

An intracranial EEG natural scenes dataset to integrate electrophysiology with fMRI

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The iEEG Natural Scenes Dataset

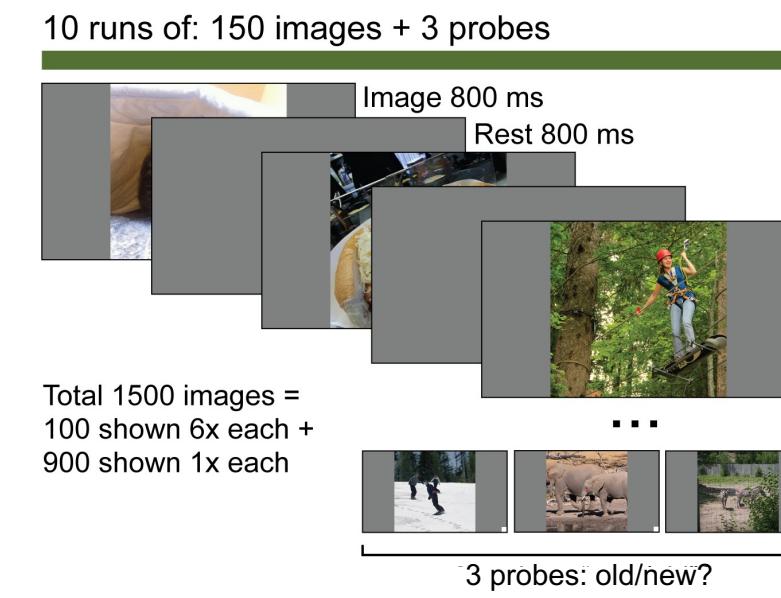
The massive 7T fMRI Natural Scenes Dataset was recently released (1).

These fMRI data provide a highly robust dataset for developing encoding models of human vision.

To resolve the temporal dynamics of the underlying neurophysiological signals, we collected the iEEG-NSD dataset.

