UCM-I: A Rule-based Syntactic Approach for Resolving the Scope of Negation

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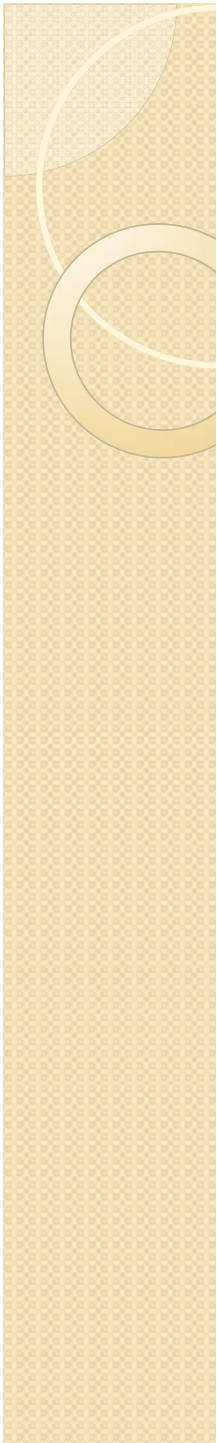NIL (Natural Interaction based on Language)

Motivation

- Negation has become a very important linguistic factor in many NLP task
- The effect of negation is considered as:
  - Modifier that reverse the meaning
  - A polarity shifter
  - An emotion shifter

Challenge

- Task 1: scope detection
  - Cue detection
  - Scope detection
  - Event detection
- An adaptation of the system presented in (Carrillo de Albornoz et al. 2010)
  - Detect and process negation in opinionated texts
  - Improve polarity and intensity classification tasks

The Rule-based Syntactic Approach for Sentiment Analysis

- Methodology:
  - Detecting the negations cues
  - Use the syntax tree of the sentence to delimit the scope of the negation cue
  - Post-processing the scope to adjust it
- Benefits:
  - Very simple technique
  - Domain independent
  - Good performance in Sentiment Analysis (SA) tasks

Detecting negation cues

- ## SA approach
  - List of explicit negation cues
  - Common spelling errors *(dont, havent,…)*
- ## Challenge adaptation
  - False negation cues rule: excludes some expressions such as *not only*, *not just*
  - Tag questions rule: excludes old English forms such as *"You could easily recognize it, could you not?"*
  - Automatic detection of implicit negations cues (typically considered as affective words in SA)

Automatic detection of implicit negations

- Find all words with prefixes *dis-, a-, un-, in-, im-, non-, il-, ir-*

- Find all words with suffixes *–less*

- Determining if the identified word is a negation cue:
  - Retrieve the appropriate synset of the word from WordNet
  - Check if removing the affix/suffix the word exists in WordNet
  - Check if the resulting word belongs to the antonyms of the original word (has the opposite meaning)

Delimiting the scope of negation

- SA approach:
  - ◦ Find in the syntax tree the first common ancestor that encloses the negation token and the word immediately after it
  - ◦ Assume all descendant leaf nodes to the right of the negation token to be affected by the scope
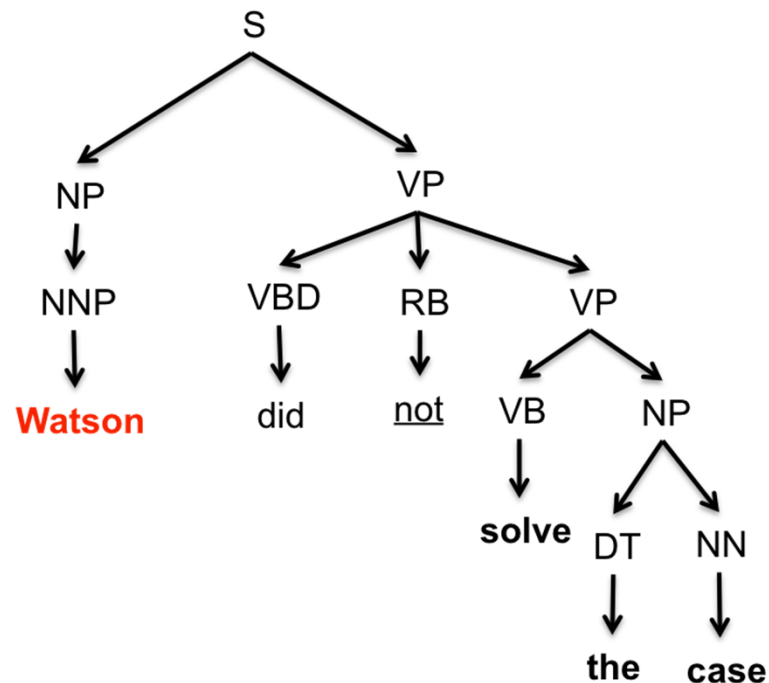
Post-processing the scope

- Challenge adaptation:
  - Expansion to subject rule: expands the negation scope in order to include the subject

    [This theory would] not [work]

  - The subject is not usually considered as scope in SA:

    The beautiful views of the Eiffel Tower are [not guaranteed in all rooms]

  - *If that, "Beautiful" should change its polarity*

Post-processing the scope

- Challenge adaptation:
  - Subordinate boundaries rule: delimits the scope between the main clause and secondary clauses

    [Her father] refused [to have anything to do with her] ***because*** *she had married without his consent*.

