

Robust Sub-Graph Generation for Abstract Meaning Representation Parsing

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Abstract

The Abstract Meaning Representation (AMR) is a representation for open-domain rich semantics. Generating semantic sub-graphs from contiguous tokens is a crucial part of AMR parsing. We propose a small set of actions to *construct* a sub-graph at test time from a span of tokens, which allow us to greatly expand our generalization from training data. We show that our set of construction actions is a good approximation which we can learn with a simple classifier. This reduces the need for sparse dictionary lookups, which improves generalization on unknown words and allows us to exploit statistical efficiency on a small training set. We demonstrate that our approach improves on published state-of-the-art AMR parsing, from 0.58 smatch to 0.64 smatch on the LDC2013E117 dataset.

1 Introduction

The Abstract Meaning Representation (AMR) (Banarescu et al., 2013) is a rich semantic formalism that attempts to capture many useful pieces of semantic information in a single joint representation. These include (but are not limited to) named entity recognition, semantic role labeling, word sense disambiguation, and coreference. The AMR sembanking effort promises to produce a breakthrough resource in broad domain semantic parsing, for both its size and the AMR formalism’s expressive richness. As of this writing AMR has one published parser, JAMR (Flanigan et al., 2014), which reported very promising results. After experimentation with several different structured prediction algorithms, we find that JAMR’s architecture is a very strong framework for further parser development, and present an improvement to the JAMR parser’s concept identification stage.

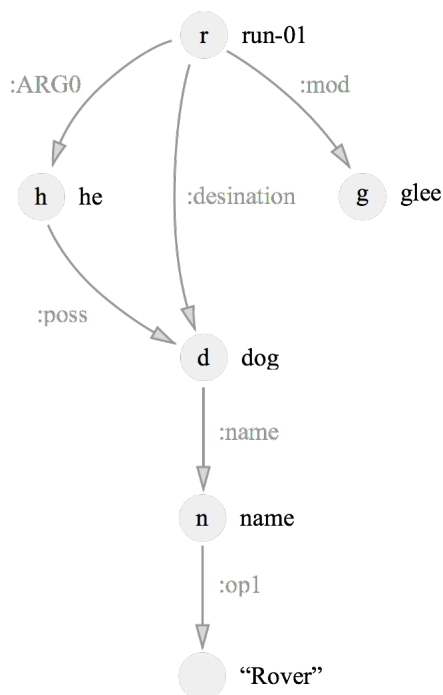


Figure 1: “He gleefully ran to his dog Rover”

2 A Crash-Course in AMR

AMR is a semantic formalism that represents meaning as a directed graph, where nodes represent concepts and arcs are relationships between concepts. AMR makes no effort to have a one-to-one correspondence between nodes in a graph and tokens in a source sentence, and so is not a “semantic dependency” representation. In fact, AMR will often expand single tokens into large sub-graph elements, or ignore tokens completely.

To introduce AMR and its notation, we’ll unpack the translation of the sentence “he gleefully ran to his dog Rover”. We show in Figure 1 the interpretation of this sentence as an AMR graph. Note that the root node of the graph is labeled “run-01”, which is the name of a frame drawn from PropBank [citation needed] for the sense of the verb “ran” in this sentence. “run-01” has an

outgoing “ARG0” arc to a node “he”, with semantics drawn from the PropBank frame for “run-01” having its ARG0 *be the object* “he”. The “run-01” has an outgoing “mod” to “glee,” which has the catch-all semantics that “run-01” is somehow modified by the concept “glee.” “run-01” also has a “destination” arc to “dog,” which draws its semantics from Vivek Srikumar’s thesis chapter on preposition sense tagging [citation needed]. Then we have a section of the graph that is best interpreted as a unit, where all of the children of “dog” effectively mean that “dog” has the name “Rover.”

AMR has a specification for writing these potentially cyclic, decidedly non-tree graphs cleanly in text. It works as follows: follow a breadth first traversal of the graph from the root. When you encounter nodes you haven’t seen before, write them with a coreference tag and a slash, as in

```
(h / he)
```

When you encounter nodes you’ve already written down somewhere else in the written representation, simply write down its coreference tag

```
(h)
```

to refer back to the original node unambiguously.

The entire sentence parse for “he gleefully ran to his dog Rover” can be written in text form as follows:

```
(r / run-01
  :ARG0 (h / he)
  :mod (g / gleeful)
    :destination (d / dog
      :poss-of h)
      :name (n / name
        :opl "Rover"))
```

Note the coreference back to the (h / he) from the arc :poss-of out of (d / dog).

