WordNet Troponymy and Extraction of “Manner-Result” Relations

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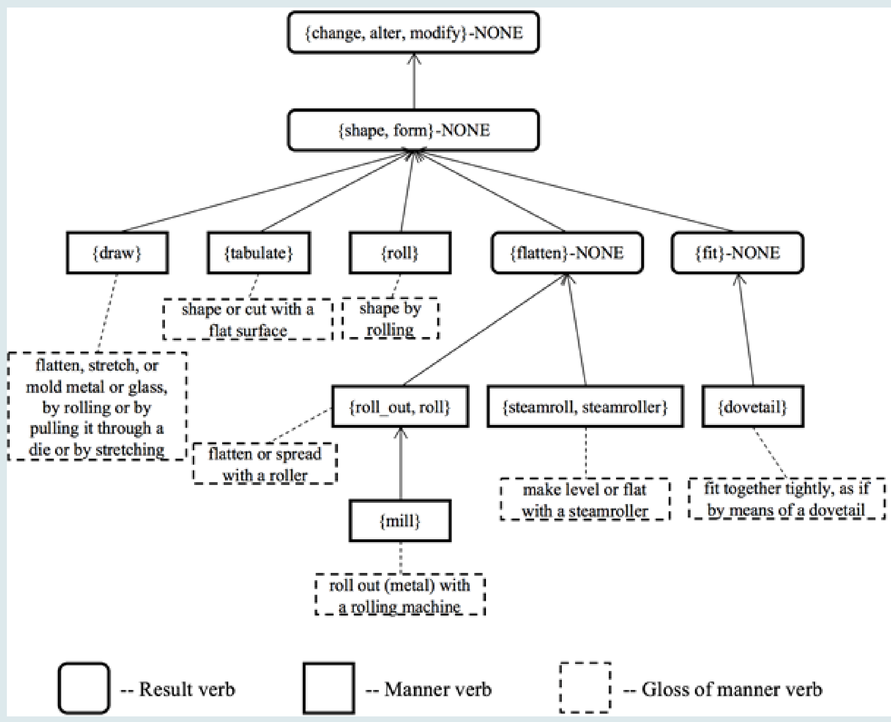
Introduction

WordNet (WN) as a database is widely used in variety of tasks related with extraction of semantic relations. Verbs in WN are organized hierarchically as troponym-hypernym relations.
Meanwhile, the definition of troponym has something in common with the definition of a manner verb suggested by B. Levin and M. Rappaport Hovav (2010). They pointed out that a study of the English verb lexicon reveals that there can be verbs that describe carrying out activities – manners of doing; and there can be verbs that describe bringing about results. Manner verbs are *walk, jog, stab, scrub, sweep, swim, wipe, yell,* etc. Result verbs are *break, clean, crush, destroy, shatter,* etc.

Results

As a result, after running all the top 127 result verb synsets we got the total number of 1541 sequences. It means, 1541 manner-result causal relations have been extracted.
Each sequence consists of marked synsets from the top verb synset to the bottom verb synset.
If the synset doesn’t contain any patterns we mark it as “NONE”. If the synset contains at least one of the patterns we mark it with its gloss.
The results are based on the analysis of the whole set of verbs in WN and are considered as preliminary ones.



Purpose

The purpose is to extract manner-result relations from WordNet.
They are hidden in the WN verb hierarchy. We know for sure that this kind of relations is a subset of troponym-hypernym relations. However, there are not any explicit ways to extract them yet.
Our idea is that manner-result relations can be extracted if two conditions, applied to troponym-hypernym relation are valid:
1) The hypernym is a result synset;
2) In the glosses of its troponyms one of the two templates can be found: “V + by” or “V + with”; where V = hypernym.

Procedure

The procedure of extraction includes 3 steps:

- extraction of the top verb synsets (total 564 extracted),
- b) extraction of the result synsets and the change-of-state synsets among them manually (total 127 extracted),
- c) running automatically the algorithm “*V + by*” and “*V + with*” on 127 top synsets

Evaluation of the Results

To evaluate what is the scope of the results we compare them with another type of causal relations that is explicitly presented in WN 3.1: *cause*-relation.
Cause-relation refers to the relation between two verbs V_1 and V_2 where V_1 logically causes V_2 (Fellbaum, 1998). For example, the verb *kill* causes the verb *die.*
Running through 13789 verb synsets in WN 3.1 we automatically extracted 219 verb synsets that contain *cause*-relation. Among them there are 63 verb synsets that cause the same synset. In other words, there are 63 causal relations with absolutely identical left and right sides:

{dry, dry_out} causes *{dry, dry_out}*
{lengthen} causes *{lengthen}*, etc.

It happened because of polysemy in verb meaning. Synsets here are formally identical but represent different meanings of verbs. Since it is hard to use such kind of causality in applications, the real number of the verb synsets that contain *cause*-relation can be reduced to 156.
Comparison of 156 verb synsets containing logical *cause*-relation with 1541 non-logical (empirical) causal relations shows that the scope of the latter relations is significant.
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Conclusion

In this paper, we have described how to extract “manner verb-result verb” causal relations from WN.
We got 1541 types of manner-result causal relations. These types of extracted relations can be widely used in commonsense knowledge bases for the prediction of action consequences and unfolding the possible reasons for the results. Commonsense knowledge bases enriched by using this approach can be exploited in dialog systems and the other specific technologies and applications.

References

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