Domain-independent Models of Text Structure

Regina Barzilay

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Domain-Dependent Content Models

- Capture topics and their distribution
- Based on pattern matching techniques
  - Motifs of semantic units
  - Distributional model
- Useful in generation and summarization

Domain-Dependent Rhetorical Model

Domain: Scientific Articles

- Human exhibit high agreement on the annotation scheme
- The scheme covers only a small fraction of discourse relations

Is it Realistic

Domain-Independent Rhetorical Model

- Model elements:
  - Binary Relations
  - Compositionality Principle
- Requirements:
  - Stability and Reproducibility of an Annotation Scheme
  - Expressive Power of a Model

Rhetorical Structure Theory

(Mann&Thompson:1988, Matthessen&Thompson:1988)

- Developed in the framework of natural language generation
- Aims to describe "building blocks" of text structure
  - Nucleus vs Satellites
  - Binary Relations between Discourse Units
- Compositionality principle define how to build a tree from binary relations

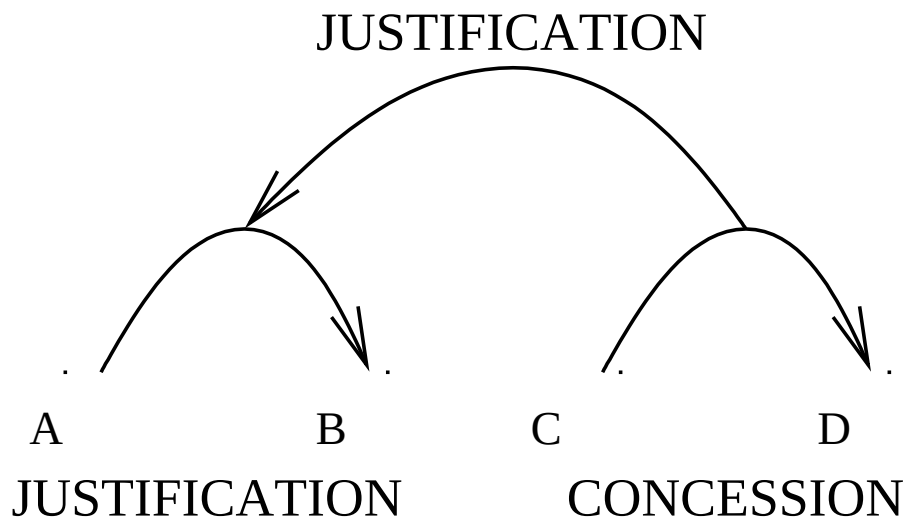
Example

[No matter how much one wants to stay a non-smoker,^{A}], [the truth is that the pressure to smoke in junior high is greater than it will be any other time of one's life. ^{B}] . [We know that 3,000 teens start smoking each day, ^{C}] [although it is a fact that 90% of them once thought that smoking was something that they'll never do. ^{D}]

Binary Relations

- (JUSTIFICATION, A, B)
- (JUSTIFICATION, D, B)
- (EVIDENCE, C, B)
- (CONCESSION, C, D)
- (RESTATEMENT, D, A)

RST tree



Compositionality

Whenever two large text spans are connected through a rhetorical relation, that rhetorical relation holds between the most important parts of the constituent spans.

Marcu (1997): used constraint-satisfaction approach to build discourse trees given a set of binary relations

Relations

Relation	Nucleus	Satellite
Background	text whose understanding is being facilitated	text whose understanding is being facilitated
Elaboration	basic information	additional information
Preparation	text to be presented	text which prepares the reader to expect and interpret the text to be presented

Ambiguity

John can open the safe.
He knows the combination.

To see this image, go to
http://images.google.com/images?q=yolady.gif

Automatic Computation

(Marcu, 1997; Marcu&Echihabi, 2002)

Surface cues for discourse relations:

I like vegetables, but I hate tomatoes.

Automatic Computation of RST Relations

(Marcu, 1997)

- Aggregate discourse relations to a few stable groups: (contrast, elaboration, condition, cause-explanatuin-evidence)
- Establish deterministic correspondence between cue phrases and discourse relations:
  - $\{$ But, However $\} \rightarrow$ Contrast
  - $\{$ In addition, Moreover $\} \rightarrow$ Elaboration

Accuracy

- Compared against manually constructed trees
- Tested against human-constructed trees
- Automatically constructed trees exhibit high similarity with human-constructed trees
- However, see (Marcu&Echihabi, 2002) CONTRAST vs ELABORATION: only 61 from 238 have a discourse marker (26%)

Other Words Also Count!

(Marcu&Echihabi, 2002)

Surface cues for discourse relations:

I like vegetables, but I hate tomatoes.

Method

- Assume that certain markers unambiguously predict discourse relations
- Create Cartesian product of words located on two sides of a discourse marker
- For each pair of words, compute its likelihood to predict a discourse relations
- $argmax_{r_k} P(r_k|(s_1, s_2)) =$
  $argmax_{r_k} P((s_1, s_2)|r_k) * P(r_k)$, where
  $P((s_1, s_2)|r_k) = \prod_{i,j \in s_1, s_2} P((w_i, w_j)|r_k)$