  - Use special delimiters and their part of speech to solve ambiguity with correct subordinate sentences

Tokens	POS	Tokens	POS
so, because, if, while, until, since, unless	IN	why, where	WRB
before, than, despite	IN	however	RB
what, whose	WP	";", - , :, ;, (,), !, ?, .	-

Post-processing the scope

- Challenge adaptation:
  - Prepositional phrases rule: expands the scope when the negation cue is followed by a propositional phrase
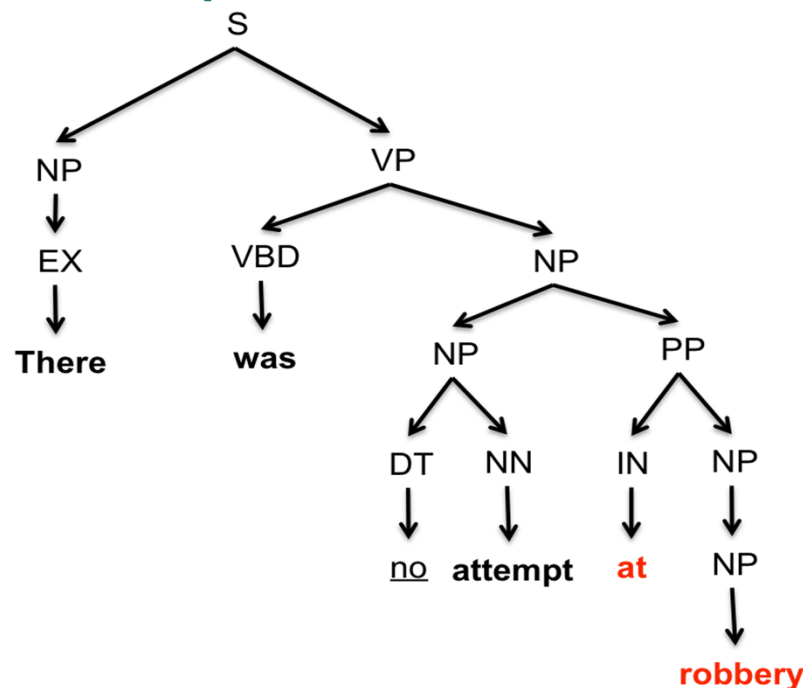
Finding negated events

- Not focus in detecting negated events
- Only consider a single type of negated events
  - Remove the affix of cues that are implicit negations and tag the resulting word as a negated event

  [The oval seal is] **un**_doubtedly_ [a plain sleeve-link]

Results for the development set

Metric	Pr.	Re.	F-1
Cues	92.55	86.13	89.22
Scope (cue match)	86.05	44.05	58.27
Scope (no cue match)	86.05	44.05	58.27
Scope tokens (no cue match)	88.05	59.05	70.69
Negated (no cue match)	65.00	10.74	18.43
Full negation	74.47	20.23	31.82

Results for the test sets (jointly)

Metric	Gold	System	Tp	Fp	Fn	Pr.	Re.	F-1
Cues	264	278	241	29	23	89.26	91.29	90.26
Scope (cue match)	249	254	116	24	133	82.86	46.59	59.64
Scope (no cue match)	249	254	116	24	133	82.86	46.59	59.64
Scope tokens (no cue match)	1805	1449	1237	212	568	85.37	68.53	76.03
Negated (no cue match)	173	33	22	11	151	66.67	12.72	21.36
Full negation	264	278	57	29	207	66.28	21.59	32.57

Error analysis

- Respect the automatic detection of implicit negation method
  - Precision of 100% and Recall of 53%
  - Fails in derived forms of adjectives such as *unburned* or *uncommonly*
- Scope detection
  - Error in detecting the subject

  [I know absolutely] nothing [about the fate of this man]

Error analysis

- Scope detection
  - Error when the subject or the object of an event is negated

    I think, Watson, [a brandy and soda would do him] no [harm]

    No [woman would ever send a reply-paid telegram]

  - Error in complex sentences with subordinate conjunctions

    [Where they came from, or who they are,] nobody [has an idea]

Conclusions and Future Work

- We have presented a rule-based syntactic approach for resolving the scope of negation

- The method successes in identifying negation cues

- The method performs well determining the scope of negation

- Poor results in negated event detection

- Domain independent

Conclusions and Future Work

- Improve the automatic method for detecting affixal negations (more WordNet relations such as "derived from adjective" or "pertains to noun")

- Extend the automatic detection of implicit negation method to include infixal negations

Thank you!
Any question?