

Bharath Irigreddy

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Education

University of Maryland, College Park

Dec 2023

Professional Masters in Robotics, GPA: 3.74/4.0

Coursework: Statistical Pattern Recognition, Computer Vision, Algorithms and Data structures for Geo-spatial Analysis, Perception and Planning for Autonomous Robots, Control of Robotic Systems, Robot Learning.

Indian Institute of Technology, Bhilai

May 2020

Bachelor of Technology, Mechanical Engineering GPA: 8.23/10.0

Coursework: Machine Learning, Computational Physics, Kinematics, Dynamics, Control Systems, Digital Signal Processing.

Skills

Programming: C++ (LibTorch, Eigen), Python (PyTorch, OpenCV, Tensorflow, JAX, Numpy), C, Matlab, R, ROS2, SQL, Git.
Deep Learning: Transformers, LSTM, VAE, Diffusion Models, GAN, Flow Matching, NeRF, RL (PPO, SAC, GRPO).

Experience

ML Engineer, USDA - Agricultural Research Service – Maricopa, AZ

Feb 2024 - Present

- Developed SatFlow, a **generative model** for synthesizing high-resolution (Landsat-like) satellite imagery and also inpainting cloud-occluded pixels by leveraging low-resolution (MODIS) data. Trained via **conditional flow matching**, SatFlow demonstrated superior performance compared to **diffusion**-based model and STARFM. ([arXiv](#))
- Contributed to the development of [GeoEPIC python package](#) that provides essential tools to develop reproducible and scalable modeling workflows for geo-spatial crop simulations. Utilized multiprocessing, redis caching, pygmo and google earth engine.

Graduate Assistant, SMaRS Group | USDA – UMD

May 2023 - Dec 2023

- Implemented MaskFormer model for delineating agricultural fields from aerial imagery with a detection score of around 0.82.
- Developed a calibration framework to optimize EPIC crop simulation model parameters by integrating LAI predictions (via a **neural network**) and observed carbon fluxes, improving accuracy of **crop yield prediction** and **carbon monitoring**. [link](#)

Research Assistant Intern, Robotics and Intelligent Systems Laboratory – IIT Hyderabad

2021

- Developed a **Reinforcement Learning** based control policy utilizing Asymmetric **Soft Actor-Critic (SAC)** algorithm and Hindsight Experience Replay to achieve robust control of an underactuated planar manipulator simulated in MuJoCo.
- Designed and fabricated a prototype serial spherical manipulator for tele-echography (Remote ultrasound). Implemented and tested **differential kinematics**-based tele-operation control system using a dummy transducer equipped with an IMU sensor.

Publications

- [DeepQC](#): A deep learning system for automatic quality control of in-situ soil moisture sensor time series data.
- Crop type mapping in smallholder agricultural settings with Sentinel-1 SAR time series, Springer Nature Book Chapter

Projects

NeRF implementation from scratch in C++

[GitHub/NeRF.cpp](#)

- Implemented NeRF (Neural Radiance Fields) pipeline in C++ utilizing LibTorch for 3D reconstruction and Novel View Synthesis, featuring siren layers and a proposal network for efficient ray sampling during training.

Fine-tuning LLMs with Reinforcement Learning

[GitHub/Minimal-GRPO](#)

- Implemented an adaptation of the GRPO algorithm utilizing HuggingFace transformers and pyTorch libraries to fine-tune open language models (like Llama3.2 and Qwen2.5) using RL to improve their performance on custom math dataset.

PatchGAN based Image Colorization

- A U-net model is trained in adversarial fashion to generate a plausible color version of a given B/W image, with a discriminator network assessing the realism. The model was trained and evaluated on 20,000 images from the COCO dataset.

Computer vision algorithms

- Implemented various algorithms including iterative closest point for 2D shape alignment, KLT key-point tracking, affine structure from motion for 3D reconstruction, SLIC super pixels segmentation, Depth from stereo.

Quadrotor Simulation with Trajectory Planning and Non-Linear Control

[GitHub/Quadrotor](#)

- Optimal minimum snap trajectory is generated to navigate a 3D Occupancy Map stored in an Rtree. Implemented Informed RRT* algorithm and piece-wise polynomial curve fitting. Employed a nonlinear geometric controller for trajectory tracking.

iLQR for nonlinear trajectory optimization

[GitHub/iLQR](#)

- Developed an iterative Linear Quadratic Regulator (iLQR) algorithm with support for constraints on inputs and state variables for nonlinear trajectory optimization, demonstrated through planning for tasks such as vehicle overtaking and lane shifting.