Improving Event Coreference Resolution by Modeling Correlations between Event Coreference Chains and Document Topic Structures

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Introduction

We propose a holistic approach to identify coreference relations between event mentions by modeling:

- Correlations between the main event chains of a document with topic transition sentences.
- Inter-coreference chain correlations.
- Genre-specific distributional characteristics.
- Sub-event structure.

Key Observations

- Event mentions make the backbone of a document.
- Same events are repeated for:
  - describing a new aspect or further information of the event.
  - content organization purposes.
- Coreferent Event mentions are thus scarce and play a key role in achieving a **coherent content structure**.
- Coreferent Entity mentions, on the other hand, are often characterized by nearness.

Dataset	Type	0	1	2	3	4	> 4
richERE	event	11	**34**	**20**	**9**	**7**	**19**
	entity	**34**	33	14	6	3	10
ACE-05	event	5	**33**	**19**	**10**	**9**	**24**
	entity	**37**	28	12	7	4	13
KBP 2015	event	15	**34**	**12**	**9**	**6**	**24**
KBP 2016	event	8	**43**	**15**	**7**	**6**	**21**
KBP 2017	event	12	**49**	**13**	**7**	**4**	**15**

Table 1: % of adjacent (event vs. entity) mention pairs based on the number of sentences between two mentions.

Modeling Correlations

We model discourse level event-topic correlation structures by formulating ILP to:

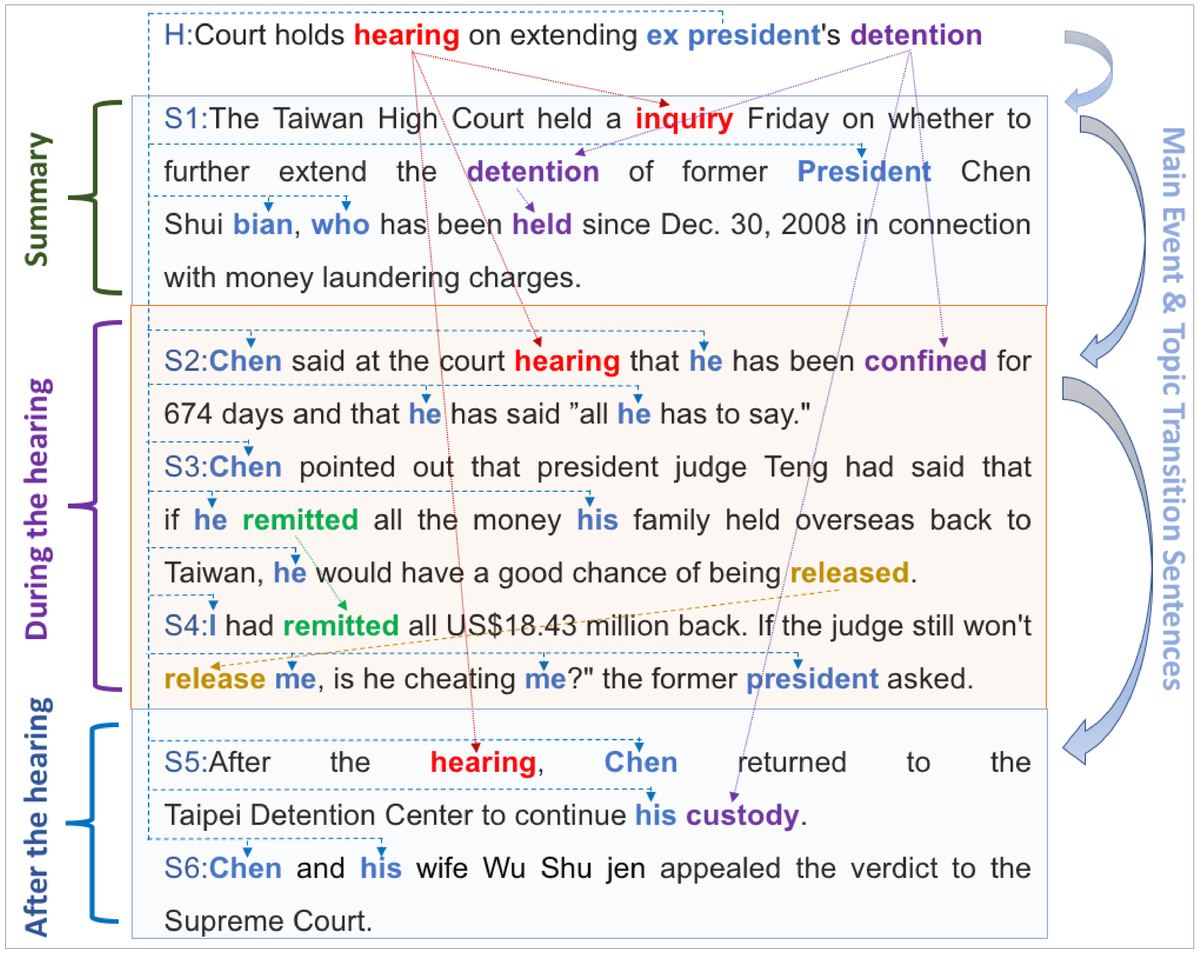

Figure 1: An example document to illustrate the characteristics of event and entity coreference chains.

- **Encourage** coreference links between event mentions (Main events) appearing in Topic Transition Sentences.
- **Encourage** linking more event mentions to a chain that has a large stretch (Global Chain).
- **Encourage** coreference links between event mentions in sentences that contain other known coreferent event mentions.
- **Encourage** more coreference links in initial sections of documents.
- **Discourage** initiating new coreference chain in later part of documents.
- **Discourage** coreference links between Subevents and other event mentions.

Results & Analysis

Datasets: **KBP 2015** for training and news articles in **KBP 2016, 2017** for testing.

Model	BCUB	CEAFE	MUC	BLANC	*AVG*
KBP 2016					
Local Classifier	51.47	47.96	26.29	30.82	39.13
Basic ILP	51.44	47.77	26.65	30.95	39.19
+Discourse	51.67	49.1	34.08	34.08	42.23
Joint Learning	50.16	48.59	32.41	32.72	40.97
KBP 2017					
Local Classifier	50.24	48.47	30.81	29.94	39.87
Basic ILP	50.4	48.49	31.33	30.58	40.2
+Discourse	50.35	48.61	37.24	31.94	42.04

Table 2: Results for event coreference resolution systems on the KBP 2016 and 2017 corpus. Joint Learning results correspond to the result files evaluated in Lu and Ng, 2017.

- Discourse structure augmented model achieved superior performance compared to the local classifier based system across all the metrics.
- Specifically, MUC F1 score, evaluating the pairwise coreference link prediction, improved by over 28%.
- Discourse structure helps in linking lexically diverse coreferent event mentions.

Generalizability

- Structures agnostic to document-genre:
  - main event coreference chains have extended presence.
  - semantically correlated events co-occur.
- Distributional characteristics are genre-specific.
  - segment-wise distributional patterns may require alteration based on domain-specific knowledge.

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References

Jing Lu and Vincent Ng. 2017. Joint learning for event coreference resolution. In Proceedings of the 55th Annual Meeting of the ACL. Volume 1, pages 90-101.