COMPUTATIONAL LINGUISTICS

9

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9. Supertagging

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Based upon slides by Michael Auli, Rober Hass and Aravind Joshi

Why supertag?

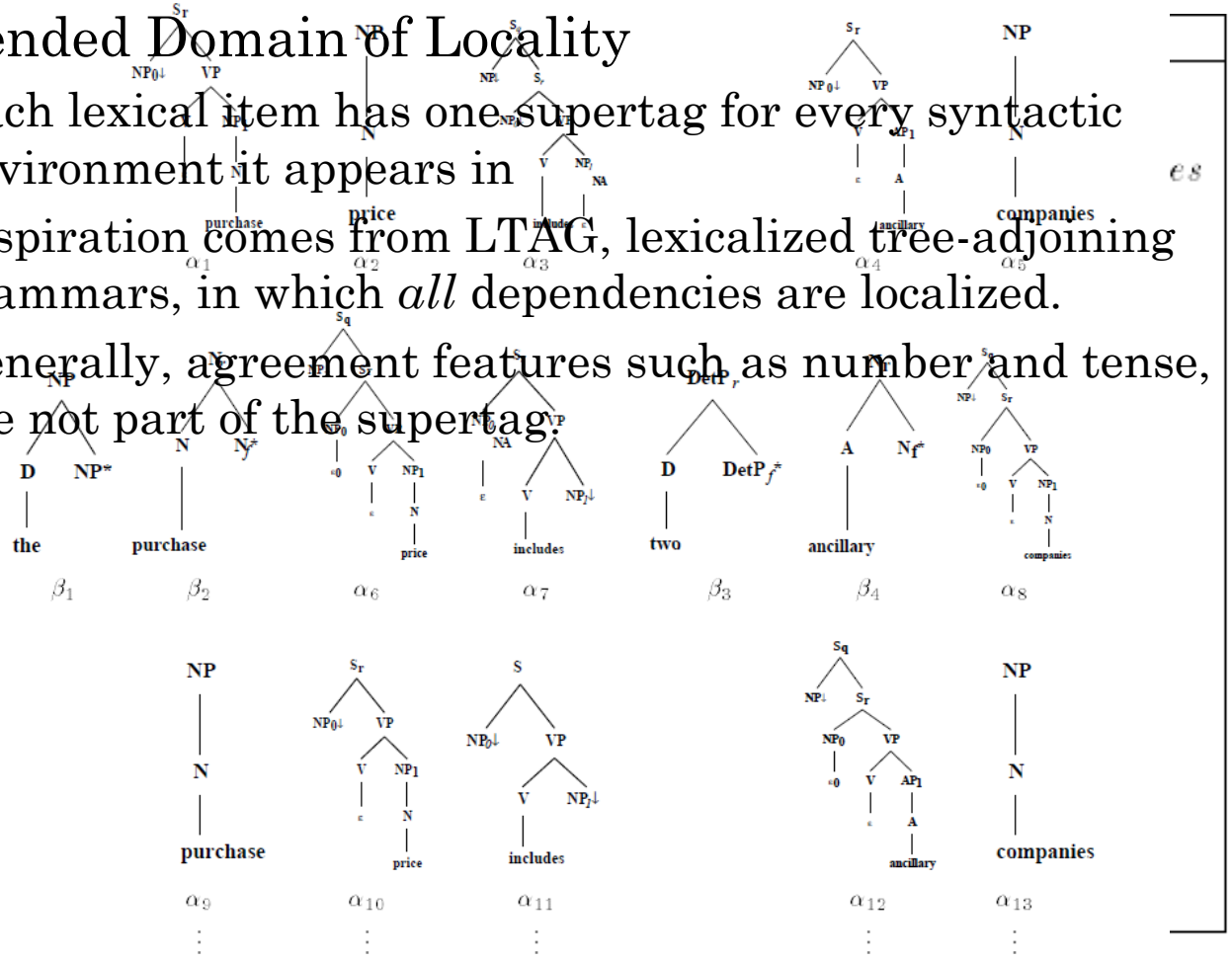
- If lexical items have more description associated with them, parsing is easier
  - Only useful if the supertag space is not huge
- Straightforward to compile parse from accurate supertagging
  - But impossible if there are any supertag errors
    - We can account for *some* supertag errors
    - Don't always want a full parse anyway

What is supertagging?

- Systematic assignment of supertags
- Supertags are:
  - Statistically selected
    - Robust
    - Tends to work
  - Linguistically motivated
    - This makes sense

What is supertagging?

- Many supertags for each word
  - Extended Domain of Locality
    - Each lexical item has one supertag for every syntactic environment it appears in
    - Inspiration comes from LTAG, lexicalized tree-adjoining grammars, in which *all* dependencies are localized.
    - Generally, agreement features such as number and tense, are not part of the supertag.



