The Overall Markedness of Discourse Relations

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Introduction

- How can discourse relations be categorized? Continuity of time, space, perspective... (Segal et al., 1991; Murray, 1997)
  - Continuous: *I was tired, so I drank a cup of coffee.*
  - Discontinuous: *I drank a cup of coffee but I was still tired.*
- Are discontinuous relations harder to process than continuous ones? Yes. (Segal et al., 1991)
- Are discontinuous relations more marked than continuous ones? Should be, but with Asr and Demberg (2013)'s measure, not quite. (Asr and Demberg, 2012, 2013)
- Here we improve on Asr and Demberg's measure and show that the results obtained fit the continuity hypothesis very well.

Rethinking the Markedness Measure

The markedness measure from Asr and Demberg (2013):

$$markedness(r) = \sum_c p(c|r)\frac{npmi(r;c)+1}{2} \propto I(C;R=r) \quad (1)$$

where r is a relation and c is a discourse connective.

- **M-exp (Asr and Demberg, 2013): C = all discourse connectives**
- **M-all (this paper): C = all discourse connectives and the null connective**

> Asr and Demberg (2013) propose this measure in the surprisal framework of Levy (2008), and restrict the scope of the data to only Explicit relations in PDTB. Surprisal is defined as
>
> $$surprisal \propto -\log p(w_i|w_{1...i-1}, CONTEXT) \quad (2)$$
>
> Using only explicit connectives as proposed by Asr and Demberg (2013) causes the domain of w_i to shift according to the prediction of whether an explicit relation is coming up or not. However it is more likely that one assigns probabilities to all words given the preceding context, which includes the case where no connective is predicted. Therefore, we calculate "M-all" using all explicit and implicit relations, with a null connective accompanying all the implicit relations.

Results

Results on Penn Discourse Treebank

Database details:

- A corpus of Wall Street Journal articles annotated with discourse relations (Prasad et al., 2008).
- "Explicit" relations v.s. "Implicit" relations
  - Explicit: I like coffee **because** it is delicious.
  - Implicit: I like coffee. It is delicious.

Asr and Demberg (2012) classified relations in PDTB according to the continuity hypothesis:

Level 1 Relation	Level 2 Relation	Level 3 Relation	Continuity
TEMPORAL	Asynchronous	precedence	Discontinuous
		succession	Discontinuous
	Synchronous		Ambiguous
CONTIGENCY	Cause		Continuous
	Condition		Unidentified
COMPARISON			Discontinuous
EXPANSION	Instantiation		Continuous
	Restatement		Continuous
	List		Continuous
	Alternative		Discontinuous
	Exception		Discontinuous
	Conjunction		Ambiguous

Table 1: Continuity of relations according to the continuity hypothesis (Asr and Demberg, 2012).

- TEMPORAL relation: discontinuous therefore high markedness. M-exp assigns a low markedness to TEMPORAL but M-all correctly assigns a high value to it.

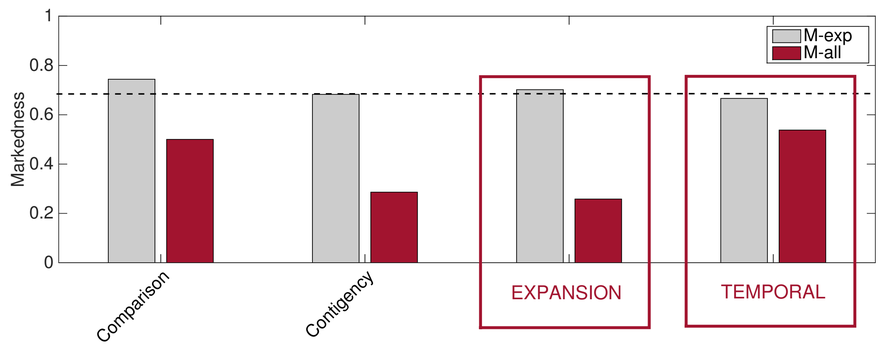

Figure 1: Comparison of markedness measures for PDTB level 1 relations

- EXPANSION relation: mostly continuous therefore low markedness, as predicted by M-all but not by M-exp. Markedness scores for level 2 relations reveal that EXPANSION has the least marked sub-relations.

