Prabin Kumar Rath

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Education

Arizona State University — Aug. 2022 – May 2024
M.S. in Robotics and AI (Thesis track), GPA 4.0/4, Advisor - Prof. Nakul Gopalan — *Tempe, Arizona*

National Institute of Technology Rourkela — July 2016 – May 2020
B.Tech. in Computer Science and Engineering, GPA 8.91/10 — *Rourkela, India*

Research Experience

Language Grounding and Planning Lab — May 2023 – Present
Arizona State University, Advisor - Prof. Nakul Gopalan — *Tempe, Arizona*

- Designed a novel Transformer-Diffusion policy for generative neural motion planning, enabling ***zero-shot* configuration space planning** across **7** commercial robots in unseen real-world environments. [Project]
- Developed a differentiable collision model for robotic manipulators and leveraged its gradients for reactive collision avoidance, enhancing the **safety of human-robot interactions**.
- Created synthetic data generation pipelines with **PyBullet**, **Coppeliasim**, and **NVIDIA Isaac-Sim** simulators.
- Enabled real-time simulation of **1000+** robots for training Gym compatible RL policies with RGBD observations.

Electric Vehicles and Intelligent Transportation Lab — Sept. 2022 – May 2024
Arizona State University, Advisor - Prof. Hongbin Yu — *Tempe, Arizona*

- Analyzed safety envelope and time to collision metrics between vehicles and pedestrians, enabling **real-time reporting of AV induced unsafe situations** at urban traffic intersections. [Project]
- Integrated pretrained vision models for 3D object detection, and Kalman filter for 7-DoF bounding box tracking on real-world LiDAR pointcloud data achieving **83.6% mAP** and **87.4% MOTA** respectively.
- Developed novel Graph Neural Network and Pointnet models for object boundary prediction and 3D bounding box regression on unseen LiDAR data, achieving **10 fps** inference speed with **Hesai OT128 sensor**.

Unmanned Vehicles Robotarium Lab — May 2019 – July 2019
University of Calgary, Advisor - Prof. Alex Ramirez-Serrano [Letter] — *Calgary, Alberta*

- Devised a Detection and Tracking of Moving Objects (DATMO) algorithm for collision-free navigation in cluttered and GPS-denied environments. Achieved detection accuracy of **91.42%** for unseen moving objects. [Project]
- Worked with **Velodyne VLP-16** LiDAR and **Intel T-265** tracking camera to setup indoor robot navigation.
- Collected, organized and published three indoor pointcloud datasets for DATMO benchmarking.
- Implemented C++ scripts for real-time pointcloud processing and validated its performance on KITTI dataset.

Soft Computing Lab — Dec. 2018 – Jan. 2019
IIT Kharagpur, Advisor - Prof. Dilip Kumar Pratihar [Letter] — *Kharagpur, India*

- Developed a real-time remote teleoperation system for bipedal exoskeleton, enabling precise mimicry of human leg motion. Evaluated effectiveness for rehabilitation through experiments with **18 human subjects**. [Project]
- Utilized ESP8266 Wi-Fi, and MPU9250 9-axis IMU for closed loop PID control on a Raspberry Pi computer.
- Implemented the control algorithm using C++ and validated its effectiveness using gait pattern analysis.

Selected Publications

[1] **Rath, Prabin Kumar**, and Nakul Gopalan. *"Whole-Body Neural Policy for Zero-Shot Cross-Embodiment Motion Planning."* In ICRA 2025, and RSS 2024 Workshop on Embodiment-Aware Robot Learning. [Preprint]

[2] **Rath, Prabin Kumar**, Blake Harrison, Duo Lu, Yezhou Yang, Jeffrey Wishart, and Hongbin Yu. *"Evaluating Safety Metrics for Vulnerable Road Users at Urban Traffic Intersections Using High-Density Infrastructure LiDAR System."* No. 2024-01-2641. SAE Technical Paper, 2024. [Paper]

[3] **Kumar Rath, Prabin**, Alejandro Ramirez-Serrano, and Dilip Kumar Pratihar. *"Real-time moving object detection and removal from 3D pointcloud data for humanoid navigation in dense GPS-denied environments."* Engineering Reports 2, no. 12 (2020): e12275. [Paper]

[4] **Rath, Prabin Kumar**, Neelam Mahapatro, Prasanmit Nath, and Ratnakar Dash. *"Autonomous Chess Playing Robot."* In 28th IEEE International Conference on Robot and Human Interactive Communication (RO-MAN), pp. 1-6. IEEE, 2019. [Paper]

Projects

Masked Trainable Embeddings for Efficient Task Learning [Project] Fall 2023
- Incorporated trainable adapters into Action Chunking Transformer (ACT) policy for multi-task learning.
- Improved few-shot learning performance of the baseline by **32%** using an online embedding masking strategy.

Multi-Robot Swarm Pattern Formation from Hand-drawn Images [Project] Fall 2023
- Developed controllers for a swarm of **16 e-puck** robots using the signed distance field of hand-drawn images.
- Utilized Control Barrier Functions (CBF) for collision-free swarm pattern formation in CoppeliaSim.

Stacking Cubes with Turtlebot Robotic Arm [Project] Spring 2023
- Created a ROS MoveIt package using IKFast and RRT* for robotic cube stacking, achieving **95%** success rate in Gazebo simulations and **78%** on physical 3D-printed hardware.
- Trained a torque-controlled visual reinforcement learning policy using Soft Actor-Critic (SAC) algorithm to grasp cubes from random locations with RGBD observations, achieving **73%** success rate.

Preference Learning from Automatic Ranked Demonstrations [Project] Spring 2023
- Implemented D-REX inverse reinforcement learning algorithm to train reward functions from suboptimal demonstrations using Luce-Shepard preference modeling.
- Trained a PPO reinforcement learning policy using the learned reward function that outperformed the expert demonstrator policy by **233%**.

