



Pushkar Ambastha

Roll No.: 210106050

B.Tech - Bio Science and Bio Engineering

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EDUCATION

Degree/Certificate	Institute/Board	CGPA/Percentage	Year
B.Tech. Major	Indian Institute of Technology, Guwahati	7.85 (Current)	2021-Present
Senior Secondary	CBSE Board	92.2%	2021
Secondary	CBSE Board	95.2%	2019

EXPERIENCE

- Massachusetts Institute of Technology(MIT) Media Labs** June 2023 - Present
Undergraduate Researcher - Remote
Cambridge, MA
Advisor: **Prof. Ramesh Raskar** (Camera Culture Group, MIT Media Labs, MIT)
 - Developing methods to calibrate clinical Agent-Based Models(ABMs) directly from biopsies to have a mean accuracy of **77%** under the Spatial Agreement Measure(*SAM*) Metric, minimizing the number of biopsy samples taken.
 - Designing a novel multi-modal calibrated ABM pipeline to apply gradient-based ABMs to simulate tumour-immune cell interactions. (for *Cytotoxic CD8+ T Cells in multiple carcinomas and melanoma cases*)
 - Extended a novel pip library **AgentTorch** (Pytorch framework to design, simulate, and optimize agent-based models) for the cancer immunotherapy domain. Extracting the parameters from the classification model with an accuracy of **90%**. (IHC stained tissue sections based on the expression of Ki67)
- Hugging Face** May 2023 - Present
Research Intern - Remote
Brooklyn, NY
Advisor: **Katie Link** (Hugging Face X Health, Healthcare/Medicine at Hugging Face)
 - Developing novel models derived from the cumulative performance and extrapolation of Segment Anything Model (*SAM*), Medical SAM (*Med-SAM*), Fast-SAM, and Faster-SAM.
 - Designed a novel pipeline using the frozen Image encoder of Med-SAM and the decoder architecture from Fast-SAM, leading to a **68%** decrease in inference time and an **82%** decrease in size compared to the Vanilla SAM model.
 - The results, when observed in Modalities such as Pathology, X-Ray, CT, and Ultrasound, gave an average improvement of **0.48** in mean Intersection of Union (*mIOU*) and **0.42** in Dice Score Coefficient (*DSC*).
- University of Utah** Nov. 2022 - Feb. 2023
Research Intern - Remote
Salt Lake City, UT
Advisor: **Tushar Kataria**
 - Analysed Domain Shift in biomedical image segmentation models as a critical insight into Model Explainability. (for both binary and multiclass semantic segmentation instances)
 - Fine-tuned **U-Net**, **DeepLabV3** model on Dataset like GlaS from MICCAI (2015), CRAG, CPM15 to observe domain dependency of models on the dataset, created a pipeline to improve Image masks **mIOU** and **Dice Score**.
 - The results achieved for metrics like mIOU Loss, Pixel Accuracy, Jaccard Loss, and Dice Score met the standards of prior field experiments, like **0.96** for CRAG and **0.89** for GLAS (*mIOU*). (Pathological Modality)
- Domain-specific Question Answering chatbot** Dec. 2022 - Feb. 2023
11th Inter IIT TechMeet, IIT Kanpur
[Github](#)
 - Developed a question-answering system by retrieving the top candidate sentences from the corpus, used up to free collab resources, and **quantized** models to keep **latency** less than **1000 ms**.
 - Developed question-answering **pipeline** using techniques like model distillation, sparsification, pruning, and fine-tuning the **DebertaV3-Base** model to decrease inference time and have a minimum loss in accuracy.
- Cover Generation using OpenAI tools** Jan. 2023 - March 2023
IITG.ai Club, IIT Guwahati
[Github](#)
 - Developed a **multi-modal** pipeline that converts **audio/text** input into **images** using state-of-the-art **OpenAI** tools. Generated optimal transcripts for the podcasts and songs with **OpenAI Whisper** to create prompts.
 - Designed **pipeline** with Latent Diffusion Models (**DALL-E**) to generate aesthetic cover images from created prompts using **ChatGPT/GPT-2** models.
- Super Resolution Photographic Mosaic** March 2023 - April 2023
Coding Club, IIT Guwahati
[Github](#)
 - Developed a **Computer Vision** pipeline that enhances the images by **super-resolution** and stitching.
 - Designed multi-model **pipeline** consisting mainly of Latent Diffusion Upscaler model for super-resolution and Image Stitcher for creating a **panorama**.

