Multiple Alternative Sentence Compressions and Word-Pair Antonymy for Automatic Text Summarization and Recognizing Textual Entailment

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Antonymy

Kinds

- Clear opposites:
  - *wet – dry*
  - *hard – soft*
  - *promoted – demoted*

→ 
manually created lexicons

- Contrasting word pairs:
  - *promoted – censured*
  - *hard – fluid*
  - *flinch – advance*

→ 
largely unrecorded

Computing word-pair antonymy: Mohammad et al. 2008

Method:
- Identify contrasting word pairs
  - using seed antonym pairs and thesaurus categories.
- Determine degree of antonymy
  - using distributional distance and tendency to co-occur.

Evaluation:
950 GRE-style closest-opposite questions.

Results:
F score = .70 (baselines: .20 and .22).

Why be antonymy-aware

- **Recognizing Textual Entailment and Contradictions**:
  Antonyms and polarity can preserve or contradict meaning.
  - **paraphrases**:
    Sirius Black could not evade the dementors.
    The dementors caught Sirius Black.
  - **disagreement, contention, and contradiction**:
    Giuliani's 9/11 emergency management was prompt.
    Slow response was one of his biggest criticisms.
- **Summarization:**
  Presence of antonyms is an indicator of summary-worthy information.
  - **contrast**:
    Gregory Peck can play both strong and sensitive roles.
    Peck can only play simple roles, not complex ones.
  - identifying entailments and contradictions
- Sentiment detection, detecting humor, improving distributional thesauri.

Recognizing Textual Entailment and Contradictions

Entailment and contradiction

A practical definition of **entailment**:
A text (or source) T entails a hypothesis H if a normal reader would be happy to accept T as strong evidence that H is true (assuming that T is reliable).

A practical definition of **contradiction**:
T contradicts H if it is very unlikely that both T and H can be true at the same time.

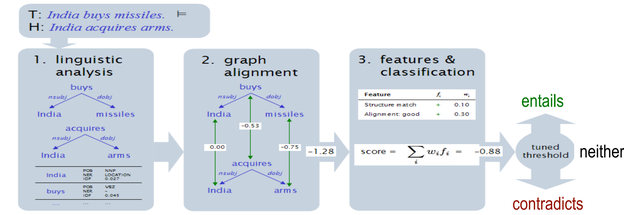
Example:

T1 Internet media company Yahoo Inc. announced Monday it is buying Overture Services Inc. in a $1.63-billion (U.S.) cash-and-stock deal that will bolster its on-line search capabilities.

Entails:
H1.1 *Yahoo bought Overture*
H1.2 *Overture was acquired by Yahoo*
H1.3 *Overture was bought*
H1.4 *Yahoo is an internet company*

Contradicts:
H1.5 *Overture bought Yahoo*
H1.6 *Yahoo sold Overture*

Stanford three-stage RTE system



Antonym features

- Check if an aligned pair of words (across T and H) are antonyms.
- If yes, then boolean features generated:
  - Antonyms appear in contexts of matching polarity
    Hitler survived the plane crash.
    Hitler died in a plane crash
  - Only the hypothesis (or source) word appears in negative polarity context
    Hitler survived the plane crash.
    Hitler did not die in a plane crash.

Summarization

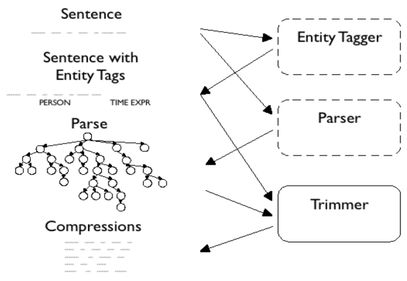
UMD three-stage architecture for summarization:

1. Tagging: the Stanford Parser (Klein and Manning 2003).
- Sentences are part-of-speech tagged and parsed.
- Named entities in the sentences are identified.

