NLP

Introduction to NLP

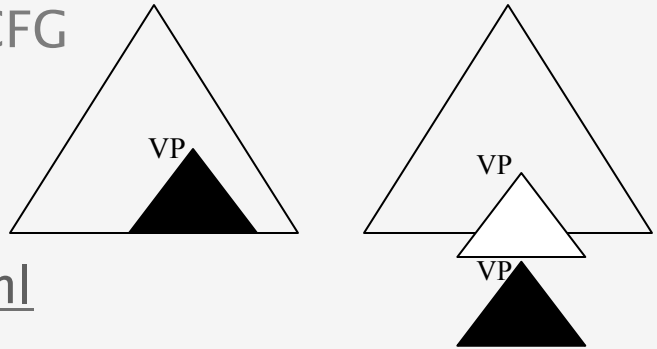
Alternative Syntactic Formalisms

Mildly Context-Sensitive Grammars

- Tree Substitution Grammar (TSG)
  - Terminals generate entire tree fragments
  - TSG and CFG are formally equivalent
- Tree Adjoining Grammar (TAG)
- Combinatory Categorial Grammar (CCG)

Tree Adjoining Grammar (TAG)

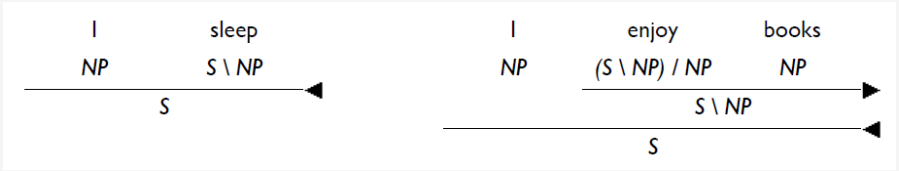
- Like TSG but allow adjunction
- It can generate languages like $a^n b^n c^n$ or ww (cross-serial dependencies):
  - e.g., Mary gave a book and a magazine to Chen and Mike, respectively.
- Expressive power
  - TAG is formally more powerful than CFG
  - TAG is less powerful than CSG
- Card game online!
  - http://www.ltaggame.com/
  - http://www.ltaggame.com/family.html



Combinatory Categorial Grammar (CCG)

- Complex types
  - E.g., X/Y and $X\backslash Y$
  - These take an argument of type Y and return an object of type X.
  - X/Y – means that Y should appear on the right
  - X\Y – means that Y should appear on the left
- Expressive power
  - CCGs can generate the language $a^n b^n c^n d^n$, $n>0$

I	NP
books	NP
sleep	S \ NP
enjoy	(S \ NP) / NP



Example from Jonathan Kummerfeld, Aleka Blackwell, and Patrick Littell

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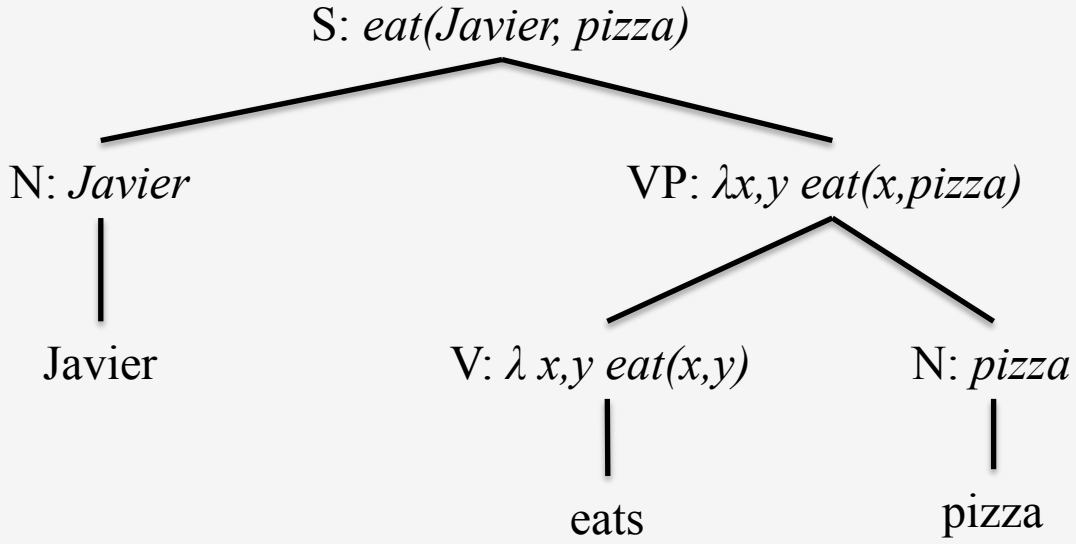
Semantic parsing

Semantic Parsing

- Associate a semantic expression with each node



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NACLO problems on parsing

External Links

- Twodee (by Jason Eisner)
  - http://nacloweb.org/resources/problems/2013/N2013-H.pdf
- One, Two, Tree (by Noah Smith, Kevin Gimbel, and Jason Eisner)
  - http://www.nacloweb.org/resources/problems/2012/N2012-R.pdf
- CCG (by Jonathan Kummerfeld, Aleka Blackwell, and Patrick Littell)
  - http://www.nacloweb.org/resources/problems/2014/N2014-O.pdf
- Combining categories in Tok Pisin (same authors)
  - http://www.nacloweb.org/resources/problems/2014/N2014-P.pdf
- Grammar Rules (Andrea Schalley and Pat Littell)
  - http://www.nacloweb.org/resources/problems/2013/N2013-F.pdf
- Sk8 Parser (Pat Littell)
  - http://www.nacloweb.org/resources/problems/2009/N2009-G.pdf

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