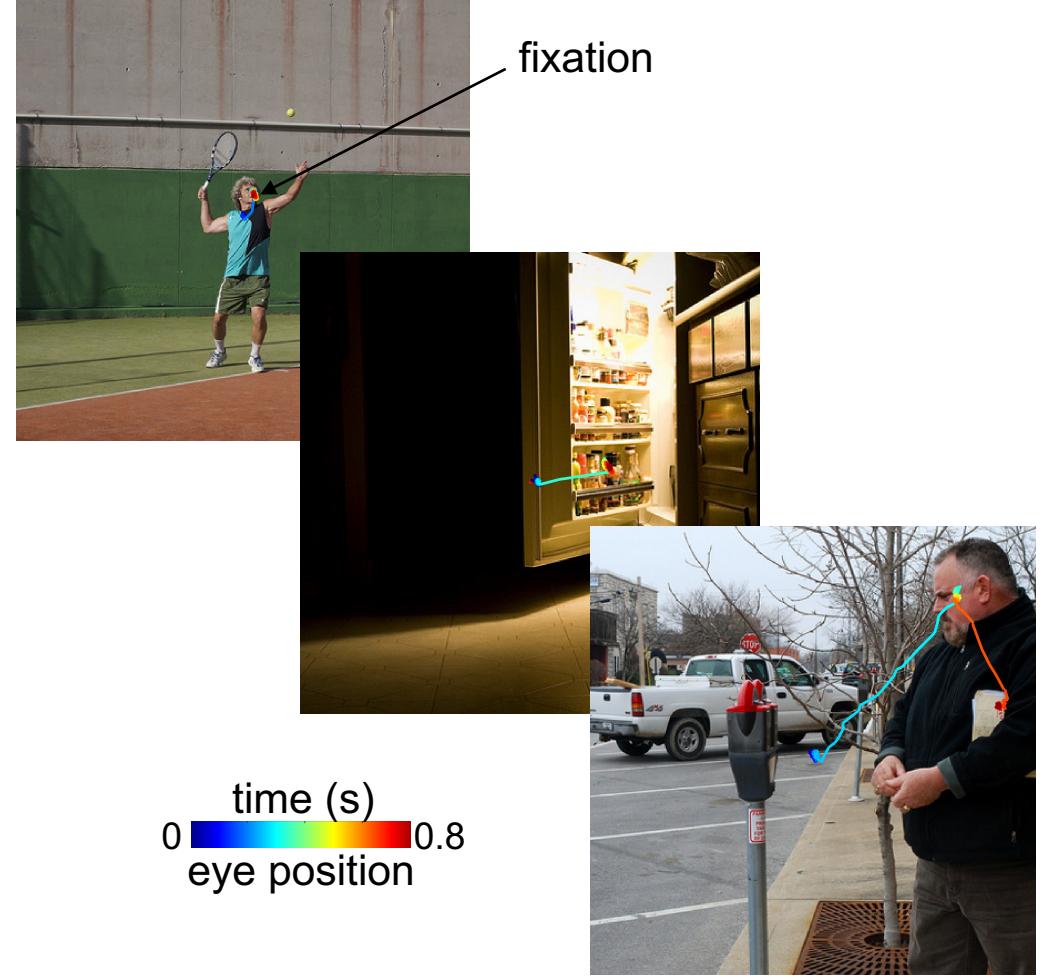
iEEG NSD design

Intracranial stereo EEG data were recorded in 16 patients at 1200-2400 Hz.



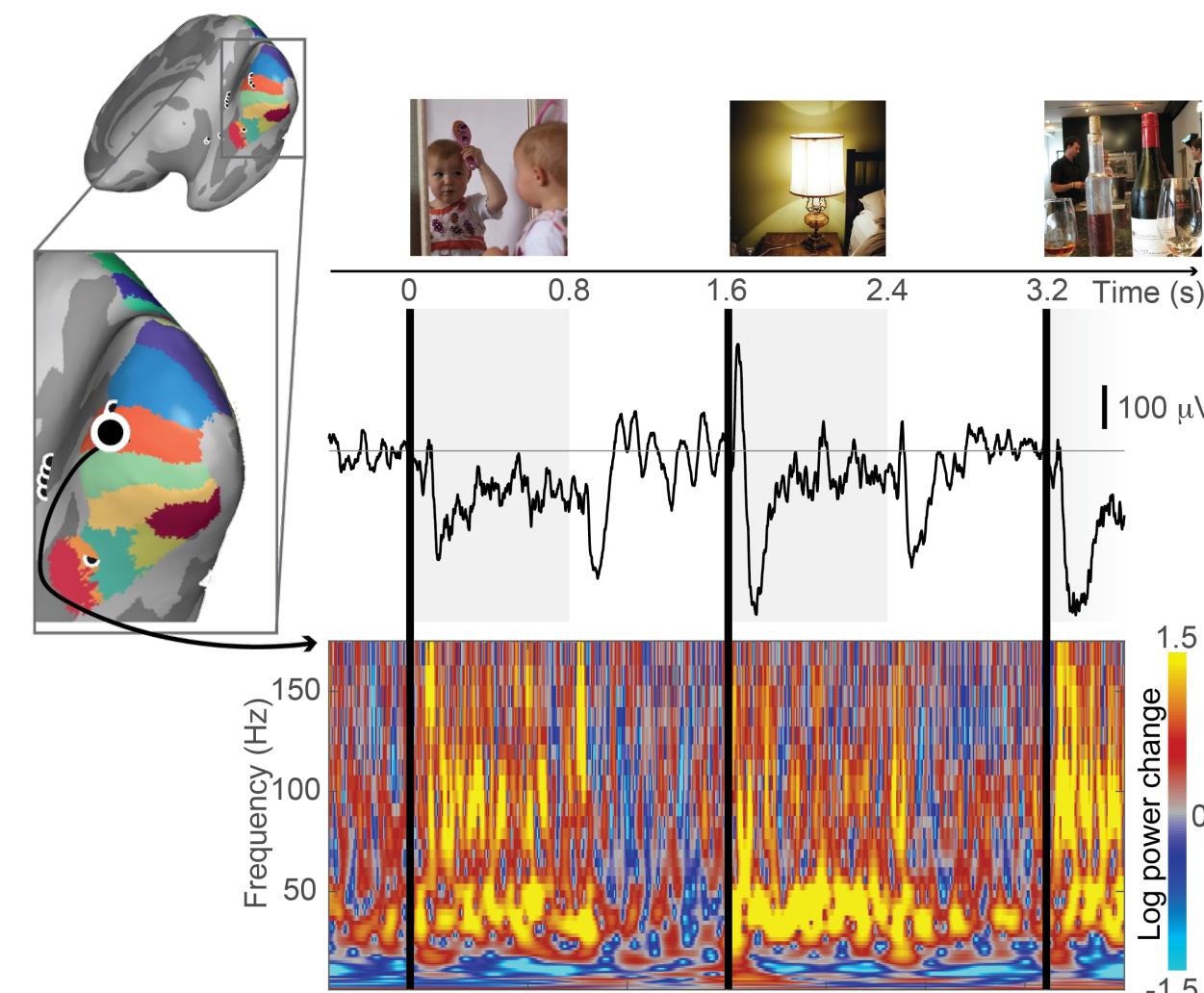
Concurrent eye tracking data

Patients were instructed to fixate, a Tobii Pro Spectrum 1000 Hz was used for eye tracking.

