Graph Methods for Multilingual FrameNets

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TextGraphs
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Overview

The FrameNet lexical database as a set of graphs

FrameNet annotation as graphs

Syntactico-semantic annotation graphs of parallel sentences

Graph methods and Conclusions
The Multilingual FrameNet Project

- **Goals:**
  - Organize and align existing FrameNet-like projects in 8-10 languages
  - Provide a multilingual language resource to NLP research, language teachers, etc.
  - Improve access to and understanding of FrameNet data from all languages (both lexicon and annotated texts)

- **Research questions:**
  - What data structures are appropriate for the new resource?
  - How “universal” are semantic frames? What are implications for MT, cross-linguistic IE & IR, etc.?
  - How can graph methods help us achieve these goals? We hope to receive suggestions from the TextGraph community
Frames, Frame elements, Lemmas and Lexical units

- Frames and Frame Elements (FEs)
  - Judgement: Cognizer, Evaluatee, Reason, etc.
  - Placing: Agent, Theme, Goal, etc.
  - Take place of: New, Old, Role, Time, etc.

  Everyone ADIMIRES her for working so hard.
  I HANG my clothes in the wardrobe.
  By 1803 cotton REPLACED wool as Britain’s leading export.

- Frames and Lexical Units (LUs)
  - Judgement: admire.v, contempt.n, stigmatize.v, reverence.n
  - Placing: place.v., drape.v, cram.v, file.v
  - Take place of: replace.v, replacement.n, take place of.v

- 1,223 frames, 10,542 FEs (9.7/frame), 13,634 LUs (12.5/frame), 202,229 annotation sets
Frames, Frame elements, Lemmas and Lexical units as a graph
Frames, Frame elements, Lemmas and Lexical units as a graph
Frames, Frame elements, Lemmas and Lexical units as a graph
Frame relations

- Inheritance
- Perspective on (full example)
- Subframe and Precedes
- Others
  - Using
  - Causative of, Inchoative of
  - Metaphor
  - "See also"

All frame relations are accompanied by relations between corresponding frame element across the frames.
“Perspective on” frame relations

Note that reality is more complex; Quitting and Firing are not the same kind of event, there are many ways employment can end: resigning under pressure, retirement, etc.
Frame Grapher

Current Frame:
Employment_scenario
Graph of FrameNet semantic types (partial)
Dr Farmery blames the Department of Health for causing undue alarm, but that claim’s rejected by the Helpline set up to address public concern.
Annotation of a sentence as a graph (1)
everyone admires her for working so hard

NP
S
Judgement
Ext Cognizer
Dep Reason
Obj Evaluatee
VPing
Sem Head
Agent
Manner
Goal
DNI
AVP
T

1 NP
1 NP
1 T

workingsohard
Grammatical Function, Phrase Type, and Other layers

- Construction Grammar is presupposed in FN syntactic analysis, but not fully explicit in the annotation.
- Grammatical functions (GFs)
  - "External"
  - "Obj"
  - "Dep"
  - Modified head
- Phrase types (PTs)
  - NP, VPto, AdjP, etc.
- "Other" layer
  - Relativizer and Antecedent
We will be looking at (a clause from) a sentence from a TED talk by Ken Robinson: “Do Schools Kill Creativity?”:

*The thing they were good at at school was not valued or was actually stigmatized.*
The FrameNet lexical database as a set of graphs

Syntactic (constituency) tree of sentence

The thing they were good at school wasn't valued or was actually stigmatized.
Syntactico-semantic graph of English sentence
学校は
学校は
gakkou wa
学校-TOPIC
彼らの
彼らの
karera no
their
才能を
才能を
sainou o
talent-ACC
評価し
評価し
hyoukashi-
value
ない
ない
-nai
not
どころか
どころか
dokoroka
instead
ダメ
ダメ
dame
unacceptable
と
と
to
烙印を
烙印を
rakuin o
brand-ACC
押し
押し
oshi-
press
てしまう
てしまう
-te shimau
"end up"
NP:
NP:
EXPERTISE
[2] N
Protagonist
彼らの
彼らの
karena no
their
Obj
Evalume
Skill
T

