Ling/CSE 472: Introduction to Computational Linguistics

6/1/15

Representing Meaning

Overview

- Return midterms
- Variation in semantic representations
- Ambiguity/vagueness
- Cross-linguistic semantic analysis
- Discourse structure/semantics of paragraphs
- Other reading questions

Reading question

- When introducing analyzing time, it mentions that "Not surprisingly, there are a large number of schemes for representing this kind of temporal information. The one presented here is a fairly simple one that stays within the FOPC framework of reified events that we have been pursuing." Because of this I wonder how many different systems are there for doing semantic analysis? It is largely standardized across the field which one is used, or is there a lot of variation? It seems that different languages and purposes of the programs could benefit from variations compared to using any one system - can certain portions be modified while the overall structure remains a standardized approach? It seems this could be very possible with the logical combinations used to combine disjoint parts.

Comparative Computational Semantics Workshop Berlin, November 2014

- http://moin.delph-in.net/WeSearch/Ccs

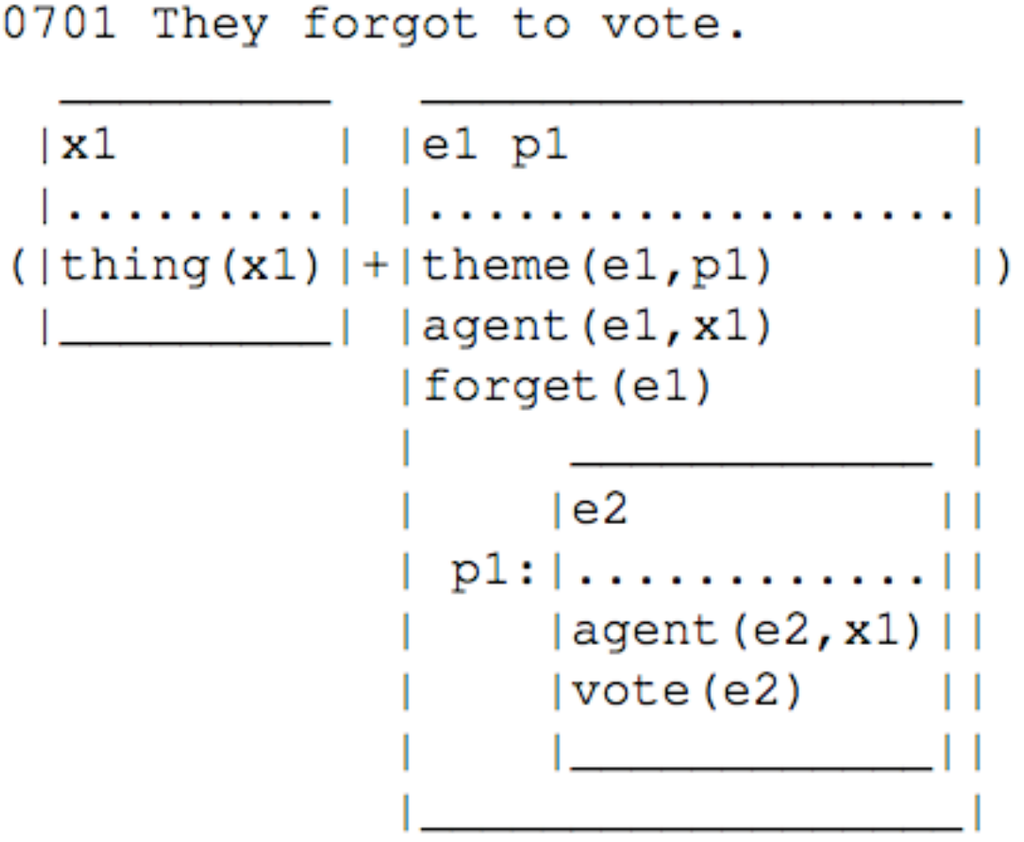
- “the goal is to discuss specific semantic analyses for a range of individual phenomena. to facilitate comparison across frameworks, we will provide a selection of exemplars and invite participants to (a) sketch (or compute) salient properties of what they consider the semantics of the phenomena in question; and (b) look over our characterization of the phenomena and ERG semantic fingerprints, to give critical feedback.” (From the invitation to the workshop)

