Extracting magneto encephalography-quality insights from electro encephalography data.

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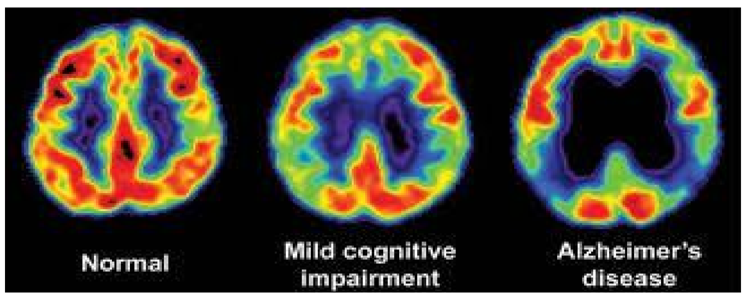
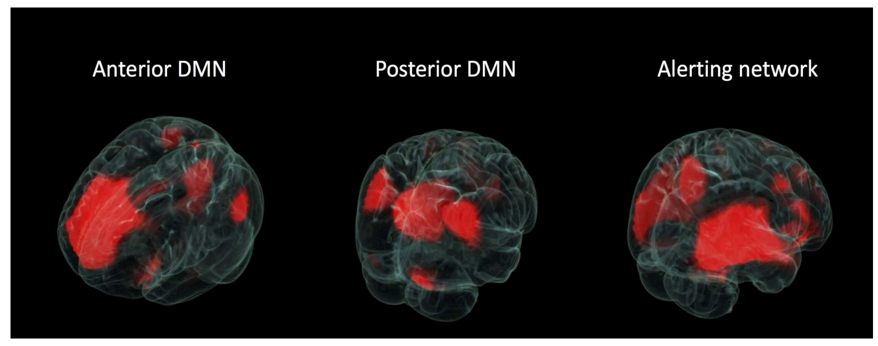
Brain Imaging

Quantifying the activity in regions of the brain is paramount in diagnostics.

Both Alzheimer's disease and epilepsy can be observed using brain imaging.

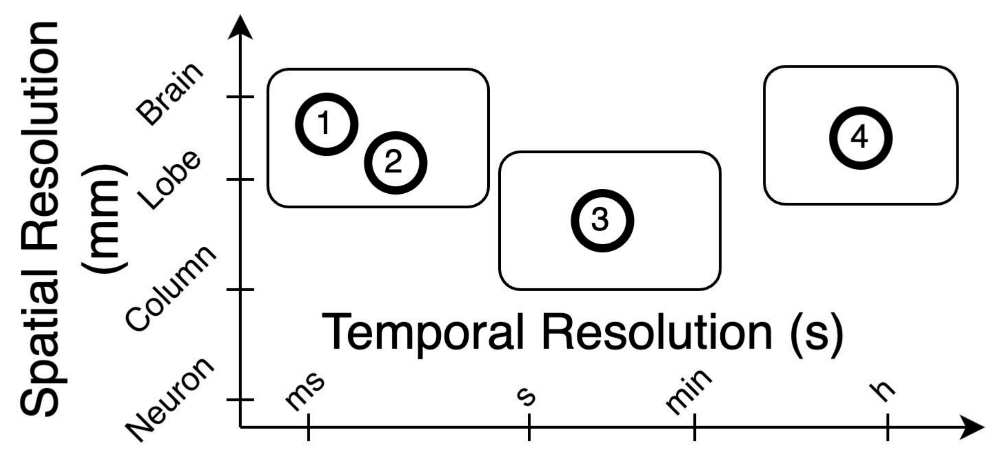




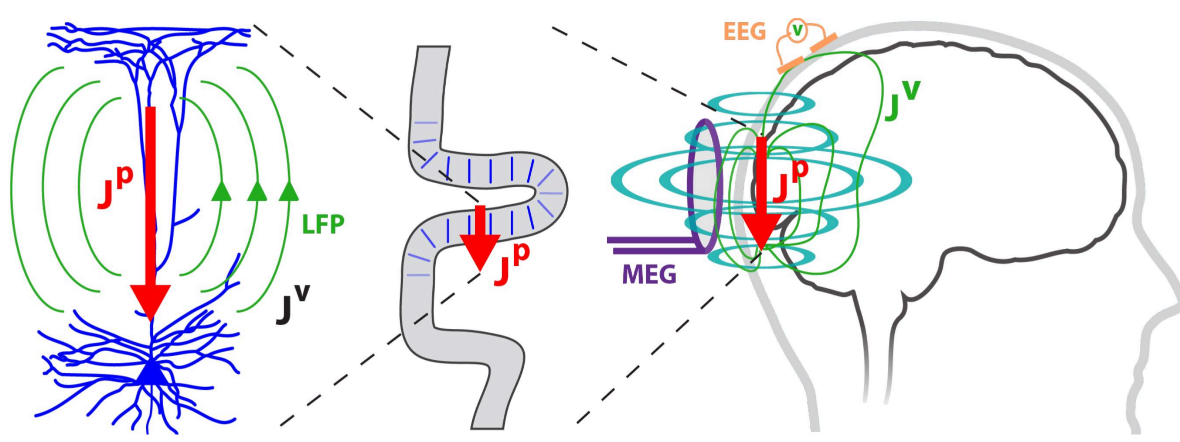
Imaging techniques reconstruct levels of brain activity.

Temporal ⏱ and Spatial 🔍 **resolution determine the quality** of imaging techniques.

① EEG	② MEG	③ fMRI	④ PET
high ⏱	**high** ⏱	low ⏱	low ⏱
poor 🔍	**high** 🔍	high 🔍	low 🔍
low 💵	**high** 💵	high 💵	high 💵
low ⛓	high ⛓	high ⛓	high ⛓



⚡ Whenever **high temporal resolution is crucial → EEG/MEG** ⚡



Both EEG and MEG **capture the electrical activity deriving from synapses.**

Electrical **currents suffer distortion** (hindering spatial resolution) from the **skull**.

