Mainak Deb

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DOB: November 9th, 2000

Research

June 2024 **Small-scale adversarial perturbations expose differences between predictive encoding models of human fMRI responses**
Nikolas McNeal*, **Mainak Deb***, Apurva Ratan Murty.
(∗: Equal contribution)
Accepted at NeurIPS 2024 Unireps Workshop.

January 2024 **Microarchitectural Design Variation of the Echinoid Skeleton: A 3D Structural and Mechanical Study of Paracentrotud lividus**
Valentina Perricone, Pasquale Cesarano, **Mainak Deb**, Derek Lublin, Mirko Mutalipassi, Lucia Pappalardo, David Kisailus, Francesco Marmo.
(Preprint)

Internships and Industry

January 2024 **Research Intern @ MurtyLab, Georgia Tech**
- Developed projects dealing with adversarial robustness in models trained on brain data, inducing brain-like topography in ANNs (paper under review, ICLR 2025), and simulating the effects of brain perturbations (lesion/stroke) on human visual perception.
- Leveraged fMRI datasets (NSD, DeepRecon, Murty185), built a python package (private) to seamlessly interface between fMRI data to pytorch dataloader.
- Trained language (GPT) and vision models, sometimes on brain data.

July 2022 **Research Engineer @ Artflow.ai** (Sequoia funded)
- Fine-tuning and building prompt systems to tame large language models like GPT-3 (davinci003), GPT-3.5-turbo and GPT-4.
- Built the LLM pipeline for Artflow Storystudio, turns natural language "ideas" like "cat enters a baking competition" into a visual storyboard first, then into an AI generated movie. Here's the official product showcase video and walkthrough for story studio.
- Leveraged sentence embeddings, audio embeddings and LLMs in tandem to facilitate automatic asset retrieval, including AI voices (replica and 11labs), music, shot-type, and sound sfx.
- Worked on 3D inpainting based camera movements and narrow depth-of-field effects on scene images to mimic the effect of high-end camera work.
- Accelerate the company since 3 months of its inception into the first thousand paid users.

July 2021 **Google Summer of Code 2021 Intern @ International Neuroinformatics Coordinating Facility**
Trained deep neural networks from scratch to help map the embryogenesis process in C. elegans worm embryo and deployed models live on the web using ONNX. Feel free to check out the detailed report and work repository

January 2022 **Research Intern @ Hybrid Design Lab, University of Campania, Italy**
Worked on generating time-varying textures that emulate Sea Urchin skeletons using Neural Cellular Automata and experimented with the latent output channels (apart from RGB) to generate vibrant psychedelic patterns. This was showcased at the Echino Design exhibition, 24 February 2022 at Città della Scienza, Naples, Italy.

March 2022 **Research Intern @ Department of Structures for Engineering and Architecture of University of Naples Federico II**
Worked with Prof. Francesco Marmo (and team) on bio-mechanical research that has the goal of geometrically and mechanically characterizing the stereom of echinoid exoskeletons. I processed micro-CT data to extract geometrical models of the stereom using computer vision, here's the Github repository and corresponding preprint

Relevant Personal Projects

December 2021 **Text-2-Neural Cellular Automata**
[Github, Blog post]
Generate beautiful cellular automata patterns from natural language prompts, using CLIP-guided Neural Cellular Automata, built using PyTorch.

December 2020 **Deceptive Digits**
[Github, Blog post]
Class guided generation for handwritten digit images, accomplished by training two PyTorch based custom neural networks (with label embeddings) simultaneously in a GAN framework.

November 2020 **Eyes on the Road**
The aim of this project was to train a PyTorch based Deep Convolutional Neural Network to classify driver activity (texting/talk on phone etc.). The testing accuracy was 93.9%, but I also tested the model on some real life images of my brother for fun.

August 2020 **Bank me Later**
Trained a PyTorch dense-net to predict if a client subscribes to a term deposit or not using attributes like job, marital status, age etc with an accuracy of 94%

March 2020 **Deep Wine Connoisseur**
The quality of wine is directly correlated to its chemical composition, I used these chemical attributes to train a PyTorch dense-net to predict its quality.

February 2020 **Facial Expression Classifier**
Trained a PyTorch based Deep Convolutional Neural Network to classify human facial expressions from images from from live webcam feed

Achievements

April 2021 **3rd Prize - MLOps for Good Hackathon**
Organized by Microsoft, Iguazio and MongoDB
Built and hosted Deepfake Shield - an online tool that uses deep-learning to detect deepfakes in an image.

April 2021 **First Prize (Education Track) - Hello World Hackathon**
Organized by CalHacks (University of California, Berkeley)
Built SignLingo - A deep learning based sign-language tutor which works via live webcam video feed.

October 2020 **First Prize - Lights, Camera, Hacktion! Hackathon**
Organized by Major League Hacking
Uses Computer Vision to automatically pause/play videos depending on user's attention to screen.

September 2020 **Third Prize - New Friends New Hacks**
Organized by Major League Hacking
Built an efficient Computer Vision based face mask detection system powered by OpenCV.

Areas of Interest

Computer Vision, Deep Neural Networks, GANs, Adversarial Attacks, NLP, Brain Computer Interface

Education

Expected 2023 **Bachelor's of Technology**, *Electrical and Computer Engineering*, ASE, Amrita Vishwa Vidyapeetham, Kollam, India. GPA: 8.3/10.0

2016 - 2018 **Higher Secondary**, Amrita Vidyalayam, Kolkata , India. Marks: 89%

Technical Skills

Programming	Python, Prompt Systems
Primary-Libraries	PyTorch, OpenCV, NumPy, SciPy, Pandas, PIL, Matplotlib, Seaborn, Plotly, Slurm, Pycortex, Brainscore
Tools	Jupyter Notebooks, Git, conda, SSH

Languages

English, Hindi, Bengali