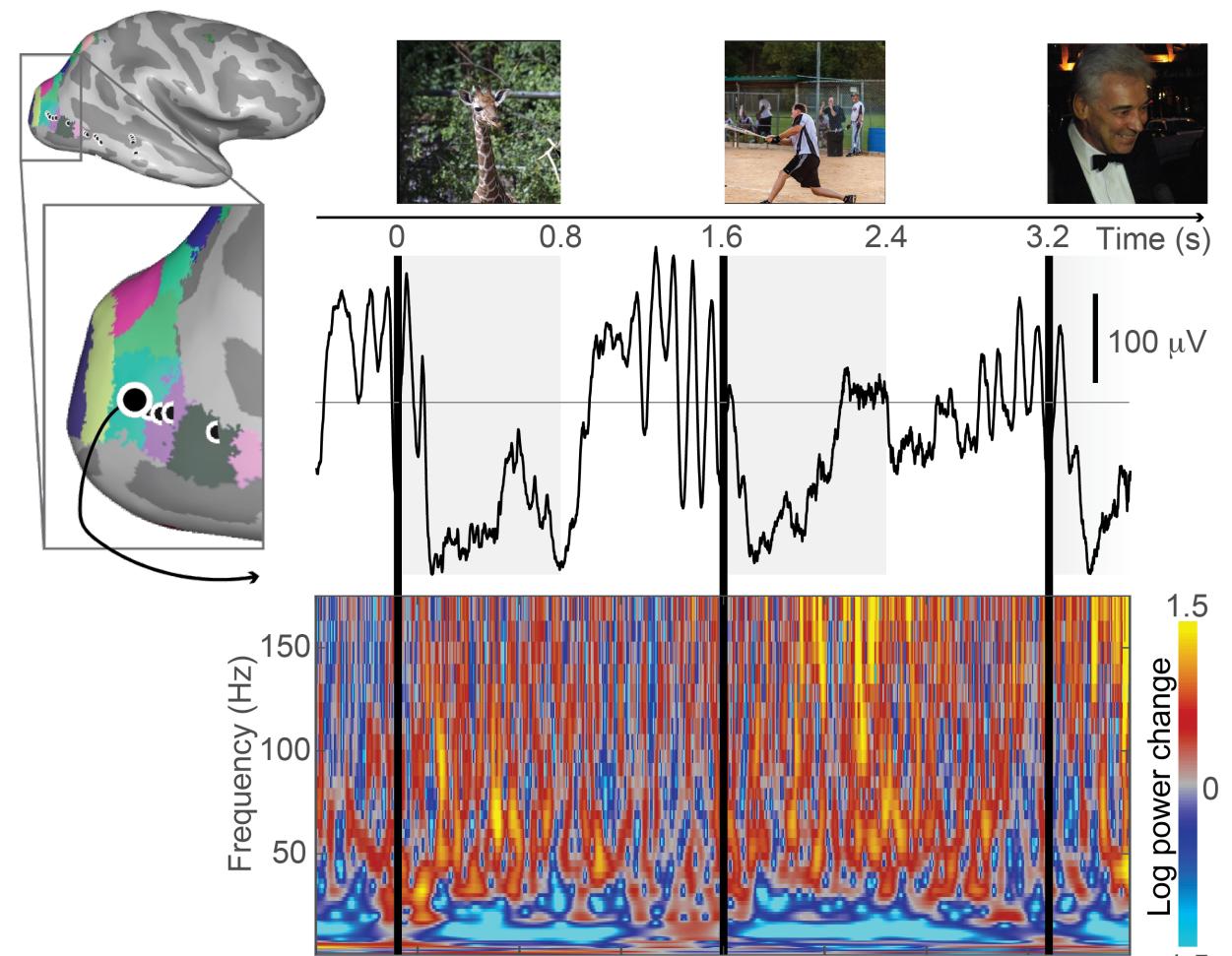


Timing allows for rich neural signal extraction

Example single trial data from a V1v electrode.



