

A Framework for Decoding Event-Related Potentials from Text

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Background

- Event-related potentials (ERPs) used to probe rapid, online language processing Kuperberg, 2016
- Growing interest in language processing with natural stimuli Frank et al., 2015; Broderick et al., 2018
- Novel analyses are required that...
 - ...enable broadly applicable quantitative comparison of online language processing
 - ...abstract over aspects of ERP signals not relevant to language processing

Proposal

- Pre-train autoencoder to compress ERP data
- Fix decoder parameters and replace encoder with language model

Take-home Message

- ERPs well reconstructed by autoencoders
- Word embeddings...
 - ...do *not* improve semantic processing over surprisal and semantic distance.
 - ...show biggest contribution for perceptual/morphological processing

Autoencoder

- Different levels of compression based on EEG frequency bands

# of (Latent) Time Steps	# of (Latent) Electrodes	
200	32	Gamma
100	32	
34	32	
17	16	
9	8	Beta
5	4	
		Alpha
		Theta

Models

- Baseline variables
 - Frequency, Surprisal, Semantic Distance
- Word embeddings
 - Static: GloVe Pennington et al., 2014
 - Contextual: ELMo Peters et al., 2018

