Mayukh Deb

mayukhmainak2000@gmail.com mayukhdeb.github.io mayukhdeb mayukhdeb

Education

Georgia Institute of Technology *Aug 2024 – Present*

PhD Student - Cognition and Brain Science - Murtylab - PI: Ratan Murty

- Building brain-inspired algorithms to improve Language and Vision models (see recent work: toponets)
- Training self-supervised vision models on egocentric video data captured on the Meta Aria research kit
- Exploring ways to build more efficient vision models through structured sparsity and recurrent inference
- Figuring out ways to *control* where different capabilities emerge in vision models

Publications (Google Scholar)

TopoNets (ICLR 2025 Spotlight → toponets.github.io) Jan 2025

Mayukh Deb, Mainak Deb, N. Apurva Ratan Murty
Inducing topographic structure in Vision and Language models (GPTs). Yielded brain-like functional organization, lower dimensionality, and efficiency through structured pruning.
Featured by College of Sciences News @ Georgia Tech

AtMan (NeurIPS 2023 + featured in **Scientific American)** Jan 2023

Mayukh Deb*, Björn Deiseroth*, Samuel Weinbach* et al. (* = equal contribution)
Causally trace and explain LLM outputs without gradients. Works on anything with attention. Foundation behind Aleph-Alpha's Explain functionality

DORA (ICLR 2023 Trustworthy ML workshop + TMLR) June 2022

Kiril Bykov, **Mayukh Deb**, Klaus Robert Müller et al.
Clustering neurons and detecting spurious outlier features with feature-vis.

CONFORM: A Project to Create Crowd-Sourced Open Neuroscience fMRI Foundation Models (**NeurIPS 2025 Workshop**) Nov 2025

Benjamin Lahner, Andrew Luo, Jacob Prince **Mayukh Deb**, Leila Webhe, Aude Oliva, N. Apurva Ratan Murty, Michael J. Tarr et al.
A proposal for a crowd-sourced fMRI foundation model that integrates large-scale data aggregation, generative denoising, and meta-learning to overcome current limits in human neuroimaging.

MOSAIC: A Scalable Framework for fMRI dataset aggregation and modeling of human vision (**preprint + webpage + python library**) Nov 2025

Benjamin Lahner, **Mayukh Deb**, Aude Oliva, N. Apurva Ratan Murty
MOSAIC is composed of eight large-scale vision fMRI datasets totaling 93 subjects, 430,007 fMRI-stimulus pairs, and 162,839 naturalistic and artificial stimuli. It enables large-scale pre-training of Vision models on human fMRI data.

End-to-end Topographic Auditory models Replicate Signatures of the Human Auditory Cortex (**ArXiv preprint**, under review) Sep 2025

Haider Al-Tahan, **Mayukh Deb**, Jenelle Feather, N. Apurva Ratan Murty
The first end-to-end topographic deep neural networks for audition. Showed signatures like tonotopic maps, Music and Speech selectivity, etc while preserving model performance.

Talks

Vision Sciences Society, 2025 (abstract, YouTube video) Jan 2025

Experience

Research Engineer @ Aleph-Alpha *Nov 2021 – May 2023*

- Led their Trustworthy AI project and built AtMan
- AtMan was the foundation behind Aleph-Alpha's "explain" API for LLMs

- Also worked on building multimodal search-engines.

Research Intern @ MIT Brain + Cognitive Sciences *May 2023 - Dec 2023*

Worked with Dr. Nancy Kanwisher's lab on 2 projects:

- Inducing brain-like topographic structure in transformers (eventually led to toponets)
- Training data-constrained vision models on fMRI data

Research Engineer @ Eden.Art *Dec 2023 – Aug 2024*

- Implemeted tools like Textual Inversion, IP-Adapters and ZipLoRA into production.
- Built flexible pipelines to fine-tune diffusion models (SDXL, SD3) quickly on user data

Intern @ RunwayML *Jan 2021 – Feb 2021*

- Implemented, optimized (1.4x speedup) and dockerized pipelines for optical-flow (RAFT) and video frame interpolation (RIFE) models to be used in Runway's video editing tool.

Google Summer of Code @ INCF *May 2020 – Aug 2020*

- Worked with OpenWorm to train models to extract metadata from microscopic videos/images embryos
- Also mentored two contributors in GSoC 2023.

Open Source (over 100k installs on pip)

TopoLoss - 4k downloads

- Induce topographic structure in pytorch models during training with this loss function
- Works on both Linear and Conv layers
- Core codebase behind toponets and the corresponding pre-trained vision and language models

torch-dreams - 58k downloads

- A highly flexible framework to do feature visualization on pytorch models

MOSAIC - 2k downloads

- Python package to efficiently load one of the largest fMRI datasets (Lahner et al.)

Eden - 10k downloads

- Single python decorator to convert a python function into a hosted endpoint with queuing (celery)
- Foundational pet-project which eventually led to eden.art

DevoLearn - 35k downloads

- Trained models to segment embryo data from microscope
- Outcome of Google Summer of Code, 2020 and then taken forward by other students in the next years

tgtqdm

- Drop-in replacement for `tqdm` to log progress via telegram

druta

- A fast video dataset format for Pytorch
- Multiple orders of magnitude faster than other frameworks like decord (but requires more disk space)

More projects can be found on my github profile: github.com/mayukhdeb

Technologies

Languages: Python and a little bit of CUDA – I just learn whatever is required

Frameworks: PyTorch, NumPy, einops, Pandas

Tools: SLURM