How to supertag

"Alice opened her eyes and saw."

- Supertags:
  - Verb
    - Transitive verb
    - Intransitive verb
    - Infinitive verb
    - …
  - Noun
    - Noun phrase (subject)
    - Nominal predicative
    - Nominal modifier
    - Nominal predicative subject extraction
    - …

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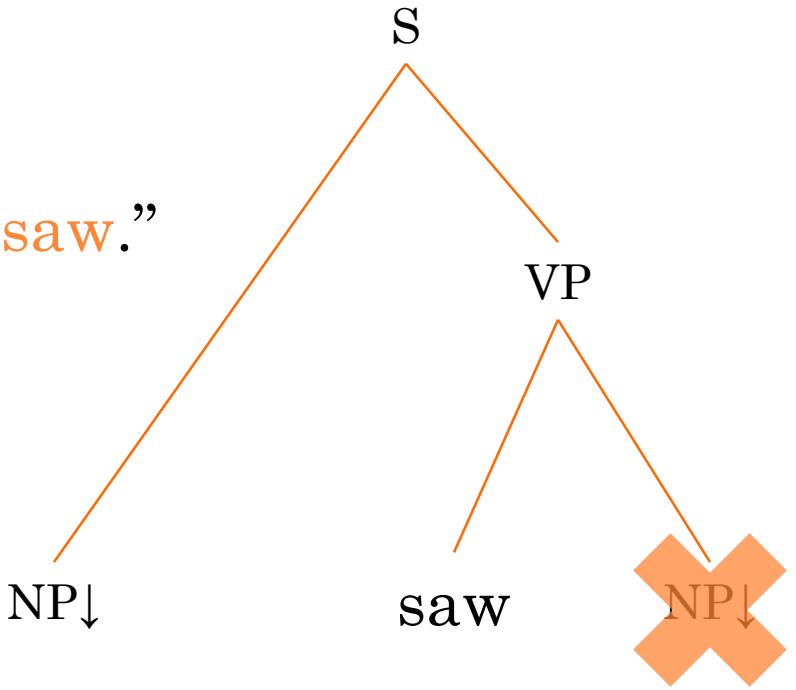

How to supertag

- A supertag can be ruled out for a given word in a given input string…
  - Left and/or right context is too long/short for the input
  - If the supertag contains other terminals not found in the input