3 Methods

AMR training data is in the form of bi-text, where we are given a $\langle \text{sentence}, \text{graph} \rangle$ pair, with no explicit alignments between them.

We’ll use a running example of a sentence and its corresponding AMR parse throughout this paper, to motivate our method.

DICTIONARY VERB IDENTITY LEMMA NONE

The sailor walked quickly over to admiral Nelson with his dog.

3.1 Electronically-available resources

We strongly prefer that you prepare your PDF files using L^AT_EX with the official ACL 2015 style file (acl2015.sty) and bibliography style (acl.bst). These files are available at <http://acl2015.org>. You will also find the document you are currently reading (acl2015.pdf) and its L^AT_EX source code (acl2015.tex) on this website.

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It is of utmost importance to specify the **A4 format** (21 cm x 29.7 cm) when formatting the paper. When working with dvips, for instance, one should specify `-t a4`. Or using the command `\special{papersize=210mm,297mm}`

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For reasons of uniformity, Adobe's **Times Roman** font should be used. In $\text{\LaTeX}2\text{e}$ this is accomplished by putting

```
\usepackage{times}
\usepackage{latexsym}
```

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Center the title, author's name(s) and affiliation(s) across both columns. Do not use footnotes for affiliations. Do not include the paper ID number assigned during the submission process. Use the two-column format only when you begin the abstract.

Type of Text	Font Size	Style
paper title	15 pt	bold
author names	12 pt	bold
author affiliation	12 pt	
the word "Abstract"	12 pt	bold
section titles	12 pt	bold
document text	11 pt	
captions	11 pt	
abstract text	10 pt	
bibliography	10 pt	
footnotes	9 pt	

Table 1: Font guide.

Title: Place the title centered at the top of the first page, in a 15-point bold font. (For a complete guide to font sizes and styles, see Table 1) Long titles should be typed on two lines without a blank line intervening. Approximately, put the title at 2.5 cm from the top of the page, followed by a blank line, then the author's names(s), and the affiliation on the following line. Do not use only initials for given names (middle initials are allowed). Do not format surnames in all capitals (e.g., use "Schlangen" not "SCHLANGEN"). Do not format title and section headings in all capitals as well except for proper names (such as "BLEU") that are conventionally in all capitals. The affiliation should contain the author's complete address, and if possible, an electronic mail address. Start the body of the first page 7.5 cm from the top of the page.

The title, author names and addresses should be completely identical to those entered to the electronical paper submission website in order to maintain the consistency of author information among all publications of the conference. If they are different, the publication chairs may resolve the difference without consulting with you; so it is in your own interest to double-check that the information is consistent.

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Text: Begin typing the main body of the text immediately after the abstract, observing the two-column format as shown in the present document. Do not include page numbers.

Indent when starting a new paragraph. Use 11 points for text and subsection headings, 12 points for section headings and 15 points for the title.

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Headings: Type and label section and subsection headings in the style shown on the present document. Use numbered sections (Arabic numerals) in order to facilitate cross references. Number subsections with the section number and the subsection number separated by a dot, in Arabic numerals. Do not number subsubsections.

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“(Gusfield, 1997) showed that ...”

you use

“Gusfield (1997) showed that ...”

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As reviewing will be double-blind, the submitted version of the papers should not include the authors' names and affiliations. Furthermore, self-references that reveal the author's identity, e.g.,

“We previously showed (Gusfield, 1997) ...”

should be avoided. Instead, use citations such as

“Gusfield (1997) previously showed ...”

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References: Gather the full set of references together under the heading **References**; place the

section before any Appendices, unless they contain references. Arrange the references alphabetically by first author, rather than by order of occurrence in the text. Provide as complete a citation as possible, using a consistent format, such as the one for *Computational Linguistics* or the one in the *Publication Manual of the American Psychological Association* (American Psychological Association, 1983). Use of full names for authors rather than initials is preferred. A list of abbreviations for common computer science journals can be found in the *ACM Computing Reviews* (Association for Computing Machinery, 1983).

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¹This is how a footnote should appear.

²Note the line separating the footnotes from the text.

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Long papers may consist of up to 8 pages of content, plus two extra pages for references. Short papers may consist of up to 4 pages of content, plus two extra pages for references. Papers that do not conform to the specified length and formatting requirements may be rejected without review.

Acknowledgments

The acknowledgments should go immediately before the references. Do not number the acknowledgments section. Do not include this section when submitting your paper for review.

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