RST Parser

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Discourse and RST schema

- It is a linguistically schema for describing natural texts, characterizing their structure primarily in terms of relations that hold between parts of the text.

- The final goal of RST parser is to produce a tree structure as a representation of how all units of the text relate to each other.

- Some other schemas regarding discourse structure exists
RST components

1. **Elementary discourse units (EDUs)** - Texts can be segmented into minimal spans
2. **Relations among EDUS** - Spans are joined into discourse relations
3. **Nuclearity (nucleus / satellite)**: the nucleus is more central to the text’s purpose (more salient to the discourse structure)
4. **Recursive relations** - Spans that are in a discourse relation may enter into new relations
Example 1

The projections are in the neighborhood of 50 cents a share to 75 cents, compared with a restated $1.65 a share a year earlier, when profit was $107.8 million on sales of $435.5 million.
Example 2

Which is selling three automotive replacement parts divisions, Parker Hannifin is retaining, Thomas曰。...
Motivation

● Describes the high-level organization of text or speech

● Downstream applications:
  ○ Summarization
  ○ Sentiment analysis
  ○ Question answering
RST flow

- Divided into non-overlapping text chunks (EDUS)

- Consecutive sub-trees are put in relation with each other:
  - 60+ relation type in original schema; clustered into 18 relation types
  - Mark the nucleus. The nucleus is considered as more prominent than the satellite
RST *shift-reduce* parser

- State is represented by *stack* and *queue*
- At each step select a single action:
  - *shift* the front of the queue onto the top of the stack
  - *reduce* the top two elements on the stack in a discourse relation
    - Select relation type
    - Select nucleus of action
Reduce action

queue

| e_17 | e_16 | e_15 | e_14 | e_13 |

stack

| t_3 |
| t_2 |
| t_1 |

contrast

t_4
t_2
t_3
t_1
Reduce action #2

- e_17
- e_16
- e_15
- e_14
- e_13

- t_1
- t_2
- t_3
- t_4
- t_5

Contrast

Attribution
Example 3
Discourse Markers

- Conjunctions

  (11) [Share prices in Frankfurt closed narrowly mixed] [after Wall Street opened stronger.]

- Structural clues

  (298) [Under a proposal by Democrats to expand individual retirement accounts, a $2,000 contribution by a taxpayer in the 33% bracket would save $330 on his taxes. The savings was given incorrectly in Friday’s edition.]

  [See: Politics and Policy: Debate on IRAs Centers on Whether Tax Break Should Be Immediate or Put Off Till Retirement -- WSJ Oct. 27, 1989]
Discourse Markers

- Sentence boundaries

![Sentence diagram with discourse markers](Image)
Model

- Multiclass classification
  - Action type
  - Relation
  - Nuclearity

- Shift-Reduce parser $\rightarrow$ local decisions

- State = (2 upper elements in stack, top element in queue)
Model

- **State representation**: Let $t_i$ be the second top element in the stack, $t_{i+1}$ top element in stack and $e_j$ first element in queue

  $$s = f(t_i, t_{i+1}, e_j)$$

- State to action classifier
DPLP (Ji & Eisenstein 2014)

State representation:

\[ f^* \] maps each EDU to its bag-of-words vector \( v_i \in \mathbb{N}^{|V|} \):

\[
    s = f(t_i, t_{i+1}, e_j) = [f^*(t_i); f^*(t_{i+1}); f^*(e_j))] = [v_i; v_{i+1}; v_j]
\]
DPLP (Ji & Eisenstein 2014)

Classifier - Multiclass SVM

\[
\arg\max_{m \in 1..C} \mathbf{w}_m^T g(s, A)
\]

\[g(s, A) = \mathbf{A}s\]

\[
\mathbf{w}_m \in \mathbb{R}^k \\
\mathbf{A} \in \mathbb{R}^{k \times 3|V|}
\]
Features

- **Lexical features**
- POS tag at beginning and end of the EDU
- Length of EDU in tokens
- Distance between EDUs
- Whether two EDUs are in the same sentence
Model variants

- Single model for (action_type, relation, nuclearity) vs. 3 models
- Learnable state representation
- Decoding
Usefull links

- **DPLP (SVM):**  http://www.aclweb.org/anthology/P14-1002
- **Neural discourse parsers:**
  - https://aclweb.org/anthology/Q16-1023 (neural model for dependency parsing)
- **Evaluation and comparison of different models:**
  http://www.aclweb.org/anthology/D17-1136
- **RST schema:**  ftp://128.9.176.20/isi-pubs/tr-545.pdf