Spatiotemporal Learning for Traffic Flow Prediction [Project] Fall 2022
- Experimented with different CNN backbones (ResNet, VGG, EfficientNet, InceptionNet) for analyzing the spatio-temporal learning performance in traffic flow prediction.
- Improved upon the STResNet baseline achieving an average grid **RMSE 17.9** on TaxiBJ and BikeNYC datasets.

Monte-Carlo Tree Search Pacman Agent [Project] Fall 2022
- Developed an AI agent for the Pacman game using the MCTS algorithm in Python. Merged reflex behavior and greedy A* search to achieve a win rate of **80%** on standard layouts.
- Benchmarked against three conventional game-theory agents using statistical ANOVA Tukey HSD tests.

Autonomous Underwater Vehicle (AUV) [Project] Spring 2019
- Formulated OpenCV functions for reliable detection of underwater artifacts, thereby enabling autonomous execution of **8** different tasks under challenging lighting conditions and underwater glare.
- Implemented state machines in C++ for autonomous execution of underwater exploration missions.

Chess Playing Robot [Project] Spring 2018
- Developed image processing algorithms using OpenCV for human chess move detection from an overhead camera.
- Designed UI in Qt C++ for real-time human robot interaction, enabling mid-game saving and resume features.
- Created Arduino scripts for accurate positioning of CNC controller using feedback from IR sensors.

Industry Experience

Experian June 2024 – Present
MLOps Engineer *Costa Mesa, California*
- Developed scalable workflows for ML model life cycle management, created inference orchestration platforms adhering to millisecond latency response SLAs serving **300+** enterprise clients. [Product]
- Created asynchronous regression infrastructure with a Record–Replay mechanism, ensuring backward compatibility and robust software deployment, thereby reducing unprecedented production failures by **37%**.
- Automated excel file parsing and generated **200k** edge-cases for analyzing Experian consumer credit records.
- Enabled multi-layered identity verification and fraud prevention features using OTP, KIQ, and document checks.
- Deployed containerized Fast API microservices on AWS Fargate with Elasticsearch, AWS S3, Docker, and Jenkins.

Wells Fargo Aug. 2020 – July 2022
Software Engineer *Hyderabad, India*
- Architected multi-threaded Rest API modules in Python to interface with Azure Cognitive Services and optimized average response time by **75%**, while delivering **4x** throughput.
- Engineered OCR pipelines for table layout detection and extraction of customer data from scanned bonds and contracts, resulting in a **400 hours/week** reduction of manual labor.
- Designed configurable and robust regular expression modules for numerical data extraction from **2.4 million** handwritten forms and documents.
- Utilized xUnit to ensure consistent backward compatibility with **95%** code coverage over multiple releases.

Academic Service

Robotics and AI Paper Reviewing

- Conference: ICRA 2025, 2024 | RA-L 2023 | IROS 2023 | RO-MAN 2023
- Workshop: PRL@AAAI 2025 | PRL@ICAPS 2024

Teaching and Mentorship

- Project Mentor for graduate course *"Connected and Automated Vehicles"* under **Prof. Jeffery Wishart**, Arizona State University (Fall 2023). Conducted class meetings, guiding student groups to successful project completion.
- Delivered a seminar lecture on topic *"Application of LiDAR Detection and Tracking in Quantifiable Safety Metrics Analysis"*, Arizona State University (Fall 2023). [Slides]
- Served as a Grader for undergraduate course *"Emerging Technology in Automotives and Transportation"* under **Prof. Hongbin Yu**, Arizona State University (Fall 2022).
- Taught the basics of robot design and Arduino programming to freshmen students at NIT-Rourkela. Mentored a group of five students to build a line-following robot (Fall 2017).

Achievements

- Recipient of **Gold Coin Award 2022** for engineering excellence at Wells Fargo, Hyderabad.
- **MITACS Globalink 2019** fellowship to pursue a 12 weeks research internship at the University of Calgary.
- First position out of 15 teams at National AUV competition organized by NIOT, **SAVe 2019**, IIT-Madras, Chennai.
- Second position out of 27 teams at International AUV competition by IEEE-OES, **SAUVC 2018**, Singapore.
- Received India's top 10 innovative project award for Chess Playing Robot at **Quest Ingenium 2018**, Bangalore.
- Third position out of 50 teams at **KSHITIJ 2017** Semi Autonomous Robotics competition, IIT-Kharagpur.
- Third position out of 10 teams at **MINARE 2017** Manual Robotics competition, NIT-Rourkela.

[Certificates Folder]

Skills and Interests

Interests: Robot Learning, 3D Perception, and Software Engineering

Programming Languages: Python, C/C++, MATLAB, C#, TypeScript, Java, Shell

Robot Simulators: Gazebo, CoppeliaSim, PyBullet, Nvidia IsaacSim

Cloud Technologies: AWS, Azure, Kubernetes, Docker

Tools and Frameworks: PyTorch, TensorFlow, ROS/ROS2, OpenCV, Open3D, Angular, Linux, Git

References

Prof. Nakul Gopalan, Arizona State University (Master's Thesis Advisor) [nakul.gopalan@asu.edu]

Prof. Hongbin Yu, Arizona State University (Master's Thesis Co-Advisor) [hongbin.yu@asu.edu]

Prof. Yezhou Yang, Arizona State University (Master's Project Advisor) [yz.yang@asu.edu]

Prof. Suchismita Chinara, NIT-Rourkela (Bachelor's Advisor) [suchismita@nitrkl.ac.in]

Prof. Ratnakar Das, NIT-Rourkela (Bachelor's Advisor) [ratnakar@nitrkl.ac.in]