

# Prabin Kumar Rath

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## EDUCATION

<b>Arizona State University</b> <i>Ph.D. in Computer Science, GPA 4.0/4, Advisor - Prof. Nakul Gopalan</i>	Aug. 2025 – Present Tempe, Arizona
<b>Arizona State University</b> <i>M.S. in Robotics and AI (Thesis track), GPA 4.0/4</i>	Aug. 2022 – May 2024 Tempe, Arizona
<b>National Institute of Technology Rourkela</b> <i>B.Tech. in Computer Science and Engineering, GPA 8.91/10</i>	July 2016 – May 2020 Rourkela, India

## SELECTED PUBLICATIONS

- [1] Omkar Patil, **Rath, Prabin Kumar**, Kartikay Milind Pangaonkar, Eric Rosen, and Nakul Gopalan. “Learning Factorized Diffusion Policies for Conditional Action Diffusion.” RSS 2025 RoboReps Workshop. [Paper]
- [2] **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]
- [3] **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]
- [4] **Kumar Rath, Prabin**, Alejandro Ramirez-Serrano, and Dilip Kumar Pratihari. “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]
- [5] **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]

## RESEARCH EXPERIENCE

<b>Language Grounding and Planning Lab</b> <i>Arizona State University, Advisor - Prof. Nakul Gopalan</i>	May 2023 – Present Tempe, Arizona
<ul style="list-style-type: none"><li>Designed a novel Transformer-Diffusion policy for generative neural motion planning, enabling <b>zero-shot configuration space planning</b> across <b>7</b> commercial robots in unseen real-world environments. [Project]</li><li>Developed a differentiable collision model for robotic manipulators and leveraged its gradients for reactive collision avoidance, enhancing the <b>safety of human-robot interactions</b>.</li><li>Created synthetic data generation pipelines with <b>PyBullet</b>, <b>Coppeliasil</b>, and <b>NVIDIA Isaac-Sim</b> simulators.</li><li>Enabled real-time simulation of <b>1000+</b> robots for training Gym compatible RL policies with RGBD observations.</li></ul>	
<b>Electric Vehicles and Intelligent Transportation Lab</b> <i>Arizona State University, Advisor - Prof. Hongbin Yu</i>	Sept. 2022 – May 2024 Tempe, Arizona
<ul style="list-style-type: none"><li>Analyzed safety envelope and time to collision metrics between vehicles and pedestrians, enabling <b>real-time reporting of AV induced unsafe situations</b> at urban traffic intersections. [Project]</li><li>Integrated pretrained vision models for 3D object detection, and Kalman filter for 7-DoF bounding box tracking on real-world LiDAR pointcloud data achieving <b>83.6% mAP</b> and <b>87.4% MOTA</b> respectively.</li><li>Developed novel Graph Neural Network and Pointnet models for object boundary prediction and 3D bounding box regression on unseen LiDAR data, achieving <b>10 fps</b> inference speed with <b>Hesai OT128 sensor</b>.</li></ul>	
<b>Unmanned Vehicles Robotarium Lab</b> <i>University of Calgary, Advisor - Prof. Alex Ramirez-Serrano</i>	May 2019 – July 2019 Calgary, Alberta
<ul style="list-style-type: none"><li>Devised a Detection and Tracking of Moving Objects (DATMO) algorithm for collision-free navigation in cluttered and GPS-denied environments. Achieved detection accuracy of <b>91.42%</b> for unseen moving objects. [Project]</li><li>Worked with <b>Velodyne VLP-16</b> LiDAR and <b>Intel T-265</b> tracking camera to setup indoor robot navigation.</li><li>Collected, organized and published three indoor pointcloud datasets for DATMO benchmarking.</li><li>Implemented C++ scripts for real-time pointcloud processing and validated its performance on KITTI dataset.</li></ul>	

## 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.

## PROJECTS

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### 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

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### Experian

June 2024 – May 2025

*ML Ops 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**  
*Software Engineer*

Aug. 2020 – July 2022  
*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

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### 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

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- 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

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**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

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**Prof. Nakul Gopalan**, Arizona State University (Master’s Thesis Advisor) [\[nakul.gopalan@asu.edu\]](mailto:nakul.gopalan@asu.edu)

**Prof. Hongbin Yu**, Arizona State University (Master’s Thesis Co-Advisor) [\[hongbin.yu@asu.edu\]](mailto:hongbin.yu@asu.edu)

**Prof. Yezhou Yang**, Arizona State University (Master’s Project Advisor) [\[yz.yang@asu.edu\]](mailto:yz.yang@asu.edu)

**Prof. Suchismita Chinara**, NIT-Rourkela (Bachelor’s Advisor) [\[suchismita@nitrkl.ac.in\]](mailto:suchismita@nitrkl.ac.in)

**Prof. Ratnakar Das**, NIT-Rourkela (Bachelor’s Advisor) [\[ratnakar@nitrkl.ac.in\]](mailto:ratnakar@nitrkl.ac.in)