# Pranav Deo

(+81) 070-4076-0607 | pranavdeo99@gmail.com | pranav-deo.github.io | pranavdeo99

## Summary

Passionate AI research engineer with 5 years of hands-on experience, featuring 3 years of professional engagement in robotics. Proficient in Deep Learning for controls and Computer Vision, with a pronounced focus on applying them to real-world scenarios in Autonomous Systems and Robotics.

## 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 methodology for tackling POMDP, performing in-hand manipulation tasks, relying solely on proprioception and tactile signals. Achieved broader generalization and validated the approach on a real-world multi-fingered robot

### Offline Reinforcement Learning with Mixture of Deterministic Policies

T. Osa, A. Hayashi, **P. Deo**, N. Morihira, T. Yoshiike — TMLR '23

Introduced the technique of a using mixture of deterministic policies, which addresses the problem of multi-modality of offline RL policies and significantly improves the training stability and performance of the policy

## Professional Experience

### Honda Robotics — Tokyo, Japan

**Robotics Research Engineer** — Oct'21 - Present

- In charge of developing imitation learning-based framework for efficient learning of dexterous tasks on the robot
- Deployed hybrid learning algorithms on an in-house multi-fingered robot hand, achieving dexterous task mastery
- Utilized multi-modal sensor inputs to train and deploy enhanced learning algorithms in simulation and real robot
- Constructed real-time teleoperation pipeline and collected task demonstrations using it on real hardware
- Set up and operated industry-standard object pose-tracking systems for dynamic movements with small objects
- Engineered a robust solution for 6D pose estimation of a marked object using an RGB multi-camera system

### Daikin Japan — Remote

**Computer Vision Intern** — Jun'20

- Achieved 95% test accuracy on edge devices, training object detection on a custom web-scraped dataset
- Created a browser-based interface for serving the custom detection model using Tensorflow.js and JavaScript

## Key Technical Projects

### Mahindra RISE Driverless Car Challenge | Autonomous Vehicles — Jan'18 - May'21

Prof. Amit Sethi

One of the 11 finalists among 259 teams (prize money - **$ 1 million**)

- Part of student 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 corresponding images
- **Computer Vision:** Designing **multi-task network** for perception; **30%** efficiency increase expected in real-time
- **Localization:** Worked on the **SLAM** of the car using pre-recorded sensor data of 3D lidar, GPS and IMU
- **Vehicle dynamics:** Applied adaptive **PID** and **NMPC** control for **20%** and smoother velocity and 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

### Manipulation of tiny objects in-pinch | Reinforcement Learning — Jan'24 - Present

- Set up an experiment workbench with Kinova arm mounted with a DIGIT visuotactile sensor
- Developed teleoperation system with haptic feedback-based input system and leader-follower-based control
- Analyzing learning solutions to tackle fine-grained manipulation of tiny objects in-pinch

### Histopathology Image Retrieval | Deep Learning, Computer Vision
Apr'20 - May'20

Prof. Amit Sethi

- Developed an encoder-decoder based **multi-task** model for hash code generation of histopathology images
- Achieved **96%** accuracy with unsupervised clustering of images and hashes using K-nearest neighbour network

## Education

### Indian Institute of Technology Bombay (IITB)
Mumbai, India

**B.Tech in Civil Engineering** | **GPA - 9.26**
Jul'17 - May'21

- Completed **dual minor degrees** in **Computer Science and Engineering** and **AI and 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

## Achievements

- Graduated as **Department Rank 5** in the batch of 102 B.Tech students '21
- Led a team of 10 to secure **bronze medal** in InterIIT Tech 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

### Overall Coordinator | Unmesh Mashruwala Innovation Cell, IIT Bombay
May'20 - May'21

Heading a team of **60 students** working on autonomous ground and aerial vehicles with international participation

- Orchestrated the **two-month long** recruitment process of **150** aspirants having interviews, training and projects
- Negotiated with IIT Bombay authorities for revamping of a 1400 sq. ft. lab with an estimated budget of **₹4 million**
- Created the UMIC **alumni network** with **50+ alumni** currently, organising regular **lectures** on innovation and AI
- Planned publicity drives on digital platforms, reaching over **7.6k+** students and entrepreneurs all over India

### Undergraduate Teaching Assistant | IIT Bombay

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

## Skills

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|---|---|
| **Languages** | English (*native*), Japanese (intermediate, *JLPT N3*), Hindi(*native*), Marathi(*native*) |
| **Programming** | C++, Bash, ROS, Python, Moveit, OpenCV, Pytorch, Tensorflow, JAX, MATLAB, HTML, SQL, AWS |
| **Softwares** | Git, SolidWorks, MATLAB, ANSYS, AutoCAD, Arduino, LaTeX |

## Other Projects

### ASME Student Design Challenge | Robotics
Aug'18 - Dec'18

Prof. Abhishek Gupta

- Stood **first** in **Asia-Pacific** level and qualified for international level winning prize money of **$500**
- Worked in the mechanical subsystem; contributed to the design, manufacturing, and assembly of the robot

### International Robowars | Heavy Robotics
Dec'17

Techfest, IIT Bombay

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