How to supertag

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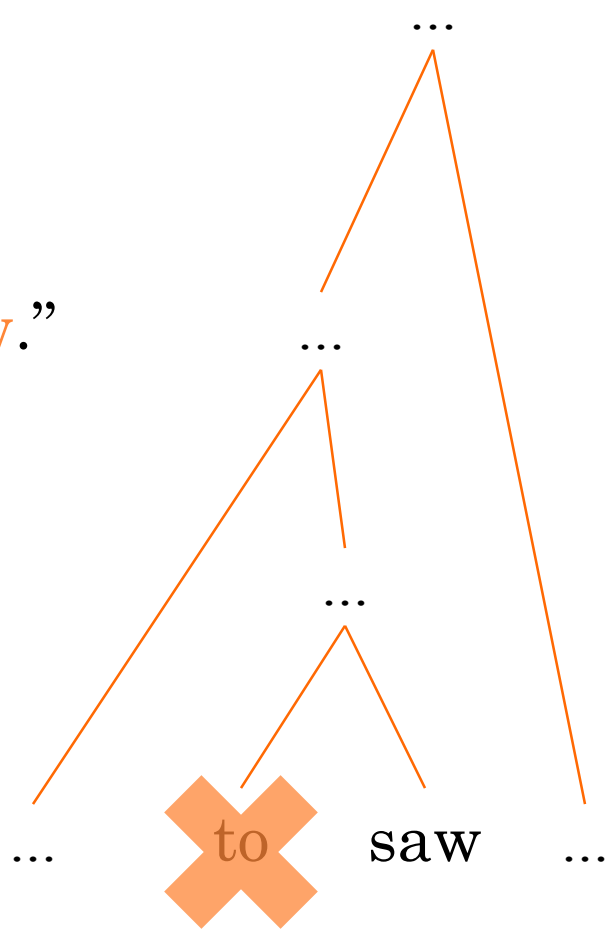
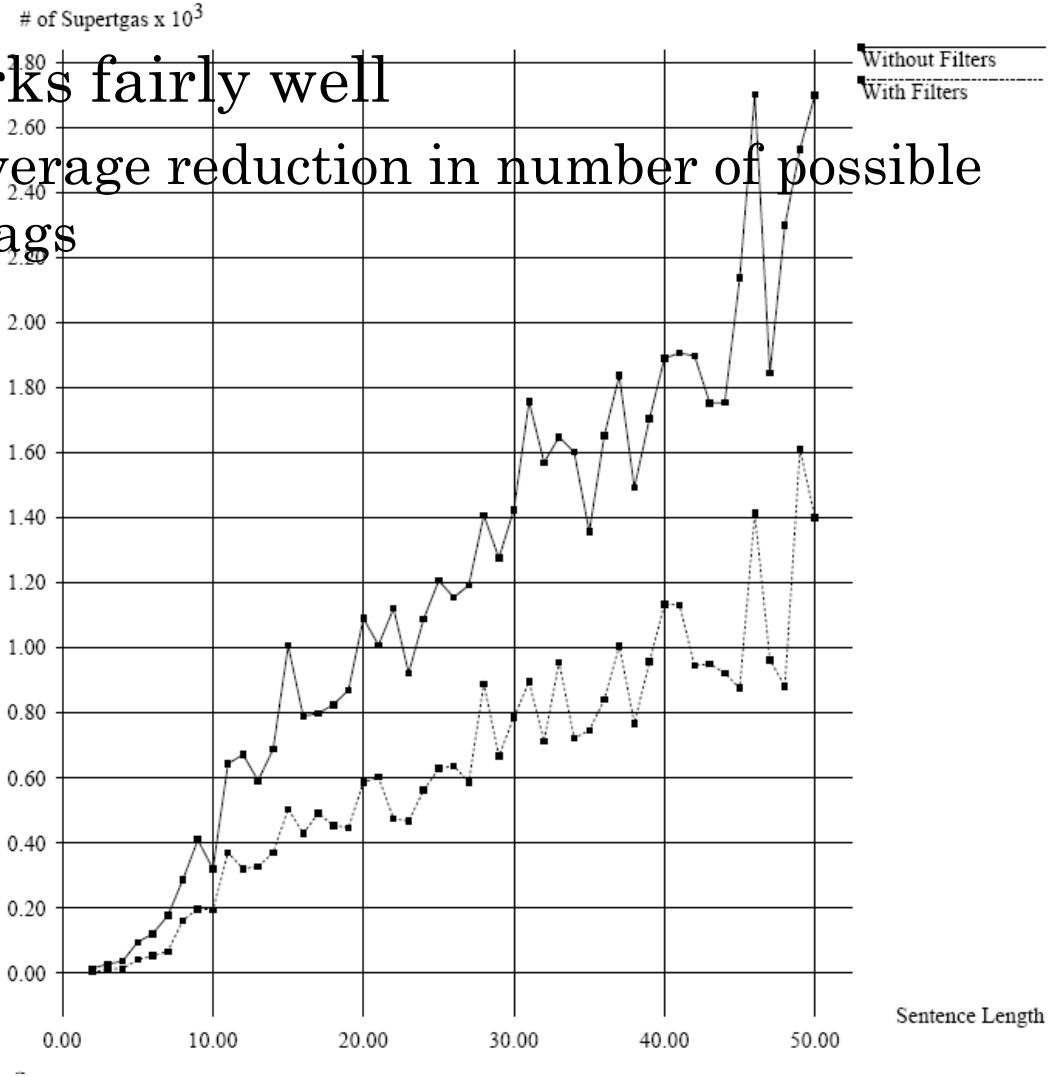


How to supertag

- This works fairly well
  - 50% average reduction in number of possible supertags



How to supertag

- …but there's more to be done
  - Good: average number of possible supertags per word reduced from 47 to 25
  - Bad: average of 25 possible supertags per word

How to supertag

- Disambiguation by unigrams?
  - Give each word its most frequent supertag after PoS tagging
    - ~75% accurate
      - Better results than one might expect given large number of possible supertags
      - Common words (determiners, etc.) usually correct
        - This helps accuracy
      - Back off to PoS for unknown words
        - Also usually correct

How to supertag

- Disambiguation by n-grams?

$$T = \underset{T}{\operatorname{argmax}} \Pr(T_1, T_2, \ldots, T_N) * \Pr(W_1, W_2, \ldots, W_N | T_1, T_2, \ldots, T_N)$$

  - We assume that subsequent words are independent

$$\Pr(W_1, W_2, \ldots, W_N | T_1, T_2, \ldots, T_N) \approx \prod_{i=1}^{N} \Pr(W_i | T_i)$$

  - Trigrams plus Good-Turing smoothing
    - Accuracy around 90%
      - Versus 75% from unigrams
    - Contextual information more important than lexical
      - Reversal of trend for PoS tagging

However…

- Correctly supertagged text yields a 30X parsing speedup
  - But even one mistake can cause parsing to fail completely
    - This is rather likely
- Solution: n-best supertags?
  - When n=3, we get up to 96% accuracy…
    - Not bad at all for such a simple method
    - 425 lexical categories (PTB-CFG: ~50)
    - 12 combinatory rules (PTB-CFG: > 500,000)