Sample representations

AMR:

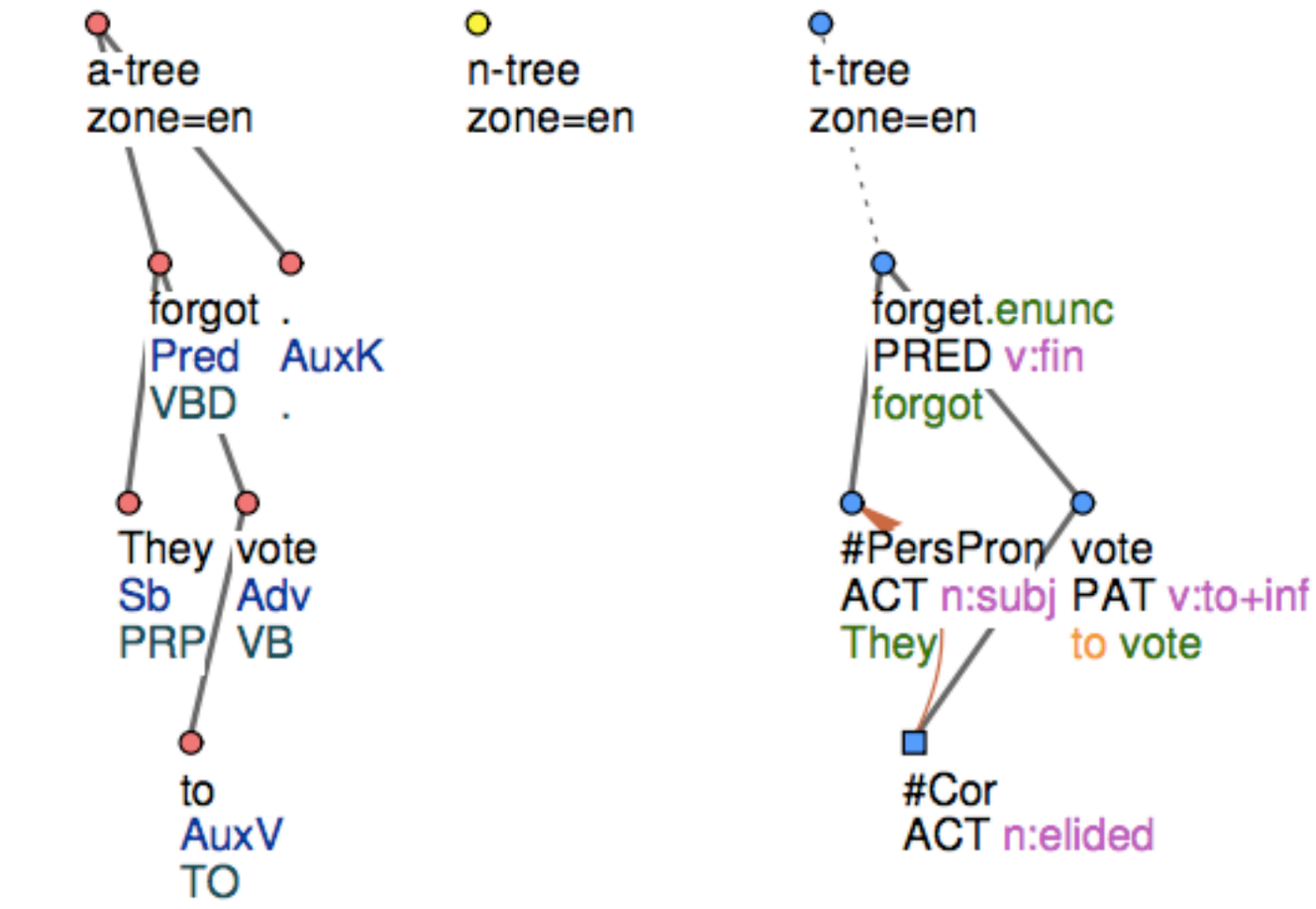
```
They forgot to vote.

(f / forget-01
      :ARG0 (t / they)
      :ARG1 (v / vote-01
            :ARG0 t))
```

