The Necessity of Parsing for Predicate Argument Recognition

Daniel Gildea and Martha Palmer

Introduction

- Work has shifted from complex, rule-based systems to simpler finite-state and statistically based systems.
- Attention has been given to labeling corpora with semantic roles, such as in FrameNet and Propbank.
- Even for a single predicate, semantic arguments often have multiple syntactic realizations.
- In (Gildea and Jurfafski, 2002) and (Miller et al., 1998), both describe systems for which there are no gold-standard parses available.
- Because the Propbank labels data from the Penn Treebank, gold-standard parses are available for the Propbank.
- This paper compares performance of a system using gold-standard parses, with that of a system using automatic parser output.

Purpose

- Quantify the effect of parser accuracy on system performance in the task of semantic role identification.
- Examine whether a flatter, “chunked” representation can be as effective as a full parse.

Semantic Role Labeling

\[
\begin{align*}
[A_0 \text{He}] & [\text{AM-MOD} \text{ would }] [\text{AM-NEG} \text{ n't }] [V \text{ accept }] \\
[A_1 \text{ anything of value }] & \text{ from } [A_2 \text{ those he was writing about}].
\end{align*}
\]

V: verb
A0: acceptor
A1: thing accepted
A2: accepted-from
A3: attribute
AM-MOD: modal
AM-NEG: negation

The Data

FrameNet
- Project at International Computer Science Institute
- Annotation is performed on the British National Corpus.
- Labels verbs, nouns and adjectives
- Focuses on semantic "frames," annotation is done by frame
- A frame is a schematic representation of a situation. Annotators define the frame, then its "frame elements."
- Frame elements take on known conceptual roles.

Propbank
- Project at University of Pennsylvania
- Annotation is performed on the Penn Treebank.
- Only addresses verbs.
- Can be thought of as "FrameNet without the Frames," annotation is done on a per-predicate basis
- Predicates are used. Arguments are labeled according to their position.
- Arguments are numbered. Similar verbs may share role sets.

FrameNet
- Frame elements have conceptual roles.
- Arguments are numbered.

Propbank
- Arguments are labeled according to their position.
- Similar verbs may share role sets.

The Model

P(r|pt, path, position, voice, hw, p)
- Phrase Type
- Parse Tree Path
- Position
- Voice
- Head Word


The Experiments

- The first experiment provided the system with arguments, the system merely had to label them. The following configurations were compared:
  - Propbank with:
    - Gold-standard parses
    - Automatic parses
    - Gold-standard parses, for which more than 10 examples were available
    - Automatic parses, for which more than 10 examples were available
  - FrameNet with automatic parses
- The second experiment was the same as the first, but the system also had to also find the arguments in this one.
- The first experiment was repeated with the path feature removed, using gold-standard Propbank parses.
- Two modifications of the path feature were tried
  - “Collapsed” paths
  - Two values: “NP under S” and “NP under VP”
- Experiments one and two were repeated using gold-standard chunks instead of parsing.

The Results

<table>
<thead>
<tr>
<th>Arguments Provided</th>
<th>Accuracy</th>
<th>Find Arguments and Roles</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold-standard parses</td>
<td>92.5</td>
<td>84.1</td>
<td></td>
</tr>
<tr>
<td>Automatic parses</td>
<td>82.0</td>
<td>76.2</td>
<td>88.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Arguments Provided, Chunking Results</th>
<th>Find Arguments and Roles, Chunking Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Path</td>
<td>Gold parse</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
</tr>
<tr>
<td>gold parse</td>
<td>82.3</td>
</tr>
<tr>
<td>auto parse</td>
<td>76.2</td>
</tr>
<tr>
<td>not used</td>
<td>gold parse</td>
</tr>
<tr>
<td>not used</td>
<td>chunks</td>
</tr>
</tbody>
</table>

Conclusions

- Other finite-state systems may do better than the chunking system in this experiment.
- By using a gold-standard chunking representation, better results have been achieved than could be expected from an automatic chunking system.
- Statistical parsers do a good job of providing information for this task. This information includes not only structure but also head words.
- Improvements in parsers will equate to improved performance on this task.