

UVAVU: WordNet Similarity and Lexical Patterns for Semantic Relation Classification



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Task Description

We built a system for task 4 of SemEval 2007. The goal of the system is the verification of seven semantic relations:

cause-effect, instrument-agency, product-producer, origin-entity, tool-theme, part-whole, and content-container.

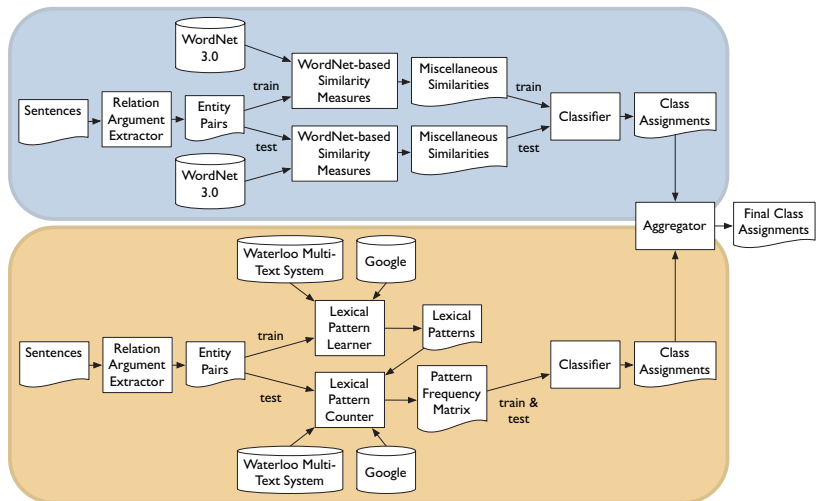
The data-set for the evaluation of this task consisted of 140 training sentences and 70 test sentences per relation. An example sentence of the cause-effect relation is the following:

“He derives great joy and <e1>happiness</e1> from <e2>cycling</e2>.”

The two arguments in this sentence have been pre-annotated with WordNet 3.0 senses. The system should classify this example as positive.

Our system consists of two parallel components, indicated by the blue and yellow boxes in the figure on the right. One component is based on WordNet similarity measures implemented in the Perl package WordNet::Similarity. The other uses lexical pattern methods on Google and the Waterloo Multi-Text System (WMTS)

System Overview



Results

relation	method	Prec.	Recall	F ₁	Acc.
1. Cause-Effect	LR	0.48	0.51	0.49	0.45
2. Instr.-Agency	DT	0.65	0.63	0.64	0.62
3. Prod.-Prod.	DT	0.67	0.50	0.57	0.46
4. Origin-Ent.	LR	0.50	0.47	0.49	0.49
5. Theme-Tool	LR	0.54	0.52	0.53	0.62
6. Part-Whole	DT	0.54	0.73	0.62	0.67
7. Cont.-Cont.	2-NN	0.66	0.55	0.60	0.62

Results of the WordNet similarity method.

relation	method	Prec.	Recall	F ₁	Acc.
1. Cause-Effect	3-NN	0.53	0.76	0.63	0.54
2. Instr.-Agency	2-NN	0.47	0.89	0.62	0.46
3. Prod.-Prod.	2-NN	0	0	0	0.33
4. Origin-Ent.	2-NN	0.47	0.22	0.30	0.54
5. Theme-Tool	3-NN	0.39	0.93	0.55	0.38
6. Part-Whole	2-NN	0.36	1	0.53	0.36
7. Cont.-Cont.	2-NN	0.51	0.97	0.67	0.51

Results of the lexical pattern method.

relation	judge 1	judge 2
1. Cause-Effect	0.93	0.93
2. Instr.-Agency	0.77	0.77
3. Prod.-Prod.	0.87	0.80
4. Origin-Ent.	0.80	0.77
5. Theme-Tool	0.80	0.77
6. Part-Whole	0.97	1.00
7. Cont.-Cont.	0.77	0.77

The agreement of two judges with the given gold-standard on a sample of 30 sentences (15 positive, 15 negative) for each relation.

Inter-Judge Agreement

To discover which relations are the most difficult to verify we manually classified a sample of 30 sentences (15 positive, 15 negative) for each relation. We measured the agreement of two human judges with the given gold-standard classification. Based on these results we conclude that the **part-whole** and **cause-effect** relations are the easiest to classify for humans and also for automatic learning methods, respectively WordNet-based, and lexical pattern-based methods.

Discussion

- The results for WordNet and pattern-based methods are complementary. We expect that a more subtle combination of these results would yield better results.
- Relations with a high consensus amongst human judges are relatively easy to learn.
- *k*-nearest neighbor methods worked well for pattern-based learning methods.
- WordNet includes meronymy relations. We expect this to boost performance for the **part-whole** relation. None of the other relations are explicitly encoded in WordNet.
- Pattern-based methods with nearest-neighbor classification only works when the targeted semantic relation is the most “obvious” relation between the two entities. For the **product-producer** relation this was not the case. Nearly all learnt patterns represent other relations than **product-producer**. For example, “<e1/> from a <e2/>” in the sense of **possession-owner**.