low quality translation is acceptable and if source and target language have similar syntax, then a direct translation system may be acceptable.

- If the system will only translate between two languages and good-quality translation is necessary, a transfer system is all that is needed.

- If the system will have to translate among several languages, an interlingua approach may be preferable, especially if the languages are from the same language family and have similar patterns of word meanings.

The Impossibility of FAHQMT

The Impossibility of Fully Automatic, High Quality Machine Translation (FAHQMT):

Little John was looking for his toy box. Finally he found it. The box was in the pen. John was very happy.

(Bar-Hillel 1959)

Machine Translation

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- post-processing by humans may be required

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  - choosing appropriate word for the target language from a set of candidate translations

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  - word processing support for text formatting

The History of Machine Translation (1)

1629   René Descartes proposes a universal language, with equivalent ideas in different tongues sharing one symbol.

1933   Russian Petr Smirnov-Troyanskii patents a device for transforming word-root sequences into their other-language equivalents.

1949   Warren Weaver, director of the Rockefeller Foundation's natural sciences division, drafts a memorandum for peer review outlining the prospects of machine translation (MT).

The History of Machine Translation (2)

1952 Yehoshua Bar-Hillel, MIT's first full-time MT researcher, organizes the maiden MT conference.

1954 First public demo of computer translation at Georgetown University: 49 Russian sentences are translated into English using a 250-word vocabulary and 6 grammar rules.

1960 Bar-Hillel publishes his report arguing that fully automatic and accurate translation systems are, in principle, impossible.

The History of Machine Translation (3)

1964   The National Academy of Sciences creates the Automatic Language Processing Advisory Committee (Alpac) to study MT's feasibility.

1966   Alpac publishes a report on MT concluding that years of research haven't produced useful results. The outcome is a halt in federal funding for machine translation R&D.

The History of Machine Translation (4)

1968   Peter Toma, a former Georgetown University linguist, starts one of the first MT companies, Language Automated Translation System and Electronic Communications (Latsec).

1969   In Middletown, New York, Charles Byrne and Bernard Scott found Logos to develop MT systems.

Machine Translation Systems

North America and Canada

- SYSTRAN
  - Originated from GAT (Georgetown Machine Translation project)
  - Founded in 1968 by Peter Toma, a principal member of the GAT project
  - Versions for English, German, Russian, French, Spanish, Dutch and Portugese
  - Purchased by Major Corporations and Government Agencies for further development, including General Motors, Xerox, Siemens, European Commission

Machine Translation Systems

- **TAUM-METEO**

  - TAUM: Traduction Automatique de l'Universtité de Montreal

  - Fully-automatic MT system METEO

  - Fully integrated into the Canadian Meteorological Center's (CMC) nation-wide weather communications network by 1977

  - Translates appr. 8.5 million words/year with 90-95% accuracy. Mistakes mainly due to misspelled input or unknown words

Machine Translation Systems: Europe

- EUROTRA

- Long-term MT research and development programme funded by the European Commission (1982-92)

- EUROTRA 1 - Research and development programme (EEC) for a machine translation system of advanced design, 1982-1990

- EUROTRA 2 - Specific programme (EEC) concerning the preparation of the development of an operational EUROTRA system, 1990-1992

MT Systems: EUROTRA 1

- EUROTRA 1 - Research and development programme (EEC) for a machine translation system of advanced design, 1982-1990

  - Main Goal: To create a machine translation system of advanced design capable of dealing with all (nine) official languages at the time (Danish, Dutch, English, French, German, Greek, Italian, Spanish and Portuguese) of the Community by producing an operational system prototype in a limited field and for limited categories of text, which would provide the basis for subsequent development on an industrial scale.

MT Systems: EUROTRA 2

- EUROTRA 2 - Specific programme (EEC) concerning the preparation of the development of an operational EUROTRA system, 1990-1992

    - Main Goal: To create, starting from the EUROTRA prototype, the appropriate conditions for a large-scale industrial development, including the development of methods and tools for the re-usability of lexical resources in computer applications as well as the creation of standards for lexical and terminological data.

Machine Translation Systems: GETA

- GETA (Group d' Études pour la Transduction Automatique) at the University of Grenoble, France

- MT research group with longest history in Europe, if not world-wide,

- headed by Bernard Vauquois and later by Christian Boitet

- Systems developed:
  - 1967-1971 development of CETA (Russian/French)
  - ARIANE -78

Machine Translation Systems: CETA

- CETA (Russian/French):
  - first large-scale second-generation system (first-generation systems aimed at direct translation) with finite- state morphology, augmented context-free syntactic analysis with assignment of dependency relations, procedural semantic analysis tranforming tree structures into an interlingua (pivot language), lexical transfer, syntactic generation and morphological generation

MT Systems: ARIANE-78

- ARIANE-78
  - emphasis on flexibility and modularity
  - powerful tree-transducers written in transfer-rule formalism ROBRA
  - conception of static and dynamic grammars
  - different levels and types of representation (dependency, phrase structure, logical) incorporated on single labelled tree structures and thus considerable flexibility in multilevel transfer representations

MT Systems: Verbmobil

- Verbmobil
  - A speaker-independent and bidirectional speech-to-speech translation system for spontaneous dialogs in mobile situations.
  - Recognizes spoken input, analyses and translates it, and finally utters the translation.
  - The multilingual system handles dialogs in three business-oriented domains (appointment scheduling, travel planning, remote PC maintenance) with context-sensitive translation between three languages (German, English, and Japanese).

MT Systems: Verbmobil

- Verbmobil
  - Travel planning scenario with a vocabulary of 10 000 words was used for the end-to-end evaluation of the final Verbmobil system
  - integrates a broad spectrum of corpus-based and rule-based methods
  - combines the results of machine learning from large corpora with hand-crafted knowledge sources to achieve an adequate level of robustness and accuracy