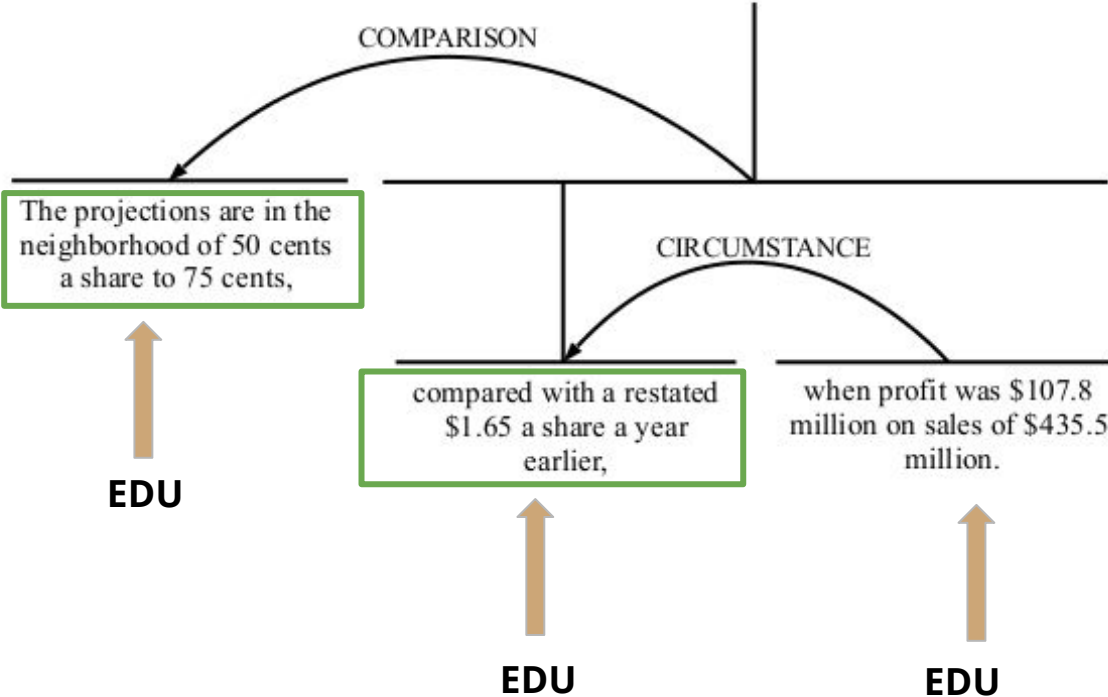# RST Parser

Slides by Omri Koshorek

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
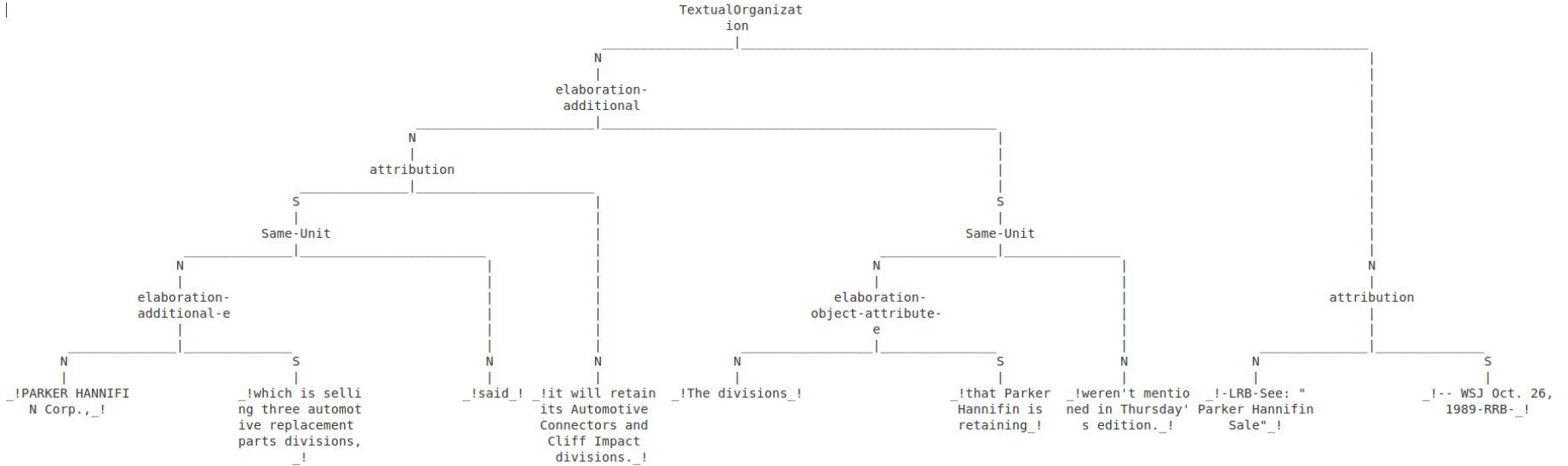
- Some other schemas regarding discourse structure exists

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

COMPARISON

The projections are in the neighborhood of 50 cents a share to 75 cents,

EDU

CIRCUMSTANCE

compared with a restated $1.65 a share a year earlier,

EDU

when profit was $107.8 million on sales of $435.5 million.

