Multilingual Semantic Parsing Using Abstract Meaning Representation

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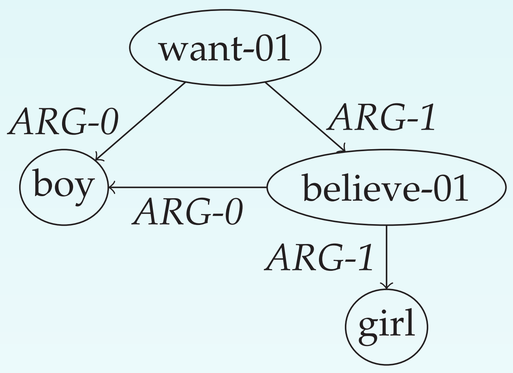
Introduction

Semantic Parsing: Given an input sentence, a semantic parser aims to extract a semantic representation of that sentence.
AMR Parsing: Abstract Meaning Representation [1] is the target semantic representation. AMRs are rooted, node-labeled and edge-labeled graphs; nodes represent concepts and edges represent relations between them.

The boy wants to believe the girl



Contributions:

- ✓ Left-to-right, linear-time transition system for AMR parsing, inspired by the ARCEAGER [2] transition system for dependency tree parsing;
- ✓ Set of metrics for fine-grained evaluation of AMR parsers;
- ✓ Multilingual AMR parsing for Spanish, Italian, German and Chinese, using annotation projection;
- ✓ Novel evaluation method that does not require gold standard graphs in the target languages

For English, we achieve performance competitive with the state-of-the-art and we report the first results on Spanish, Italian, German and Chinese.

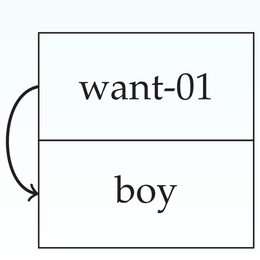
Transition system

A transition system consists of an initial state (no AMR parse created), a final state (a final AMR parse is created), a set of intermediate states and a set of transition between states.

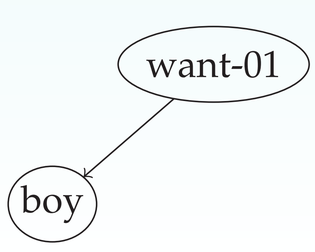
- States consist of a stack of partially processed AMR concepts, a buffer of words in the sentence that have not been processed yet and the AMR edges that have been constructed so far.
- Transitions can (a) take words from the buffer, convert them into concepts (or AMR subgraphs) and move them into the stack, (b) create edges between items in the stack and (c) remove items from the stack.

BUFFER *~~The~~ ~~boy~~ ~~wants~~ to believe the girl*

STACK



GRAPH



Transition-based parsing

Oracle: Given the gold AMR graph for an input sentence it returns the optimal transition sequence to reach the final state from the initial state.

Data: Using the AMR dataset (sentence/AMR pairs) and the oracle we can therefore create a dataset of state/transition pairs.

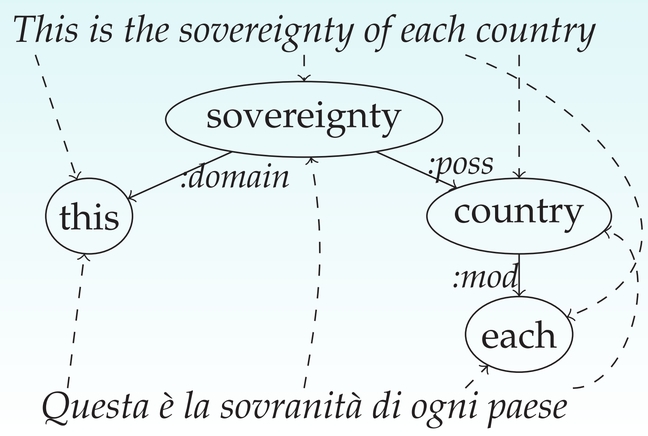
Training the parser: We then train classifiers to imitate the behaviour of the oracle.

Evaluation of English AMR parser

Metric	J'14 [4]	C'15 [5]	J'16 [6]	Ours
Smatch[3]	58	63	**67**	64
Unlabeled	61	**69**	**69**	**69**
No WSD	58	64	**68**	65
NP-only	47	54	**58**	55
Reentrancy	38	41	**42**	41
Concepts	79	80	**83**	**83**
Named Ent.	75	75	79	**83**
Wikification	0	0	**75**	64
Negations	16	18	45	**48**
SRL	55	**60**	**60**	56

Projecting to other languages

Annotation projection: method to project a training data from a source language to a target language by exploiting parallel corpora.



Projecting back to English

Problem: Gold standard AMR annotations exists only for English.

Solution 1: We can generate a silver test set in the same way we generated the training set and use this for evaluation. **But**, the English AMR parser and the word aligners, used to generate the evaluation data, make mistakes.

Solution 2: We invert the projection process and train a new English parser from the target parser. We can now evaluate the resulting English parser on a gold test set.

Evaluation of multilingual AMR parser

	Silver $e \rightarrow f$	Gold $e \rightarrow f \rightarrow e$	Gold $e \rightarrow e \rightarrow e$
Italian	0.45	0.45	0.59
Spanish	0.44	0.44	0.59
German	0.45	0.43	0.59
Chinese	0.36	0.40	0.58

Acknowledgements

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