Integrating Cognitive Neuroscience Insights into NLP: A New Approach to Understanding Narrative Processing (Abstract)

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Abstract

This paper describes how a biological neural network comprehends narratives, with the goal of applying these insights to artificial neural networks. To this end, we present our findings, recently published in Nature Neuroscience [1], detailing a mechanism by which the human brain processes narratives. Our study utilized functional Magnetic Resonance Imaging (fMRI) to monitor brain activity in human participants as they were exposed to narratives. The human brain segments continuous narratives into discrete events that are represented by neural activity. Using a novel fMRI method and a Distributional Semantic Model, we revealed that whenever an event ends, the brain binds the representation of that event with the representations of contextually-relevant past event. This suggests that narrative comprehension is based on the continuous embedding of new events into the narrative context: newly-formed event representations are updated based on prior narrative events that are uploaded from memory. This paper not only summarizes our findings, but also advocates for interdisciplinary collaboration: we aim to inspire the incorporating of cognitive principles into NLP models, which has the potential to improve the way NLP models understand and process narratives.

Keywords

narrative representation, story evolution, shift detection, brain, movie, story, fMRI, cognitive, reactivation, events

References

[1] A. Hahamy, H. Dubossarsky, T. E. Behrens, The human brain reactivates context-specific past information at event boundaries of naturalistic experiences, Nature neuroscience 26 (2023) 1080–1089.