EDU

Example 2

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
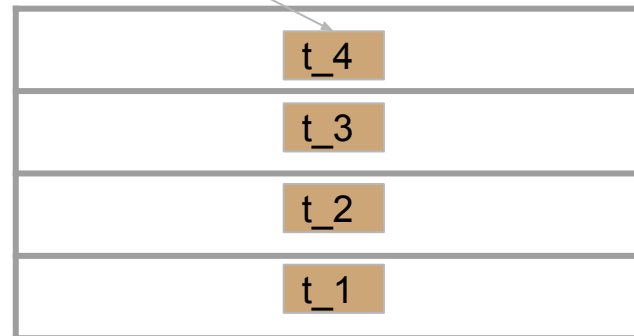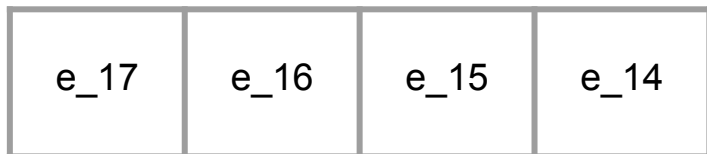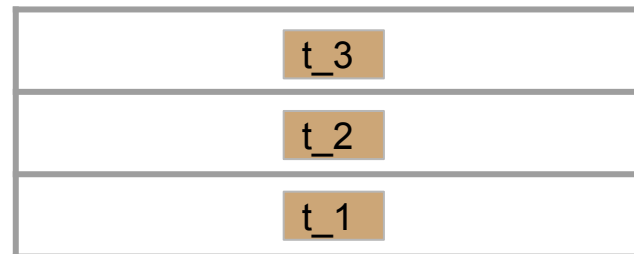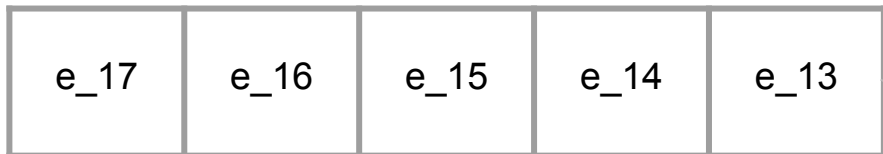
RST *shift-reduce* parser

- 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
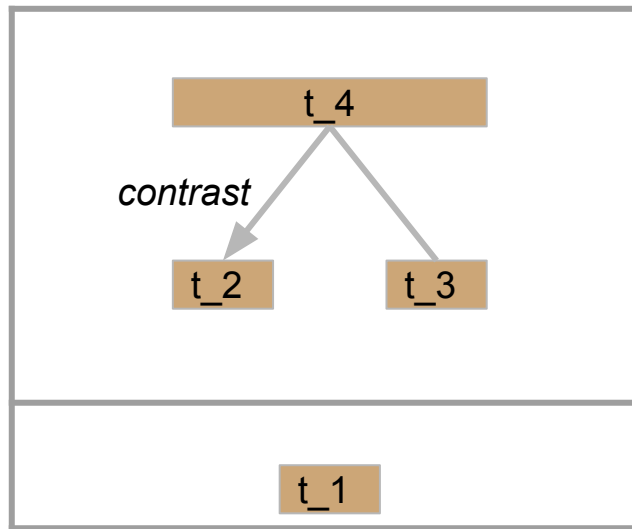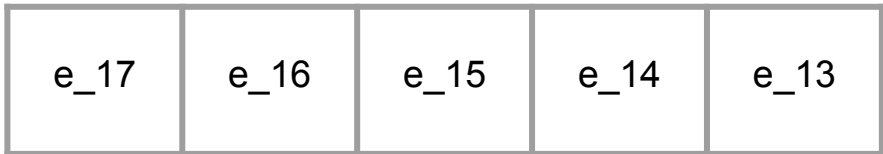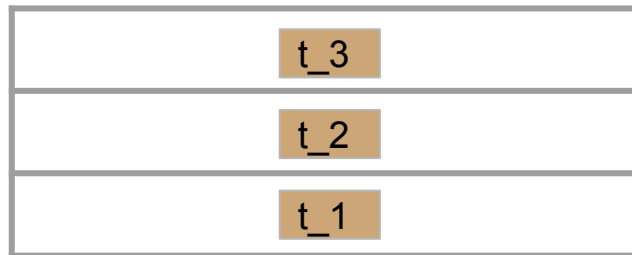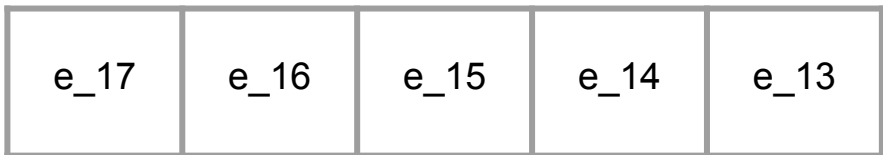   - Select nucleus of action