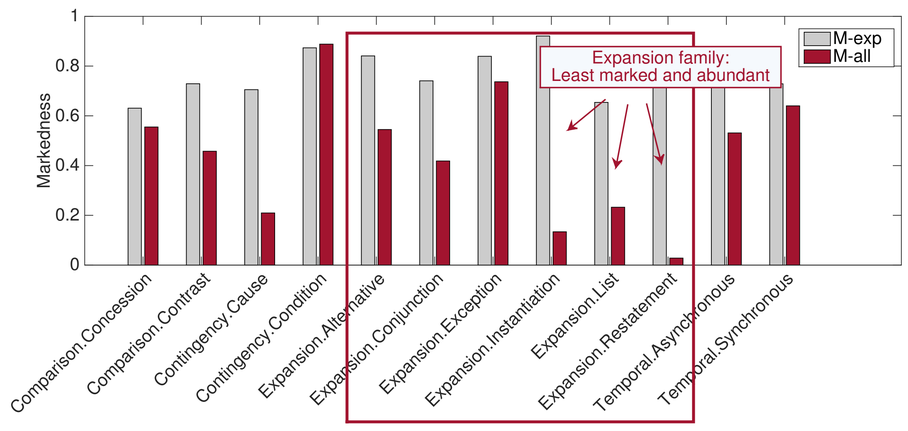

Figure 2: Comparison of markedness measures for PDTB level 2 relations

- At the level 3, *precedence* (e.g. *I had a cup of coffee before I took a bath*) should have a lower value than *succession* (e.g. *I took a bath after I had a cup of coffee*) as it follows a normal temporal order.

Metric	Precedence	Succession
M-exp	0.799	0.783
M-all	0.494	0.687

Table 2: Precedence and Succession Markedness.

Results on Chinese Discourse Treebank

CDTB (Zhou and Xue 2014) has a flat structure of only ten relations.

- TEMPORAL relation should have a high markedness value, and EXPANSION a low value similar to English. M-all correctly predicts both.
- There are also differences among languages on judgments of continuity of specific relations, e.g. CONJUNCTION.

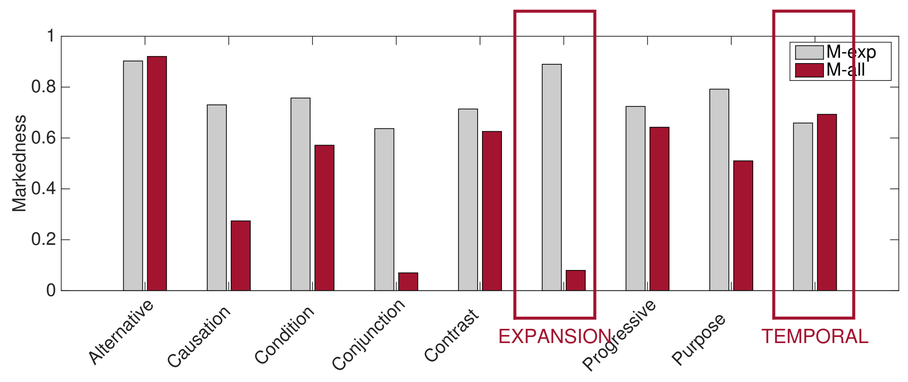

Figure 3: Markedness comparison for CDTB

Conclusions

- We expand Asr and Demberg (2013)'s measure from explicit relations only to explicit and implicit relations.
- We show that with this expansion, the predictions from the continuity hypothesis and the markedness scores match very well.
- Sanders (2005)'s causality-by-default hypothesis assumes causation is the default discourse relation. However this doesn't seem to be supported by M-all.
- Furthermore we show that the markedness rankings for the relations are mostly consistent across languages, indicating that discourse relations may not be influenced by idiosyncrasies of specific languages.

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