| Journal Name | Title | Date Published Y/M/D | Author(s) | Question Being Investigated | Methods Used | Findings |
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| Nature Neuroscience | Long-Lasting, Dissociable Improvements in Working Memory and Long-Term Memory in Adults with Repetitive Neuromodulation | 2022/8/22 | Shrey Grover, Wen Wen, Vighnesh Viswanathan, Christopher T. Gill, & Robert M. G. Reinhart | Can long-term memory and/or working memory in older adults be selectively improved through repetitive neuromodulation? | This study uses a randomized, double-blind study of two sham-controlled experiments and an additional experiment, each using different frequencies for repetitive neuromodulation | Selective improvements to long-term memory and working memory are possible through neuromodulation, depending on the frequencies of the modulations, and were seen a month after the experiments were conducted in many participants who initially had poorer cognitive functioning |
| HAL Open Science | Decoding Speech from Non-Invasive Brain Recordings | 2022/8/25 | Alexandre Défossez, Charlotte Caucheteux, Jérémy Rapin, Ori Kabeli, & Jean-Rémi King | Can non-invasive recordings of brain activity decode natural speech? | This study used brain activity recordings from MEG and EEG while participants listened to sentences and/or stories, and decoded results using wav2vec 2.0, which is trained to transform the data to predict masked parts of its own latent representations to decode linguistic features | The model had a high success rate in decoding natural speech particularly using the MEG data, and had lower but still decent accuracy for EEG data. Overall the study found that combining contrastive objects, convolutional architecture enhanced by a "subject layer," and pretrained speech representations all greatly improve the accuracy of decoding natural speech |
| BioRxiv | High-Resolution Image Reconstruction with Latent Diffusion Models from Human Brain Activity | 2023/3/11 | Yu Takagi & Shinji Nishimoto | Can images be reconstructed using human brain activity? | This study uses fMRI data and diffusion models, as well as latent diffusion models, decoding analysis, and encoding analysis in order to record, interpret, and reconstruct images from brain data | High-resolution images were constructed from human brain activity, but some images were visually inconsistent. Reconstruction quality overall was stable and accurate across subjects |
| IEEE Computer Society | Seeing Beyond the Brain: Conditional Diffusion Model with Sparse Masked Modeling for Vision Decoding | 2023/3/29 | Zijiao Chen, Jiaxin Qing, Tiange Xiang, Wan Lin Yue, & Juan Helen Zhou | Can MinD-Vis (Sparse Masked Brain Modeling with Double-Conditioned Latet Diffusion Model for Human Vision Decoding) accurately reconstruct high-quality images with correct semantics from brain recordings? | This study used fMRI data using mask modeling in a large latent space, and then augmented a latent diffusion model with double-conditioning | The MinD-Vis outperformed other models the authors used as comparison, and it was able to present a higher-quality image reconstruction with improved detail compared to previous methods |
| Nature Neuroscience | Semantic Reconstruction of Continuous Language from Non-Invasive Brain Recordings | 2023/5/1 | Jerry Tang, Amanda LeBel, Shailee Jain, & Alexander G. Huth | Can non-invasive technology decode and reconstruct continuous language? | This study used fMRI data of participants listening to narrative stories and a language model to detect and propose continuations for the sequence | Not only were decoded word sequences capturing the meaning of the stimuli, but also often specific words and phrases. When testing whether the decoded words captured the original meaning of the stories, 9 out of 16 reading comprehension questions could be answered by subjects who had only read the decoded words. They also conducted an experiment which found that not only can words the participants heard be decoded, but also the general meaning of imagined stimuli of the participants were successfully captured |
| IOP Science Journal of Neural Engineering | Direct speech reconstruction from sensorimotor brain activity with optimized deep learning models | 2023/7/19 | Julia Berezutskaya, Zachary V. Freudenburg, Mariska J. Vansteensel, Erik J. Aarnoutse, Nick F. Ramsey, Marcel A.J. van Gerven | What is the best approach to speech decoding from neural data for brain-computer interface (BCI) communication? | The researchers used high-density ECoG recordings to record neural activity from the participant's sensorimotor cortex. They then used machine learning algorithms to train models to reconstruct the participant's speech from the ECoG signals. The researchers evaluated the performance of their decoding approach by decoding individual words from the reconstructed speech and by having human listeners rate its intelligibility. | The researchers found that carefully training the machine learning models used to reconstruct speech is essential for achieving the best results. They were able to achieve individual word decoding accuracy of 92-100%, which is much higher than the chance level of 8%. The reconstructed speech was also intelligible to human listeners. These findings suggest that reconstruction-based speech decoding from sensorimotor cortex has the potential to be a promising approach for developing next-generation BCI technology for communication |
| PLOS Biology | Music can be reconstructed from human auditory cortex activity using nonlinear decoding models | 2023/8/15 | Ludovic Bellier, Anaïs Llorens , Deborah Marciano, Aysegul Gunduz, Gerwin Schalk, Peter Brunner, Robert T. Knight | What are the neural correlates of music perception? | The researchers used intracranial electroencephalography (iEEG) recordings from 29 patients who listened to a Pink Floyd song to decode the neural recordings into a recognizable song using a computational stimulus reconstruction approach. This approach had previously been used to decode speech, but this was the first time it had been used to decode music. The researchers found that they were able to reconstruct the song with a high degree of accuracy, suggesting that the stimulus reconstruction approach is a promising way to decode music from neural recordings. | The researchers found that the right hemisphere of the brain is dominant for music perception, with a primary role of the superior temporal gyrus (STG). They also found a new STG subregion that is tuned to musical rhythm, and that the STG exhibits sustained and onset responses to musical elements. These findings show that predictive modeling can be used to decode music from neural recordings, which could pave the way for new brain-computer interface (BCI) applications. |
| Nature | A high-performance neuroprosthesis for speech decoding and avatar control | 2023/8/23 | Sean L. Metzger, Kaylo T. Littlejohn, Alexander B. Silva, David A. Moses, Margaret P. Seaton, Ran Wang, Maximilian E. Dougherty, Jessie R. Liu, Peter Wu, Michael A. Berger, Inga Zhuravleva, Adelyn Tu-Chan, Karunesh Ganguly, Gopala K. Anumanchipalli & Edward F. Chang | Can we develop a speech neuroprosthesis that can restore natural communication to people with severe paralysis? | The researchers used a high-density electrode array (ECoG) to record neural activity from the participant's speech cortex. They then used deep learning algorithms to train models to decode the neural activity into speech signals. The models were able to decode the neural activity in real time and output the decoded speech signals in three different modalities: text, speech audio, and facial-avatar animation. | The findings introduce a multimodal speech-neuroprosthetic approach that has substantial promise to restore full, embodied communication to people living with severe paralysis through construction of an avatar through neural data |