Shift action

queue

e_17	e_16	e_15	e_14	e_13

stack

t_3
t_2
t_1

e_17	e_16	e_15	e_14

t_4
t_3
t_2
t_1

Reduce action

queue

e_17	e_16	e_15	e_14	e_13

stack

t_3
t_2
t_1

e_17	e_16	e_15	e_14	e_13

t_4

contrast

t_2   t_3
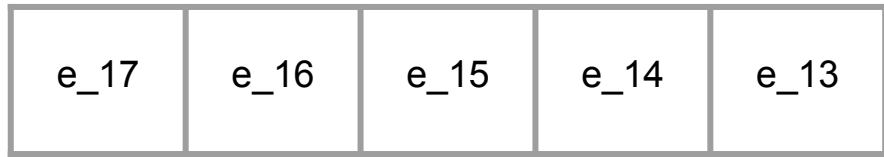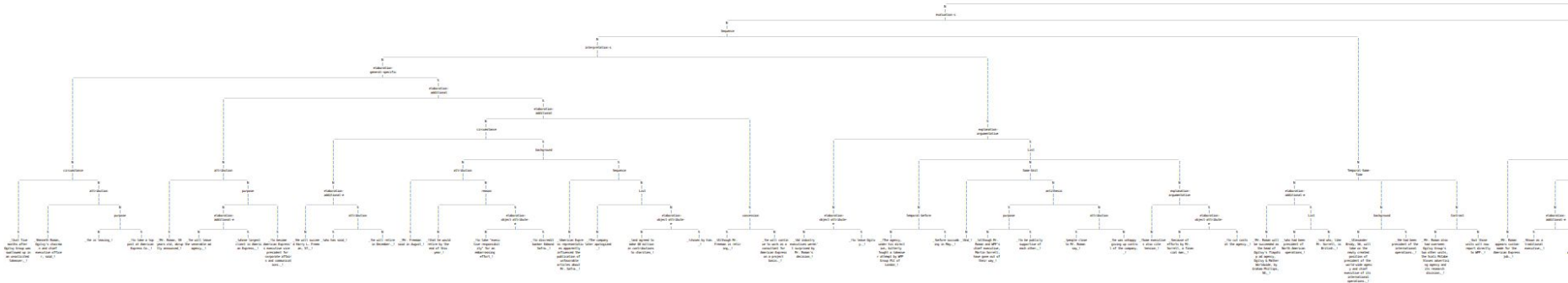
t_1

