Semantic Graphs Reveal the Narrative Framing in News

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Abstract

News should convey objective information on current events. However, the perception of news not only depends on their neutrality, but also on their framing. According to Entman (1993)[1], the framing of a communicating text depends on the selection and saliency of certain aspects. One such aspect is the narrative information embedded within texts. Such narrative framing can exemplarily be observed in the climate change debate, where the framing of news, although neutral in tone, is noticeably distinct between sources, and specific narratives (e.g., naturally-caused vs. human-made) are propagated. Therefore, our research investigates how and which narratives can be extracted from news articles. We leverage a semantic representation for text called abstract meaning representation (AMR)[2] to encode textual content as graphs and mine those graphs for their narrative information (refer to Figure 1 for an example). By identifying common elements and sub-graphs, we can reveal the narrative framing of a collection of articles. For instance, in previous research, we successfully identified noteworthy distinctions in the reporting between mainstream and conspiracy media on health-related news (e.g., COVID-19). In sum, the mainstream narratives are more science-oriented (e.g., have scientists as actors), while conspiracy narratives are belief-oriented (e.g., are embedded in a religious context). Currently, we broaden our application domain to climate change and strive for a longitudinal study of frame adoption.

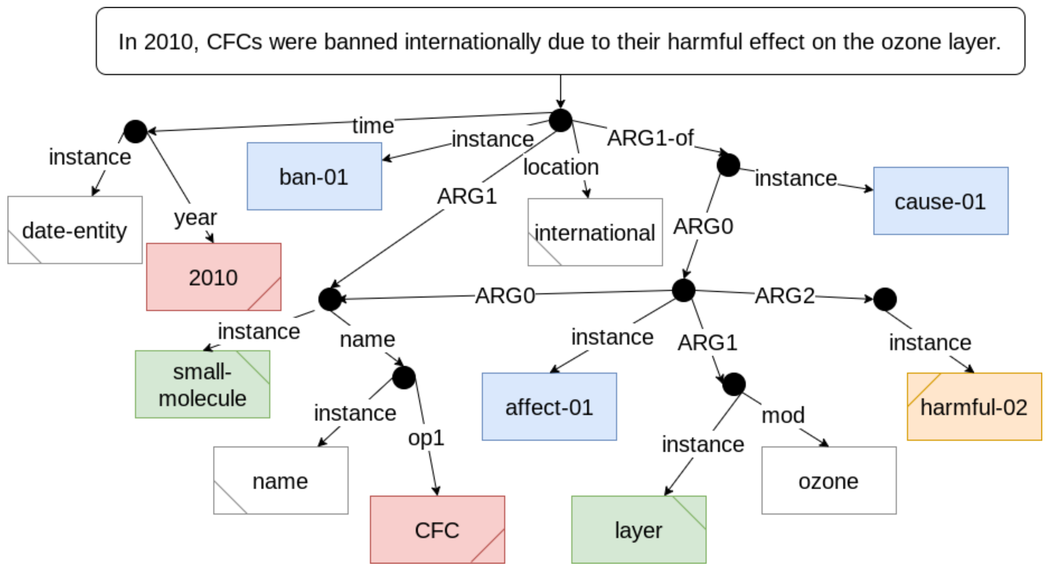

Figure 1: An example sentence regarding climate change encoded as a semantic graph, i.e., AMR, reveals the complex narrative information embedded within. The narrative is about a small molecule that is both the target (i.e., ARG1 relation) of the ban frame and the actor (i.e., ARG0 relation) the affect frame, which is the cause of the former. Hence, implicit semantic information is explicitly represented, which is important for nuanced text analyses, such as framing. A collection of such representations is then mined to reveal selected elements and the salient narratives, i.e., substructures.

AMR Graphs[3]

Goal: intermediate representation for text understanding.

- Conversion: Text → PENMAN ≙ Graphs
- Preserve Semantics
- Mine Substructures for analysis

PENMAN Notation[4]

```
# ::snt In 2010, CFCs were banned internationally due to their harmful effect
on the ozone layer.
(b / ban-01
    :ARG1 (s / small-molecule
        :name (n / name
            :op1 "CFC"))
    :location (ii / international)
    :time (d / date-entity
        :year 2010)
    :ARG1-of (c / cause-01
        :ARG0 (a / affect-01
            :ARG0 s
            :ARG1 (l / layer
                :mod (o / ozone))
            :ARG2 (h / harmful-02))))
```

AMR Properties:

- Structured representation of textual semantics
- Rooted, directed, acyclic graph
- PENMAN serialized form, but equivalent
- Leaf nodes = concepts (via instance relations)
- Edges = relations (e.g., semantic roles)
- Built-in simplifications (e.g., stemming)

Narrative Framing Analysis

Narrative analysis requires more information than individual words (e.g., in comparison with topic models). Nevertheless, we can map individual narrative elements to AMR instances concerning their relations:

- Concepts (ARG0 → agents, ARG1 → patients) ≙ characters
- Semantic frames (derived from verbs + senses) → predicate ≙ plot
- Attributes (e.g., location) ≙ setting

Experimental Results

Comparison of Media Framing between Conspiracy and Mainstream on health-related documents (i.e., COVID-19, diseases, and pharmacology):

- Belief- vs. science-oriented framing as main theme
- Differences in narrative elements
  - Characters (e.g., *Jesus* vs. *scientist*)
  - Plot (e.g., *claim* vs. *infect*)
  - Settings (e.g., *Wuhan* vs. *university*)
- Nuanced differences in sub-structures with common elements (e.g., *prevent individual* vs. *prevent spread*)
- Stable across sub-corpora (e.g., *truth* as narrative element is overrepresented in all three topics in conspiracy media)

Comparison with annotated documents regarding media frames via frame labels.

New application domain is AMR-based analysis regarding climate change debate frame adoption over time.

Discussion

AMR (as a particular kind of semantic graphs) captures the narratives via structural information in news. Hence, advances understanding of framing regarding propagated narratives. Nevertheless, several challenges remain.

Ongoing research:

- Incorporation of moral of the story, and hero/villain distinction (e.g., by incorporating external resources)
- Improved mining techniques for substructures and their comparison
- Intuitive visualization for qualitative analysis (e.g., embedding space)

Future work:

- Beyond-English application and validation
- Integration with existing framing analysis methods

References

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