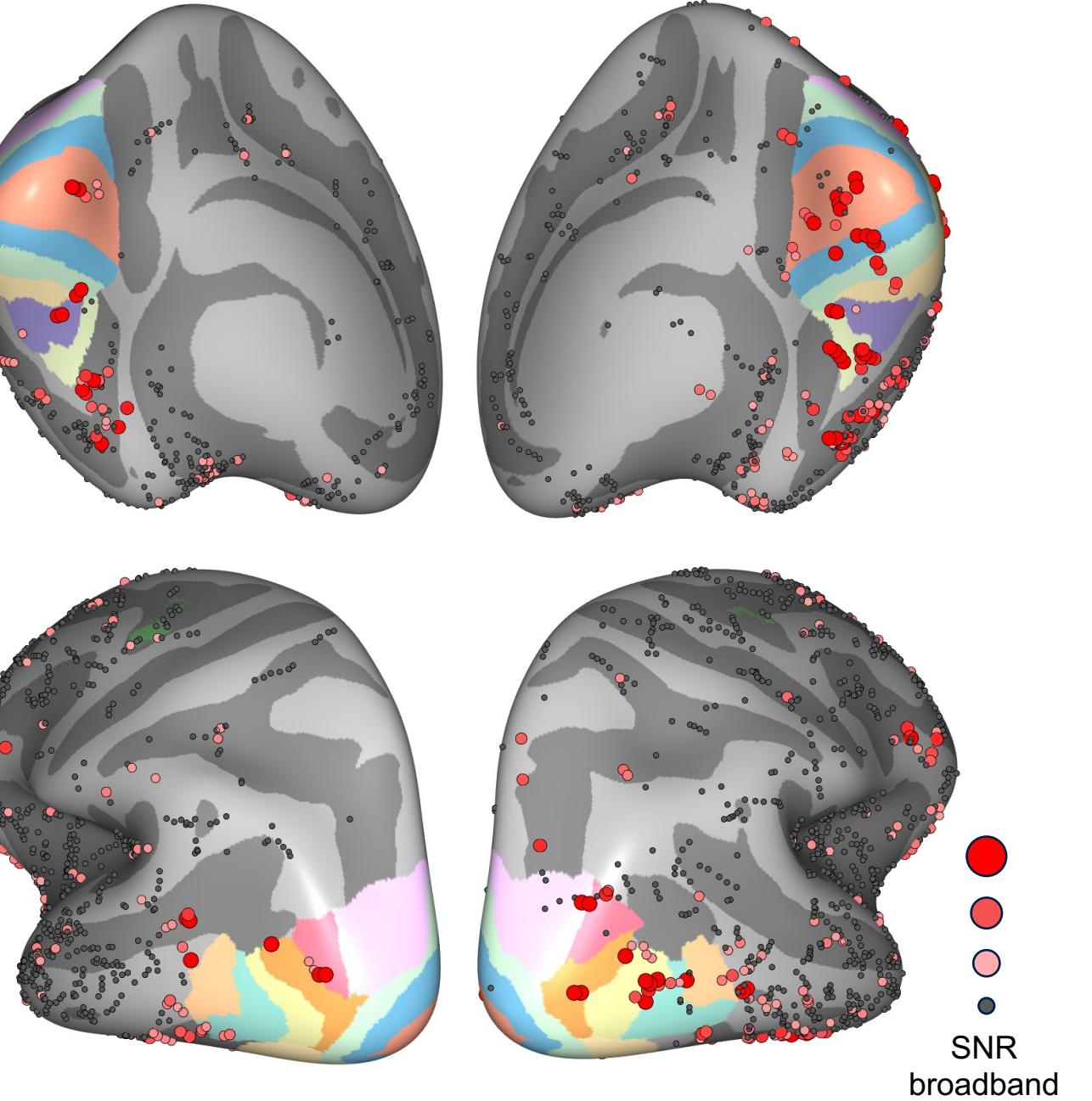
Example single trial data from an LO electrode.