Reduce action #2
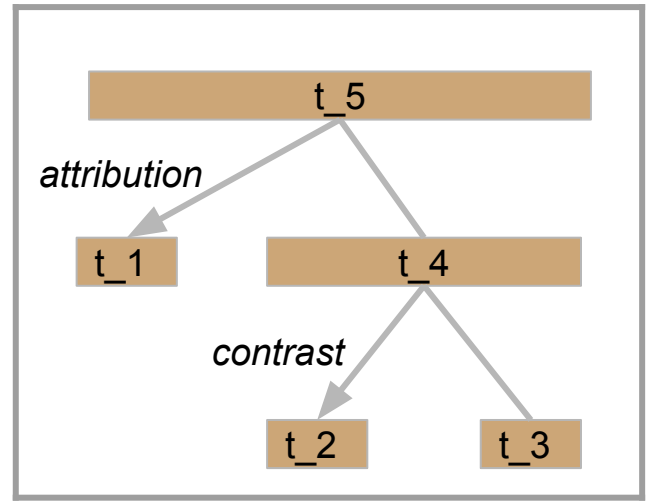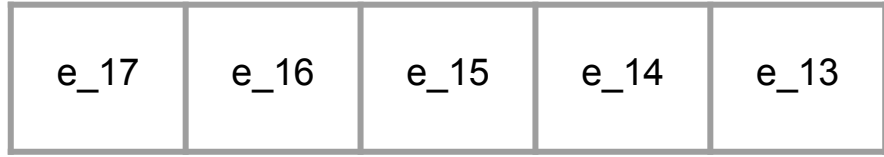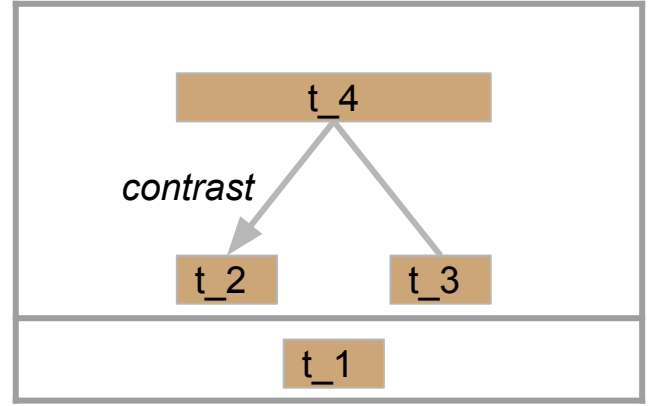
Example 3

Discourse Markers

- Conjunctions

> (11)   [Share prices in Frankfurt closed narrowly mixed] [**after** Wall Street opened stronger.]_{wsj_0374}

- 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.]^{Text} [See: Politics and Policy: Debate on IRAs Centers on Whether Tax Break Should Be Immediate or Put Off Till Retirement -- WSJ Oct. 27, 1989)]^{Footnote} _{wsj_0605}

Discourse Markers

- Sentence boundaries
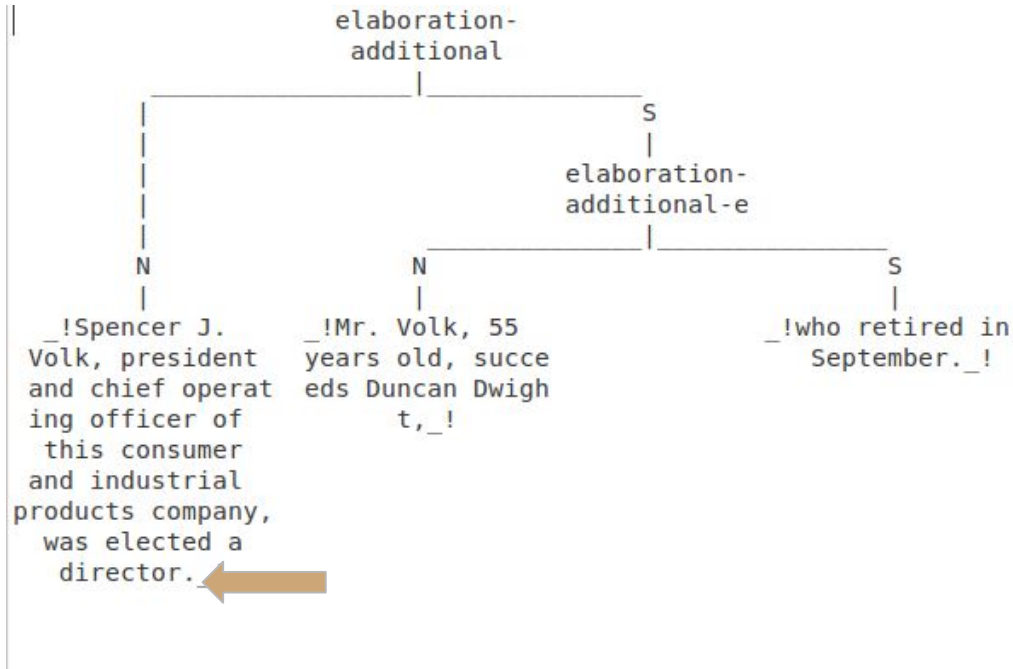
Model

- Multiclass classification
  - Action type
  - Relation
  - Nuclearity

- Shift-Reduce parser → 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

$$\underset{m \in 1..C}{\mathrm{argmax}} \quad \mathbf{w_m}^{\intercal} g(s, A)$$

$$g(s, A) = \mathbf{A s}$$

$$\mathbf{w_m} \in \mathbb{R}^k \qquad \mathbf{A} \in \mathbb{R}^{k \times 3|V|}$$

Features

- **<u>Lexical features</u>**

- 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://arxiv.org/pdf/1701.02946.pdf
  - 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