Anant Rai

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Education

New York University, Courant — Master of Science, Computer Science
CGPA - 3.86 — *September 2021 - May 2023*

Indian Institute of Information Technology, Allahabad, India — B.Tech - Information Technology
CGPA - 9.13/10 — *July 2017 - June 2021*

Experience

Research Engineer — September 2023 - Present
1X Technologies — *Sunnyvale, California*

- Currently working on RL controller for humanoids, ensuring robust and expressive behaviors that enable robot to do useful tasks at home
- Setup mocap and retargeting pipeline for training RL policies to learn human-like behaviors. Implemented motion library package to feed kinematic information from mocap to RL during training in fast and effecient manner
- Worked on conditioning a foundation imitation model to handle multimodal scenarios by integrating visual cues and language, enabling trajectory inference based on feedback. Developed an efficient fusion strategy for image and language modalities, improving the model's attention to prompts
- Designed and managed a scalable data pipeline to efficiently collect and process data from 30+ robots across multiple fleets, ensuring seamless integration for training and analysis workflows. Optimized data loading mechanisms to support large foundation models, enabling efficient multi-GPU and multi-node operations
- Scaling end-to-end robot foundation models for Humanoids that can learn both manipulation and navigation policies. Suggested and implemented training changes in existing training framework and architecture design to see roughly 20% improvements in policies involving simultaneous navigation and manipulation
- Worked on software and tooling for both Behavior Cloning and RL stack for easy visualizations, debugging & testing of various policies

Graduate Research Assistant — Jan 2022- September 2023
CILVR Lab, NYU — *New York, USA*

- Working in the field of Robot Learning, advised by Prof. Lerrel Pinto and Soumith Chintala. Using Stretch RE1 robot, to accomplish different tasks like door-opening, drawer-opening, object picking in real-world environments like homes
- Achieved fast learning of complex skills in robots, using less than one minute of human demonstrations, through RL, OT-based rewards and a residual model (Best Student Paper Award at **RSS conference 2023**)
- Fronted my research group to achieve generalization in Imitation Learning in Homes, via policies that can learn in a data-efficient manner and capture multi-modal behaviours based on conditioning
- Experimented with SSL techniques like BYOL, VICReg and MoCo along with pre-trained models like SAM and Dino to get better vision priors for downstream tasks
- Benchmarked and tested iPhone-SLAM for navigation, Lidar-based localization and 3d-scene reconstruction
- My work was recently compiled into paper: **On Bringing Robots Home**, which is archived and currently submitted to **Science Robotics**

Research & Development Intern — Jan 2021 - June 2021
Temasek Lab, Nanyang Technological University — *Singapore*

- Lead the development of Meeting Room Speech Recognition Android Application, capable of automatic transcription
- Managed scheduled implementation of features and product release, bug tracking, and optimisations of Java app. Suggested improvements on existing implementations resulting in significant performance enhancement
- For real-time updates and synchronization, used Live Data and Observers with API (Retrofit) and sockets to achieve efficient interfacing between UI and the backend
- Additionally implemented and trained image-captioning model using transformer and hosted on flask server for MAGOR live video captioning

Technical Skills

Languages: Python, Rust, Java, C/C++, SQL
Tools & Platforms: Pytorch, ROS, Firebase, Android Studio, Azure, GCP, Spring Boot

Publications

On Bringing Robots Home November 2023
Nur Muhammad "Mahi" Shafiullah,* ***Anant Rai****, Haritheja Etukuru, et al*
submitted to ***Science Robotics***

Open X-Embodiment: Robotic Learning Datasets and RT-X Models September 2023
Abhishek Padalkar, Acorn Pooley, Ajinkya Jain, ... ***Anant Rai****, et al*
submitted to ***IEEE International Conference on Robotics and Automation (ICRA)***

Teaching a Robot to FISH: Adaptive Imitation from One Minute of Demos February 2023
Siddhant Haldar, Jyothish Pari*,* ***Anant Rai****, and Lerrel Pinto*
in ***Robotics: Science and Systems (RSS)***

Predictive Risk Analysis using Deep Learning in Indian Traffic March 2021
Rahul Birendra Jha,* ***Anant Rai****, Rahul Kala*
in ***IEEE International Conference on Intelligent Transportation Systems (IEEE ITSC)***

Food Recommendation System using Neural Collaborative Filtering & Sentiment Analysis July 2020
Tinku Singh, Ashwin Raut, Dhruv Agarwal, Rahul Jha, ***Anant Rai****, Manish Kumar*
presented at ***International Conference on Advancement in Interdisciplinary Research (ICAIR)***

Projects

Risk Analysis using Trajectory Prediction in Indian Traffic *(collaboration with University of Maryland, College Park)*

- Built a module using SSD (45 mAP) and SORT to detect and track agents in novel video dataset of Indian Traffic
- Developed special LSTM based network architecture to learn the agent's behaviours and interactions for trajectory prediction in dense heterogeneous traffic
- Devised Weighted-Elliptical-Model for risk modelling and combined it with trajectory prediction to get novel predictive-risk-analysis (20% improvement over baseline). Research publication was presented at **IEEE ITSC 2021**

OxyTracker

- Developed Android app, for tracking and controlling Oxygen Cylinder supply chain for government in Haryana, India during covid
- Worked on Firebase backend to build realtime-databse for storage and authentication
- Built UI and app-logic for features like QR-scanner, unique ID generation and interface for Firbase database using Kotlin
- Ensured timely oxygen supply to homes and patients, greatly improving the supply-demand balance during the COVID-19 crisis in Haryana, India

Achievements & Extracurricular

- Paper FISH won the best student paper award at RSS 2023
- 1st in App-Development competition at IIIT Allahabad
- Runner-up in Prototype Hackathon (IIIT Allahabad)
- App-Operations Member of Asmita 2019 - Sports Festival