BRAINstorming

Create a single slide on your idea to present on Jan 8

Welcoming unpolished rough concepts or polished ideas w/ figures

End-to-end EEG to Image

Adapting fMRI reconstruction to image reconstruction from EEGs

- Architectural improvements to https://github.com/bbaaii/DreamDiffusion

We get to gather our own dataset

Real subject tests with imagined imagery, dream imagery, mobile interfaces

Partnering with the University of Toronto EEG lab

Data collection starts January 15

Interest sheet	**Name**	**Contact (email, Discord, etc.)**
	Paul Scotti	Discord: @paulscotti
	Jonathan Xu	Discord: @jonxuxu
	Joseph Pollack	Discord : @Tonic_1
	Reese Kneeland	Discord: @reesekneeland
	Ernesto Scordo	Discord: @ernomayer
	Tong Chen	Discord: @Tong
	Amir Refaee	Discord: @amirr13
	Yash Sabharwal	Discord: @yash18
	Tomas Jelinek	Discord: @tomasjelinek
	Riya Sharma	Discord: @riyamsharma
	Ramani Tyagi	Discord: @ramen5321
	Utkarsh Singh	Discord: @utxrsh_11139 Email: utxrshsingh@gmail.com
	Andrea Vitale	Discord: @tale_andrea andrea.vitale@gmail.com
	Martyna Spyra	Discord: @grendelaglaeca martyna.m.spyra@gmail.com
	Rishikesh Magar	Discord: @Rishi

MEG based video decoding

Use new open source video models and high temporal resolution MEG decoding (at least every ~500ms) for a continuous video decoding on THINGS-MEG. Meta paper.

- Will probably require some latent space blending between video segments
- MEG is likely the only modality with enough temporal resolution to do continuous video.

Interest sheet	**Name**	**Contact (email, Discord, etc.)**
	Paul Scotti	Discord: @paulscotti
	Reese Kneeland	Discord: @reesekneeland
	Utkarsh Singh	Discord: @utxrsh_11139 Email: utxrshsingh@gmail.com
	james hennessy	discord@punishedjamesthesnake
	Andrea Vitale	Discord: @tale_andrea andrea.vitale@gmail.com

Decode/map reconstructions to behavioral embedding

Image space is insufficient to capture conscious perceptual representations, as humans subconsciously filter and abstract visual information.

How can we more accurately measure and represent the perceptual content of a decoded experience?

- Form an interpretable space of behaviorally relevant dimensions humans are definitely conscious of from subjective data (already done)
- Train a model to map brain activity to this space
- Train a model to map reconstructed images of brain activity to this space
- compare

Interest sheet	**<u>Name</u>**	**<u>Contact (email, Discord, etc.)</u>**
	Paul Scotti	Discord: @paulscotti
	Reese Kneeland	Discord: @reesekneeland

Brain-based image filtering

This paper trained encoding models to predict fMRI activity corresponding to seen images. Images → pretrained latent space like CLIP → ridge regression to predicted fMRI activity

Looking at results across hundreds of different pretrained models, the by far biggest factor that led to improved encoding performance was the underlying image diversity of imageset used to train the pretrained model! E.g., even though we don't know the images used to train OpenAI's CLIP, authors could infer that the diversity of the imageset was the reason it performed so well as encoding model space. Note that image diversity is different from size of the dataset (which was *not* strongly related to performance)

SO we can use brain-based encoding model as a way to gauge the image diversity of a pretrained model even when we don't have access to the underlying imageset. This suggests we can actually use brain-based encoding as a way to quantify image diversity, meaning we can actually use it as a novel form of image dataset distillation!

Interest sheet	**Name**	**Contact (email, Discord, etc.)**
	Paul Scotti	Discord: @paulscotti
	Joseph Pollack	Discord: @Tonic_1
	Souvik Mandal	Discord: @Kaladin
	Jonathan Xu	Discord: @jonxuxu
	Utkarsh Singh	Discord: @utxrsh_11139 Email: utxrshsingh@gmail.com

Manifold shared subject spaces

Our in-prep MindEye 2 paper shows the potential of using ridge regression as a simple means to accomplish shared subject model spaces. It works incredibly well to reduce training data required for new subjects, but we never even tried other alternatives to ridge. Maybe more fancy manifold-based approaches work even better?

E.g., https://arxiv.org/pdf/2201.00622.pdf, https://www.nature.com/articles/s41586-023-06031-6

Interest sheet	<u>**Name**</u>	<u>**Contact (email, Discord, etc.)**</u>
	Paul Scotti	Discord: @paulscotti
	Diego Garcia	Discord: @diegogcerdas

DINOv2 for Radiology

Adapt DINOv2 (leading SSL model and pre-training paradigm) to radiology by continuing its training on radiological data, similar to MedSAM. However, with some changes: (1) adapt DINOv2 weights to the 3D domain using weight inflation to incorporate depth information, (2) train on multimodal 2D and 3D radiological data encompassing X-ray CT and MRI to increase dataset size and representation generalizability (using Omnivore's method) (3), and using a self-supervised learning method that works on 3D data (possibility adapting the original DINOv2 method to 3D).

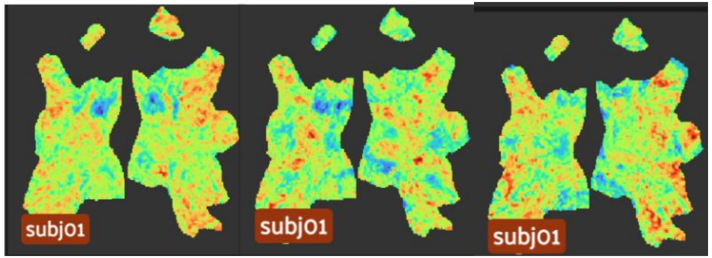
Preliminary paper: https://arxiv.org/abs/2312.02366

More details:
https://docs.google.com/presentation/d/1VtAXNPC8Hd50UYON5w7PONGjkrAg8869hwS4L0S3nUg/edit

Interest sheet	**Name**	**Contact (email, Discord, etc.)**
	Paul Scotti Joseph Pollack Souvik Mandal **Mohammed Baharoon** Ankit Singh Ernesto Scordo Syed Abdul Yash Sabharwal Tomas Jelinek Utkarsh Singh Ihab Bendid Ramani Tyagi	Discord: @paulscotti @tonic_1 @kaladin @mohammedsb, MohammedSalimAB@outlook.com @griffintaur | ankitsingh135@gmail.com Discord: @ernomayer | Email: ernestosegundo@gmail.com @abdksyed @yash18 @tomasjelinek Discord: @utxrsh_11139 Email: utxrshsingh@gmail.com @Ihab Discord: @ramen5321

Enabling human perception of fMRI maps

Which is the odd one out?



Humans struggle to see patterns in fMRI maps

Can we improve human fMRI pattern recognition performance?

1. Train a deep net on fmri
2. Visualize deep net feature maps
3. Measure human recognition performance on raw maps vs feature maps

Nb, mindeye is already a partial way to do this

Interest sheet	<u>Name</u> Connor	<u>Contact (email, Discord, etc.)</u>