LING 388: Language and Computers

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Lecture 10
Administrivia

• Homework 4 is out today
  – due next Wednesday by midnight
  – email Ben Martin (bamartin@email.arizona.edu)
  – one PDF file please (grammar and screenshots)
Computing parse trees

- **original DCG**
  - `sentence` --> `np, vp`.
  - `vp` --> `verb, np`.
  - `verb` --> `[took]`.
  - `np` --> `det, [man]`.
  - `det` --> `[the]`.

- **revised DCG**
  - `sentence(s(NP, VP))` --> `np(NP), vp(VP)`.
  - `vp(vp(V, NP))` --> `verb(V), np(NP)`.
  - `verb(v(took))` --> `[took]`.
  - `np(np(D, man))` --> `det(D), [man]`.
  - `det(det(the))` --> `[the]`.

Arity = 2

```
?- sentence(List,[]). true/false
```

Arity = 3

```
?- sentence(Parse,List,[]).
Parse = ...
true/false
```

[the, man, took, the, book]
Exercise 1

• Idiom chunks
  – *kicked the bucket*

    – has both a literal meaning

    – and is also a VP (verb phrase) idiom

    – meaning:
      – *died*
Exercise 1

• let's take the file grammar.pl from lecture 9
• add new rule
  – “kicked the bucket” is a VP idiom meaning “died”
  – vp(vp(v(died))) --> [kicked, the, bucket].
  – example illustrates the ability to return any parse we like for a given rule

• query
  – what are the possible parses for “the man kicked the bucket”?
  – ?- sentence(Parse, [the, man, kicked, the, bucket], []).
  – Parse = s(np(det(the), man), vp(v(died))) ? ;
  – false
  – computes idiomatic meaning only
Exercise 2

• add new rules
  – for “kicked” and “bucket” as a verb and noun, respectively
  – verb(v(kicked)) --> [kicked].
  – np(np(D,bucket)) --> det(D), [bucket].
  – provides the ability to return the literal parse for “kicked the bucket”
Exercise 2

• query
  – what are the possible parses for “the man kicked the bucket”?
  – ?- sentence(Parse,[the,man,kicked,the,bucket],[[]]).
  – Parse =
    s(np(det(the),man),vp(v(kicked),np(det(the),bucket))) ? ;
  – Parse = s(np(det(the),man),vp(v(died))) ? ;
  – false

  – both idiomatic and literal meanings are now possible

  – Which one comes first?
  – Which one is preferred?
A Note on Encoding Idioms

• Our ability to handle the idiom **neatly** depends on the fact that the idiom is a constituent
  – this means we can encode it in just **one** rule

• **Example:**
  – “**kicked the bucket**” is a VP idiom meaning “died”
  – \( \text{vp(vp(v(died)))} \rightarrow [\text{kicked, the, bucket}] \).
  – **very common**... V + Object(s)
  – **jump the gun**
  – **walk the plank**
  – **turn the other cheek**

• **Asymmetry:**
  – Subject+V idioms are practically non-existent
  – *The vultures appear to be circling* NP [Linguist List, Vol-4-43]
Homework 4

• Recursion type 1:
  – we can stack adjectives...
  – the bus
  – the big bus
  – the big red bus
  – the shiny big red bus
  – (cf. the big shiny red bus)


  – adjective modifies noun
  – adjective can modify already modified noun
  – and so on...

• Recursive rule:
  – right recursive rule
  – nn --> a, nn.
Homework 4

• Recursion type 2:
  – some verbs can select for clauses (and NPs): e.g. notice
    • I noticed the big red bus
    • I noticed that John noticed the big red bus
    • I noticed that John noticed that Mary noticed the big red bus
    • ...
    • \([_S \text{I noticed }[_{SBAR \text{ that } [_S \text{John noticed }[_{SBAR \text{ that } [_S \text{Mary noticed the big red bus}]},]]}]\]
[S I noticed [SBAR that [S John noticed [SBAR that [S Mary noticed the big red bus]]]]]

Parse

(ROOT
  (S
    (NP (PRP I))
    (VP (VBD noticed))
    (SBAR (IN that)
      (S
        (NP (NNP John))
        (VP (VBD noticed))
        (SBAR (IN that)
          (S
            (NP (NNP Mary))
            (VP (VBD noticed)
              (NP (DT the) (JJ big) (JJ red) (NN bus))))))))

Stanford parser output

implies rules:
• VP $\rightarrow$ VBD SBAR
• SBAR $\rightarrow$ IN S
Homework 4

• Implement a grammar that can parse examples of both types of recursion and output a parse tree
• Submit your grammar
• Submit example runs
  \((including\ at\ least\ the\ examples\ on\ the\ previous\ page)\)
• **Remember:**
  – put everything in one PDF file