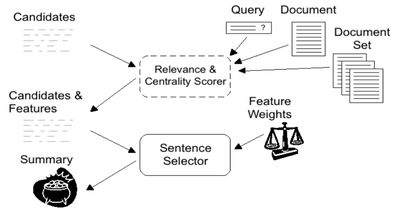
2. Sentence compression: Trimmer (Zajic 2007)
- Linguistically motivated rules to mask syntactic components of the parse of a source sentence.
- Rules are applied iteratively, and in many combinations
- Compression-specific feature values are assigned:
  - number of rule applications
  - parse tree depth of various rule applications.

3. Candidate selection
- Static features:
  - position of sentence in the document; length; compression-specific features; relevance scores
- Dynamic features include:
  - redundancy with current summary state; number of candidates from the same source document already in the summary
- Candidates are selected for inclusion until the summary reaches prescribed word limit or the pool is exhausted.

Stages 1 and 2: tagging and sentence compression.



Stage 3: candidate selection.



Trimmer + Antonymy Features

- Examine each of the words in a sentence to determine whether it has an antonym within the same within the same document.
  - If not, then the antonymy score contributed by this word is 0.
  - If yes, then the antonymy score contributed by this word is its degree of antonymy with the word it is most antonymous to.
- The antonymy score of a sentence is the sum of scores of constituent words.

Document fragment:

…
For a long time, physicists thought that the Universe will eventually contract.
New calculations show that in fact the Universe will continue to expand.
…

TAC 2008: RTE task

Data

1000 source and hypothesis pairs

Three submissions by Stanford--UMD

WordNet : used only WordNet antonyms
Automatic: used antonyms determined from our automatic method
All : used both manually and automatically determined antonyms

Results

	WordNet	Automatic	All
2-way accuracy	61.7	61.7	61.7
3-way accuracy	55.4	55.6	55.6
Avg. precision	44.08	44.26	44.27

Conclusions

- Our system stood 7th among the 33 participating systems.
- Performance using automatically generated antonyms and those compiled from a manually created resource such as WordNet is comparable.
  - Appealing method for resource-poor languages.
- Using the manually generated antonyms in addition to the automatically generated antonyms did not improve performance by much.

Future work

- Apply the method to data richer in contradictions.
- Analyze the manifestation of antonyms in contradictory source—hypothesis pairs.
- Use sophisticated antonymy features that take into account syntactic dependencies.

TAC 2008: Opinion Summarization Task

Blog data

- 609 documents covering 25 topics
- Writing style is informal
- Natural language text is enmeshed in metadata.

Extracting text to be summarized

- Extract content from HTML <BODY> … </BODY> tags
- Decode HTML-encoded characters
  - e.g., " " for space, "&amp" for ampersand
- Convert HTML separator tags into newlines
  - e.g.,
, <HR>, <TD>, <P>
- Remove remaining HTML tags
- Remove common non-content phrases
  - e.g., "Posted by...", "Published by...", "Related Stories", "Track-Back", "Blog This", "Copyright"
- Filter out any line of text containing fewer than *n* = 6 words.

UMD submissions

1. Trimmer
2. Trimmer + Antonymy features

Results

	Trimmer		Trimmer + Antonymy	
	Rank	Score	Rank	Score
Pyramid	11/19	.14/1	13/19	0.130/1
Grammaticality	16/19	4.4/10	17/19	4.318/10
Non-redundancy	3/19	6.7/10	6/19	6.364/10
Coherence	13/19	2.4/5	11/19	2.409/5
Fluency	9/19	3.6/10	15/19	3.318/10

Conclusions

- The performance of the UMD summarizer was roughly middle-of-the-pack.
- It was particularly strong in non-redundancy (rank 3).
- Adding antonymy features:
  - improved coherence
  - negatively affected other aspects.

Future Work

- Use antonymy features more extensively
  - focus on antonyms in adjacent sentences;
  - include syntactic dependency information.

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