Boxer DRS



Sample Representations

Prague FGD:



[en] They forgot to vote.

Sample Representations

ERS:

$\langle h_1,$
h_4:pron(ARG0 x_5),
h_6:pronoun_q(ARG0 x_5, RSTR h_7, BODY h_8),
h_2:_forget_v_1(ARG0 e_3, ARG1 x_5, ARG2 h_9),
h_{10}:_vote_v_1(ARG0 e_{11}, ARG1 x_5)
$\{ h_9 =_q h_{10}, h_7 =_q h_4, h_1 =_q h_2 \} \rangle$

[701] *They forgot to vote.*

XFR:

```
context_head(ctx(vote_16_101),vote_16_101)
context_head(t,forget_6_101)
in_context(ctx(vote_16_101),role(hier(sb,[['E',root]]),vote_16_101,they_1_101))
in_context(t,cardinality(they_1_101,pl))
in_context(t,past(forget_6_101))
in_context(t,role(hier(comp,[['Topic','T',root]]),forget_6_101,ctx(vote_16_101))
in_context(t,role(hier(sb,[['E',root]]),forget_6_101,they_1_101))
likely_pronoun_form(they_1_101,they)
veridicality(ctx(vote_16_101),n)
veridicality(t,p)

'They forgot to vote.'
```

Reading question

- How do semantic analyzers handle homonyms? Do they always return multiple possibilities or do some use probabilistic and/or contextual information? For example, the sentence "I read books" can have either the simple past interpretation or the habitual present interpretation, but the difference cannot be seen in the text.

Discussion

- Is “I read books” vague or ambiguous?
- How should ambiguity/vagueness be handled?
- ERG demo

Reading questions

- How well does semantic analysis work cross linguistically? A lot of the structures seem like they would vary a lot across languages.

- Are computational semantic systems typically effective cross-linguistically, or do they need to be extensively rewritten to work well on different languages?

- I'm not really understanding the rule-to-rule hypothesis, specifically what rule to what rule? Does it mean from grammar rules of the syntactic structure to the semantic meaning?

Discussion

- What is different across languages in terms of semantics?
- What is the same?
- Are interlinguas possible?

Example: Grammar Matrix semantic compositionality principle

```
basic-binary-phrase := phrase &
  [ SYNSEM.LOCAL.CONT [ RELS [ LIST #first,
                               LAST #last ],
                        HCONS [ LIST #scfirst,
                                LAST #sclast ],
                        ICONS [ LIST #icfirst,
                                LAST #iclast ] ],
    C-CONT [ RELS [ LIST #middle2,
                    LAST #last ],
             HCONS [ LIST #scmiddle2,
                     LAST #sclast ],
           ICONS [ LIST #icmiddle2,
                     LAST #iclast ] ],
  ARGS < sign & [ SYNSEM.LOCAL local &
                        [ CONT [ RELS [ LIST #first,
                                        LAST #middle1 ],
                                 HCONS [ LIST #scfirst,
                                         LAST #scmiddle1 ],
                                 ICONS [ LIST #icfirst,
                                         LAST #icmiddle1 ] ] ] ],
     sign & [ SYNSEM.LOCAL local &
                        [ CONT [ RELS [ LIST #middle1,
                                        LAST #middle2 ],
                                 HCONS [ LIST #scmiddle1,
                                         LAST #scmiddle2 ],
                                 ICONS [ LIST #icmiddle1,
                                         LAST #icmiddle2 ] ] ] ] > ].
```

