

Pranav Deo

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Summary

Robotics researcher with 4 years of industry experience and publications in A* robotics conferences. Specializing in development and deployment of deep reinforcement learning and imitation learning algorithms for industrial robotic systems. Looking to advance embodied AI through data-driven control and learning-based manipulation

Publications

Touch-based Manipulation with Multi-fingered Robot using Off-policy RL and TCL

N. Morihira, **P. Deo**, M. Bhadu, A. Hayashi, T. Hasegawa, S. Otsubo, T. Osa

ICRA '24

Devised a method for tackling POMDP in in-hand manipulation tasks, relying solely on proprioception and tactile signals. Temporal Contrastive learning (TCL) aids policy consistency, improving unseen object generalization

Offline Reinforcement Learning with Mixture of Deterministic Policies

T. Osa, A. Hayashi, **P. Deo**, N. Morihira, T. Yoshiike

TMLR '23

Introduced the technique of using mixture of deterministic policies, to address the problem of action multimodality in Offline Reinforcement Learning. This significantly improves the training stability and performance of the policy.

Education

Indian Institute of Technology Bombay (IITB)

Mumbai, India

Bachelor in Technology with Dual Minor Degrees

Jul'17 - May'21

- Graduated as **Department Rank 5** in the batch of 102 students with **9.26 GPA**
- **Major discipline:** Civil Engineering
- **Minor discipline 1:** Computer Science & Engineering
- **Minor discipline 2:** AI & Data Science
- **Key courses:** Robotics, Advanced Machine Learning, Medical Image Computing, Machine Learning for Remote Sensing, Data Structure and Algorithms, Data Science, Electrical and Electronics circuits

Professional Experience

Honda R&D | Frontier Robotics Division

Tokyo, Japan

Robotics Research Engineer

Oct'21 - Present

Touch based manipulation of tiny objects:

- Policy development for robust manipulation of very tiny objects (~2mm) using Honda's multi-fingered hand
- Training end-to-end **diffusion** based control policies that use proprietary image based tactile sensor inputs
- Improved SOTA algorithms to increase **speed by 80%** and **success rate by 10%** on precise industry tasks

In-hand object manipulation:

- Designed and fine-tuned control policies for reactive control of tools with Honda's multi-fingered hand
- Tackled the POMDP problem by using Temporal Contrastive Learning with **Online Reinforcement Learning**
- Devised a new **Offline RL** method based on mixture of policies to solve the problem of action multi-modality
- Deployed **hybrid models** by combining low-level and high-level policies, improving speed and generalization
- Developed ACT based **imitation learning** frameworks for efficient learning of long-horizon dexterous tasks
- Utilized multi-modal sensor inputs to train and deploy learning algorithms in both simulation and hardware
- Achieved a **5x speedup** by refactoring codebases for faster training and deployment with distributed systems

Real robot experimentation:

- Experienced in controlling humanoid, robotic arms, multi-fingered hands, and proprietary hardware setups
- Formulated, planned, and executed experiments with humanoid robots in real-world factory environments
- Constructed real-time teleoperation pipeline for precise robot control; collected multiple task demonstrations
- Set up and operated industry-standard object pose-tracking systems for dynamic movements of small objects
- Engineered a robust solution for 6D pose estimation of a marked object using an RGB multi-camera system

Daikin Japan

Osaka, Japan

Computer Vision Intern

Jun'20

- Created a browser-based interface for serving a custom object detection model using Tensorflow.js
- Achieved 95% IoU test accuracy on edge devices; with a CNN model trained on a custom web-scraped dataset
- Accomplished 99.4% accuracy by clustering input data using unsupervised algorithm and transfer learning

Key Technical Project

Mahindra RISE Driverless Car Challenge | Prof. Amit Sethi | Autonomous Vehicles

Jan'18 - May'21

Finalist among 259 teams (prize money - \$ 1 million)

- Part of team SeDriCa - developing **India's 1st self-driving car** targeting level 4 autonomy for Indian conditions
- **Stereo Vision:** Implemented object detection and distance estimation using point cloud and RGB images
- **Computer Vision:** Designed multi-task network for perception resulting in 30% efficiency increase in real-time
- **Localization:** Worked on SLAM for the car using pre-recorded sensor data of 3D lidar, GPS and IMU
- **Vehicle dynamics:** Applied adaptive PID and NMPC control for reduction in jerk and smoother steering profile
- **Simulations:** Built a car model with all mounted sensors in CARLA environment based on Unreal engine
- **Path Planning:** Implemented Hybrid A* and RRT* informed algorithms to work in real-time in ROS environment

Achievements

- Led a team of 10 to secure bronze medal in Inter-IIT Technical Meet on a national stage '21
- Recipient of Institute academic prize (< 1%) for consistent high academic performance at IIT Bombay '20
- Awarded Institute Technical Color (< 0.5%) for exceptional contribution to the technical sphere '20
- Secured All India Rank 1681 (< 0.8%) in JEE Advanced out of nearly 0.2 million candidates '17

Positions Of Responsibility

Large project Leader | Honda R&D Co., Ltd.

Apr'25 - Present

- Launching and leading an independent research project, successfully presented demo to **President and COO**
- Formulated research plans and managed a budget of ¥4M to improve the robot hardware capabilities
- Mentored juniors, and organized language exchange sessions to foster cross-cultural integration

Overall Coordinator | Unmesh Mashruwala Innovation Cell, IIT Bombay

May'20 - May'21

Led a team of 60 students working on autonomous ground and aerial vehicles in international competitions

- Presented progress to the Institute technical evaluation committee, securing a budget of ₹3.5M for the team
- Forged collaboration with industry leaders, securing sponsorships worth ₹2.5M in equipment for R&D
- Negotiated with IIT Bombay authorities for revamping of a 1400 sq.ft. lab with a budget of ₹4 million

Teaching Assistant | IIT Bombay

- **Engineering Graphics and Drawing** | Prof. Salil S. Kulkarni | Dept. of ME Spring'21
Created weekly solutions on AutoCAD and SolidWorks for assessment of solutions, and graded submissions
- **Computer Programming and Utilization** | Prof. Sharat Chandran | Dept. of CSE Summer'19
Mentored back-logged students, facilitated discussion on online class forum, and graded homework

Skills

Robots Honda multi-fingered hand, Allegro hand, Shadow hand, UR10, Kinova, Emika Panda, SO-101

Frameworks ROS1/ROS2, Moveit, PyBullet, Mujoco, Isaac Gym

Deep Learning JAX, Flax, Pytorch, Tensorflow, OpenCV, Python, C++

Other Projects

ASME Student Design Challenge | Prof. Abhishek Gupta | Robotics

Aug'18 - Dec'18

- Stood first in Asia-Pacific level and qualified for international level winning prize money of \$500
- Designed a robot capable of solving a maze while transporting/placing objects, optimized for time efficiency

International Robowars | Techfest, IIT Bombay | Heavy Robotics

Dec'17

- Designed a 120 lbs robot equipped with a heavy rotating drum, capable of obliterating the opponent
- Assembled the bot and design after considering various constraints, armour materials and weapons