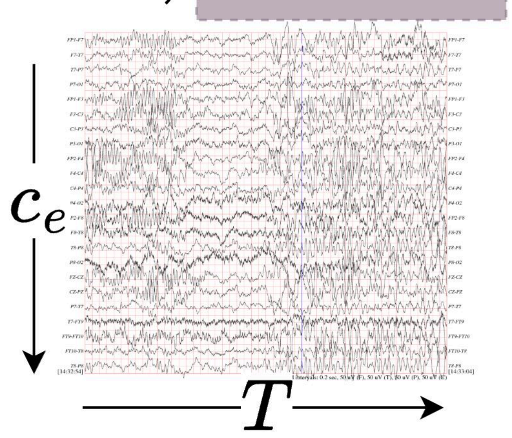
Magnetic field permeates the skull without suffering from distortion.

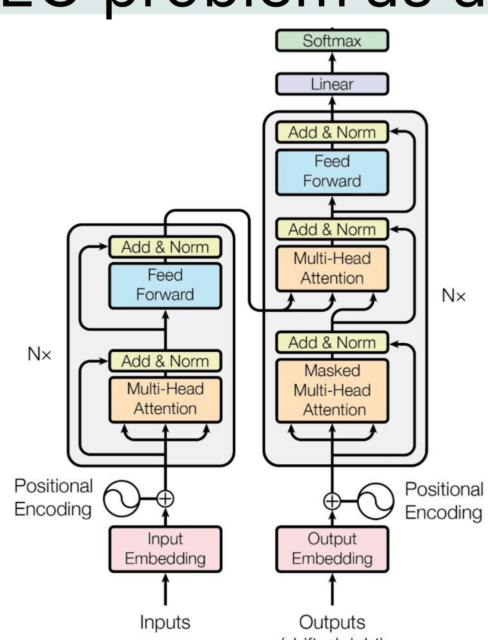
Background

Translating EEG to MEG

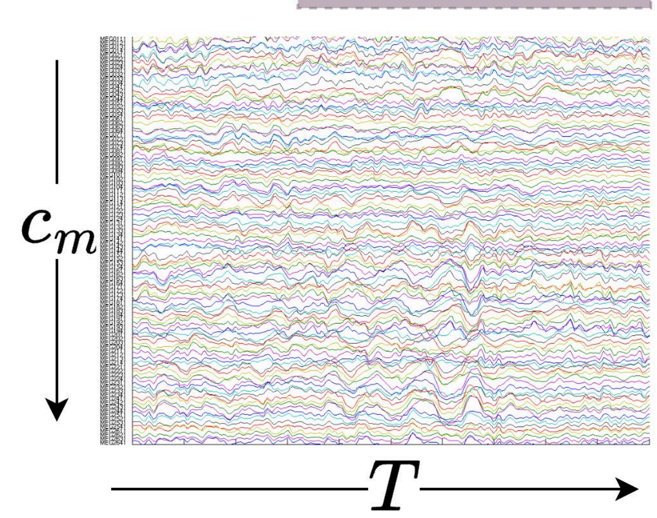
📚 We **model** the EEG-to-MEG problem as a **language-translation problem**

EEG, $e \in \mathbb{R}^{c_e \times T}$





MEG, $m \in \mathbb{R}^{c_m \times T}$



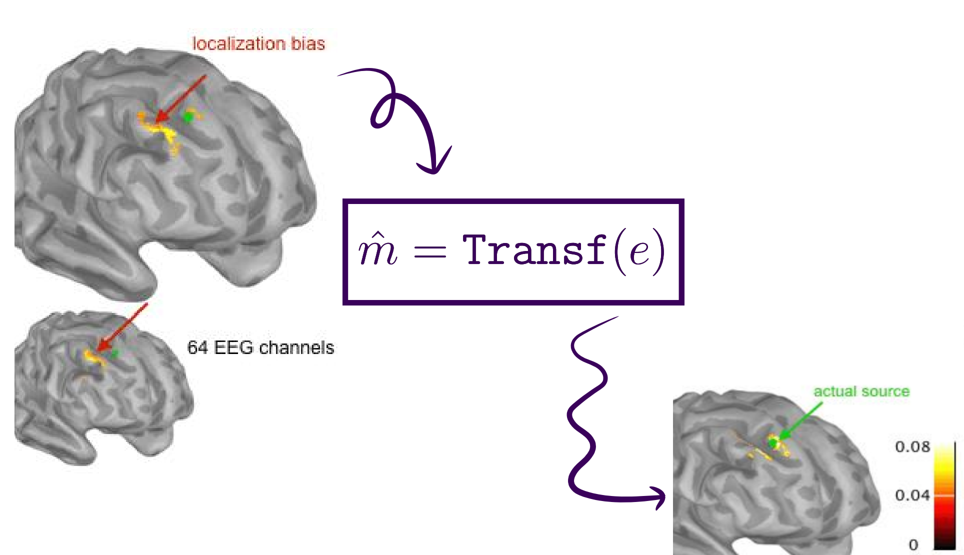
😅 **No internet-scale dataset** for brain data!

① **Pre-train EEG-Encoder** — Pre-train the encoder model on **EEG-specific dataset**

② **Pre-train MEG-Decoder** — Pre-train the decoder model on **MEG-specific dataset**

③ **Tune for EEG-to-MEG** — **Align encoder and decoder** representation using the limited data available.

Converting EEG→MEG **improves on the signal spatial resolution** 🔍**, at iso**💵.



Method