Example: Grammar Matrix head-complement structures

```
basic-head-1st-comp-phrase := basic-head-comp-phrase &
  [ SYNSEM.LOCAL.CAT.VAL.COMPS #comps,
    HEAD-DTR.SYNSEM.LOCAL.CAT.VAL.COMPS < #synsem . #comps >,
    NON-HEAD-DTR.SYNSEM #synsem ].


transitive-lex-item := basic-two-arg-no-hcons & basic-icons-lex-item &
  [ ARG-ST < [ LOCAL.CONT.HOOK [ INDEX ref-ind & #ind1,
                                 ICONS-KEY.IARG1 #clause ] ],
             [ LOCAL.CONT.HOOK [ INDEX ref-ind & #ind2,
                                 ICONS-KEY.IARG1 #clause ] ] >,
    SYNSEM [ LKEYS.KEYREL [ ARG1 #ind1,
                            ARG2 #ind2 ],
             LOCAL.CONT.HOOK.CLAUSE-KEY #clause ] ].
```

But: There are still differences!

---

na-ka yuri-lul mek-ul swu-ka iss-usi-ta.
na-ka yuri-lul mek-ul swu-ka iss-usi-ta
I-NM glass-AC eat-PRS way-NM exist-SH-DC
"I can eat glass" [kor]

Reading question

- It seems like the chapters focused mostly on small phrases and sentences. How does computational semantics extend to larger structures like paragraphs?

Discourse-level semantics

- Coreference-resolution: Which phrases refer to the same entities?
- Coherence: Do these sentence together form a coherent discourse?
- Rhetorical structure: What are the relationships between sentences?

Discourse processing example

Having revised our semantic attachment for the subject noun phrase portion of our example, let's move to the S and VP and Verb rules to see how they need to change to accommodate these revisions.

Let's start with the S rule and work our way down. Since the meaning of the subject NP is now a lambda expression, it makes sense to consider it as a functor to be called with the meaning of the VP as its argument. The following attachment accomplishes this: (Jurafsky & Martin 2008:589)

Rhetorical relations: ANNODIS_rr

What "Rhetorical Relations" have been annotated?

The relations linking DUs (EDUs or CDUs) are a set of 17 relations that were chosen because they more or less common to all the theories of discourse mentioned above, or correspond to well-defined subgroups in fine-grained theories. The intermediate level of granularity was chosen as a compromise between informativeness and reliability of the annotation process. It corresponds to the level chosen in the PDTB, and a coarse-grained RST.

Rhetorical Relation
alternation
attribution
background
comment
continuation
contrast
entity-elaboration (e-elab)
elaboration
explanation
flashback
frame
goal
meta-relation
narration
parralel
result
temploc

http://redac.univ-tlse2.fr/corpus/annodis/annodis_rr_en.html

Rhetorical relations: ANNODIS_rr (Muller et al 2012)

Overview of the ANNODIS_rr : annotated corpus with rhetorical relations

Corpus	EDU	Rhetorical relations	CDU
NEWS (Est Républicain, 39 news, 9,768 words)	1,159	1,203	510
WIKI (Wikipédia, 42 extracts of articles, 15,922 words)	2,002	2,099	867
LING (CMLF08, 2 extracts of articles, 630 words)	12	14	9
GEOP (IFRI, 3 extracts of a same report, 1,340 words)	15	19	9

Reading questions

- Is semantic analysis more easily dealt with when we constrain the domain of a language application, and are there any systems that do this? For example, limiting scope to just medical literature about one condition, or just financial-news headlines from newspapers.

- Can syntactic structures with semantic attachments be used to recognize or create humor, particularly in the form of puns and similar word play?

- What is the current state of semantic analysis? Are there any systems set up for inferring the user's intent in addition to the surface meaning of their statements?

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