- **Re-colourisation of monochrome images using conditional GANs** Aug. 2022 - Sep. 2022
Coding Club, IIT Guwahati [Github](#)
 - Trained a conditional Generative Adversarial Networks model (Discriminator and Generator) based on **U-Net** block with **Resnet18** backbone and devised **Image Processing** strategies for colorization of monochrome images.
 - Deployed a web app using **Streamlit** library on HuggingFace for the fine-tuned model over the **COCO** dataset.
- **Captcha Breaker Project** Aug. 2022 - Dec. 2022
Consulting and Analytics Club, IIT Guwahati [Github](#)
 - Deployed a **Computer Vision** program using **Streamlit** library on HuggingFace that recognizes Text-based **Captcha** images and converts them into writable text.
 - Developed the **pipeline** involving the **RCNN** model, giving Connectionist Temporal Classification(**CTC**) Loss *0.03*.

SKILLS

- **Programming:** Python, PyTorch, Tensorflow, OpenCV, Keras; C/C++; \LaTeX ; Matlab; JAX*; FLAX*
- **Web technologies:** HTML, CSS, Streamlit, Gradio, Javascript*, Flask*
- **Machine Learning/Data Analysis:** Deep Learning, including CNNs, RNNs, VAEs, GANs, Bayesian NNs, Transformers; Machine Learning, KNN
- **Wet laboratory skills:** techniques in bioengineering, biochemistry, bacterial cell culture * Elementary proficiency

KEY COURSES TAKEN

- **Mathematics:** Linear Algebra, Basic Calculus, Complex Analysis
- **Computer Science:** Data Structures and Algorithms, Computer Lab
- **Biology:** Genetic Engineering, Biochemistry, Microbiology, Cell and Molecular Biology
- **MOOCs(Coursera):** Machine Learning, Deep Learning, Computer Vision, Natural Language Processing(*NLP*)

POSITIONS OF RESPONSIBILITY

- **Research Head**, IITG.ai Club, IIT Guwahati May 2023 - Present
- **Coordinator**, Coding Club, IIT Guwahati June 2022 - May 2023
- **Associate**, Consulting and Analytics Club, IIT Guwahati Aug. 2022 - May 2023
- **Associate**, IITG.ai Club, IIT Guwahati Sep. 2022 - May 2023

ACHIEVEMENTS

- **Inter IIT Tech Meet 11.0**, Secured **Gold** Medal in High Prep problem statement by DevRev.ai 2023
 - **Kaggle 4X Expert**, Reached Expert tier in all the categories of Kaggle 2023
 - **Bronze Medal (85th Place)**, Open Problems – Single-Cell Perturbations, Kaggle 2023
 - **Bronze Medal (99th Place)**, HuBMAP – Hacking the Human Vasculature, Kaggle 2023
 - **IITG.ai Hackathon**, Secured **6th** rank in hackathon conducted by IITG.ai club 2022
 - **Joint Entrance Examination (Mains)**, Achieved a percentile of **99.29** among **1.2** million candidates 2021
 - **Joint Entrance Examination (Advanced)**, Secured All India Rank **8512** among **2,50,000** applicants 2021
 - **NEST 2021-22**, Secured All India Rank **140** among **1,00,000** candidates 2021
 - **PRMO 2019**, Qualified for the Pre Regional Mathematics Olympiad 2019
 - **NTSE 2019**, Secured a seat (first stage) in the top **8000** out of **12,00,000** candidates. 2019
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