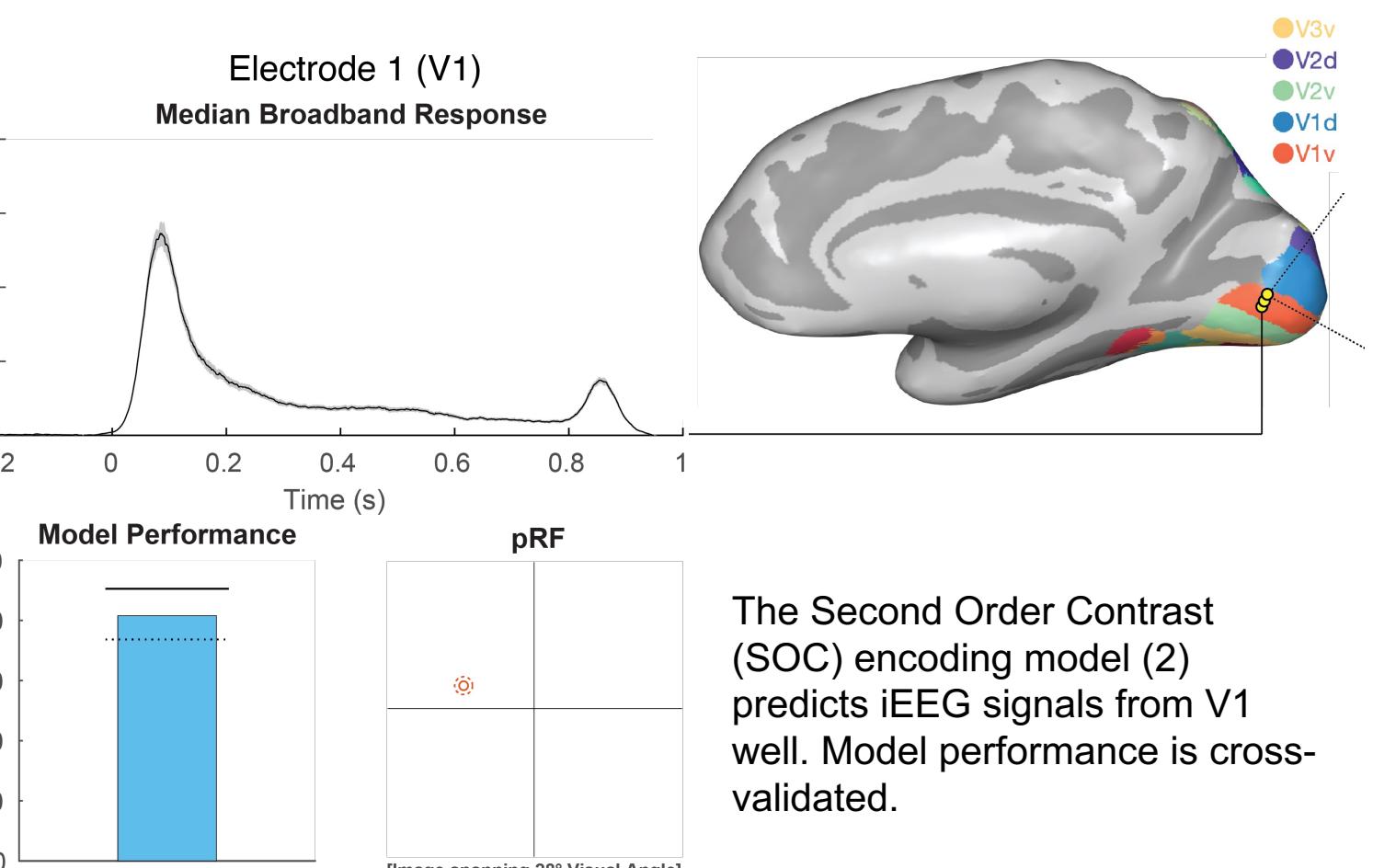
- iEEG data reveal:
- Evoked potentials at image onset and sometimes at offset
 - Broadband power increases
 - Low frequency (10-20Hz) power decreases
 - Narrowband gamma oscillations (sometimes)

Visual encodability and decodability

>300 electrodes showed broadband stimulus selectivity
>90 electrodes in visual Benson atlas locations