VP:
VP:
JUDGEMENT
JUDGEMENT
LABELING
LABELING
+Conjunction
+Conjunction

AUX:
AUX:
NEGATION
NEGATION

Head
Head

Speaker
Entity
Label
T

Sem Head
Sem Head

Marker

Cognizer

Negated_p

Aux

AdjP:
AdjP:
DESIRABILITY
DESIRABILITY

Stem:
Stem:
DESIRABILITY
DESIRABILITY

Sem Head
Sem Head

Cop

Ext
Ext

Head
Head

Negated_p

Aux

AUX

VP:
VP:
LABELING
LABELING
+Aux
+Aux

Sem Head
Sem Head

VP:
VP:
LABELING
LABELING

Supp

Sem Head

Supp

Sem Head

Negated_p

Aux

AUX

VP:
VP:
LABELING
LABELING

Supp

Sem Head

Supp

Sem Head

Negated_p

Aux

AUX

VP:
VP:
LABELING
LABELING

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Negated_p

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AUX

VP:
VP:
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LABELING

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Sem Head

Negated_p

Aux

AUX

VP:
VP:
LABELING
LABELING

Supp

Sem Head

Supp

Sem Head

Negated_p

Aux

AUX
Semantics-only graph of English sentence
Frame shifts in translation

We examined frames in two different semantic domains, in two documents with different styles of translation:

- Sherlock Holmes, *The Hound of the Baskervilles* (professional, “literary” translation)– Motion events
- TED, “Do Schools Kill Creativity?” (volunteer, “literal” translation)– Motion and Communication events

<table>
<thead>
<tr>
<th>Source</th>
<th>Langs</th>
<th>Domain</th>
<th>Same</th>
<th>Partial</th>
<th>Diff.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hound</td>
<td>EN–ES</td>
<td>Motion</td>
<td>33</td>
<td>3</td>
<td>23</td>
<td>59</td>
</tr>
<tr>
<td>TED</td>
<td>EN–BrPT</td>
<td>Motion</td>
<td>38</td>
<td>4</td>
<td>22</td>
<td>64</td>
</tr>
<tr>
<td>TED</td>
<td>EN–BrPT</td>
<td>Commun.</td>
<td>47</td>
<td>11</td>
<td>7</td>
<td>65</td>
</tr>
</tbody>
</table>
Frame Shifts in the Communication Domain

he turned to her mother and said, ‘Mrs. Lynne,…’

She said, “She did.”

I mean, he was seven at some point.

<table>
<thead>
<tr>
<th>English</th>
<th>Portuguese</th>
</tr>
</thead>
<tbody>
<tr>
<td>he turned to her mother and said, ‘Mrs. Lynne,…’</td>
<td>ele se virou para a mãe e disse: ‘Sra. Lynne,…’</td>
</tr>
<tr>
<td>I said, ’What happened?’</td>
<td>Eu perguntei: ’O que aconteceu?’</td>
</tr>
<tr>
<td>She said, “She did.”</td>
<td>Ela respondeu: Ela levou.</td>
</tr>
<tr>
<td>I mean, he was seven at some point.</td>
<td>Quero dizer, ele algum dia teve sete anos.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FrameNet Annotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statement.speak</td>
</tr>
<tr>
<td>Statement.dizer</td>
</tr>
<tr>
<td>Questioning.perguntar</td>
</tr>
<tr>
<td>Communication_response.responder</td>
</tr>
<tr>
<td>Linguistic_meaning.mean</td>
</tr>
<tr>
<td>Statement.dizer</td>
</tr>
</tbody>
</table>
Uses of Graph methods with Frame Semantic Annotation and Parsing

- Visualize of complex relations, including cross-lingual relations
- Query with graph expressions (e.g. using Neo4j DB)
- Express constraints as graph unification ($\approx$ Construction grammar)
- Summarize valences (Kernel Dependency Graphs, cf. Fillmore & Sato 2002)
Conclusions

- The current XML format is too close to the DB structure, less than optimal for both humans and machines.
- A more perspicuous representation would help collaboration in Multilingual FrameNet and NLP research more generally.
- Graphs can serve this purpose.
- We welcome your suggestions about how we can make better use of graph representations!
Acknowledgements

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- Thank you!
- Questions?
- [http://framenet.icsi.berkeley.edu](http://framenet.icsi.berkeley.edu)
Semantics-only graph of parallel Japanese sentence