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Investigating Long-Term Context of Language Models on Brain Activity during Narrative Listening in fMRI

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\textbf{Introduction}

- Sequence-based and pretrained language models have been found to be successful for text-driven prediction of brain activations.
- However, these models still lack long-term memory plausibility (i.e. how they deal with long-term dependencies and contextual information).

Can current language models deal with long-term dependencies?

\textbf{Questions}

- What kind of language models can represent long-term dependencies?
- Could these language models also predict better brain activity while subjects are engaged in longer stories?

\textbf{Main Contributions}

- We propose the problem of finding which type of language models are the most predictive of fMRI brain activity for listening tasks.

\textbf{Models Considered}

- GloVe, Long Short-Term Memory Networks (LSTM)
- ELMo, Longformer

\textbf{Evaluation Metrics}

- 2V2 Accuracy
- Pearson Correlation ($R$)

\textbf{Cognitive Insights}

- In LSTM, the cell state representations (long term memory vector) yield better encoding performance than hidden state representations.
- We used different layers of ELMo and Longformer, where higher layers display better correlation for ELMo while intermediate layers show superior performance for Longformer.

\textbf{Conclusion}

- Language models with longer context (e.g. Longformer) better predict brain activity while subjects listening to stories.
- Future Directions: (i) Use more plausible language models than Transformers. (ii) Make hierarchical language models.

\textbf{References}


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