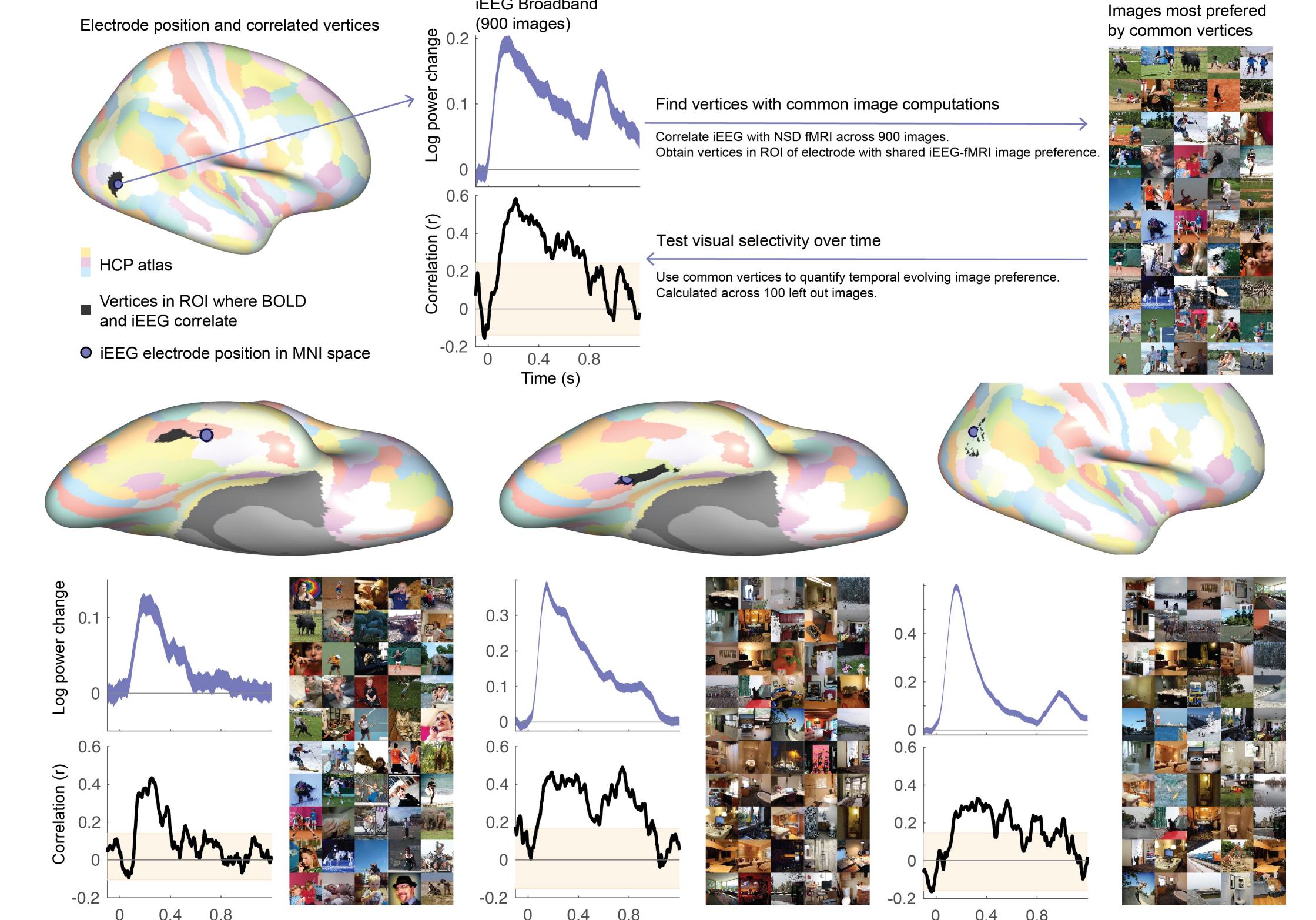


Visual encoding models can predict iEEG broadband power



The Second Order Contrast (SOC) encoding model (2) predicts iEEG signals from V1 well. Model performance is cross-validated.

Stimulus selectivity evolves over time



Summary

- NSD-iEEG data from 16 subject are fully curated in the Brain Imaging Data Structure (BIDS).
- Trials with artifacts and bad channels are annotated.
- Preprocessed data will be available for easy use.
- NSD-iEEG data are suitable for computational modeling (high quality responses to 1000 richly annotated images).
- The NSD-iEEG data are compatible with the massive NSD-fMRI dataset (1).
- Data will be released with publication.

References

- Allen, St-Yves, Wu, Breedlove, Prince, Dowdle, Nau, Caron, Pestilli, Charest, Hutchinson, Naselaris, Kay. *Nature Neuro.* 2022.
- Kay, Winawer, Rokem, Mezer, Wandell. *PLoS CB.* 2013.

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