Linguistics for Language Technologies, Language Technologies for Linguistics

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Outline

1. Lx4LT
2. LT4Lx
3. Lx4LT again?
4. Conclusion

- late 1940s – late 1960s: early Machine Translation (focus on syntax),
- late 1960s – late 1970s: AI-flavoured (knowledge, semantics, inference),
- late 1970s – early 1990s: grammatico-logical tradition (unification grammar formalisms, logical representations; syntax, semantics, discourse),
- from early 1990s: revival of finite state methods, shallow and statistical approaches, applications (MT, Automatic Summarisation, Question Answering, Information Extraction, etc.).

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- Lexical-Functional Grammar (LFG): Joan Bresnan and Ronald Kaplan,
- Generalized Phrase Structure Grammar (GPSPG): Gerald Gazdar et al.,
- Head-driven Phrase Structure Grammar (HPSG): Carl Pollard and Ivan Sag,
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- Charles Fillmore, *The Case for Case*, 1968 – basis for Semantic Role Labelling, FrameNet, etc.,
- M.A.K. Halliday’s Systemic-Functional Grammar (since early 1960s) has influenced, e.g.:
  - Winograd’s MIT Block World application (late 1960s, early 1970s),
  - the design of Functional Unification Grammar (early 1980s),
  - and Sentiment Analysis (via the Appraisal Theory of mid-1990s),
- Steven Abney’s 1990s work on chunking (and shallow parsing in general).

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A lot of hidden linguistics in annotated corpora:

- morphosyntactically – for training taggers,
- syntactically – for training parsers,
- semantically – for training Word Sense Disambiguation systems, Semantic Labelling systems, etc.

Applying supervised machine learning techniques to such resources requires no linguistic knowledge, but writing annotation guidelines – and then supervising the annotation – requires considerable linguistic expertise.
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Most obvious, but also rather trivial: the use of language corpora in lexicography.
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“Peter Sokolowski, editor at large for Merriam-Webster Inc., thumbs through the index card files at the dictionary publisher’s headquarters in Springfield, Mass.” (Associated Press, 2011)
More interesting: using data mining techniques to discover linguistic facts – annotation mining.

Tibor Kiss et al., 2010, *A Logistic Regression Model of Determiner Omission in PPs*:

- why to the doctor, from the cinema, but from school, in jail, by train, etc.?
- research on German, on a corpus annotated with parts of speech, preposition senses, etc.,
- result – a multicausal phenomenon:
  - the sense of the preposition,
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Another example – valence acquisition:

I went to Warsaw. HLT Days 2012 was great.

1. Partition the data into sentential clauses.
2. Identify verbs and argument phrases in each clause.
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- linguistic: collection of evidence,
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**Practically always two stages:**
- *linguistic*: collection of evidence,
- *statistical*: deciding which evidence is reliable.
1. Partition the data into sentential clauses.
2. Identify verbs and argument phrases in each clause.
3. Filter attested verb-argument(s) combinations based on their statistical distribution.
4. Record each remaining verb-argument(s) combination as a valence frame for the verb.

Noise produced by:

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Practically always two stages:
- **linguistic**: collection of evidence,
- **statistical**: deciding which evidence is reliable.
New fascinating area: **unsupervised learning of linguistic information**.


- **input**: raw (unannotated) natural language text data,
- **output**: a description of the morphological structure of the language of the input text,
- **with**: as little supervision (parameters, thresholds, model selection during development, etc.), as possible.

Results so far: not practically usable or theoretically exciting, but promising.

There is also ongoing research on unsupervised learning of higher linguistic levels, e.g.:

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Lx4LT again?  

Kenneth Church, *A Pendulum Swung Too Far*, LiLT 2011:

Statistical papers at ACL meetings.
Kenneth Church about late 1980s and now:

_In addition to everything else that was going on at the time, we wanted to make room for a little work of a different kind... It is nice to see the field come together as it has, but we may have been too successful. Not only have we succeeded in making room for what we were interested in, but now there is no longer much room for anything else._
Kenneth Church’s view on the history of NLP:
- 1950s: Empiricism (Shannon, Skinner, Firth, Harris),
- 1970s: Rationalism (Chomsky, Minsky),
- 1990s: Empiricism (IBM Speech Group, AT&T Bell Labs),
- 2010s: A Return to Rationalism?
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Some indicators of this trend:

- increasing linguistic knowledge injected into the best Machine Translation systems
- recognised need for more prosody in speech systems – but they require the understanding of the information structure,
- Watson uses a large coverage grammar of English (and still Requires Deeper NLP) – Włodek Zadrożny today,
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(With apologies for this shameless plug.)
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Main points:

- 1980s: very close cooperation between Lx and LT,
- mainly in the area of parsing,
- later: perceived abandonment of Lx by LT,
- but actually Lx continues to influence LT,
- currently: more and more usefulness of LT for Lx,
- beginning of another rationalist turn.

Exciting times ahead for more fruitful and bi-directional cooperation between Language Technologies and Linguistics in sight!
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Thank you for your attention!