

# SNEHAL S. DIKHALE

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## SUMMARY

Robotics Researcher with 5+ years of experience in Embodied AI and multimodal learning for dexterous manipulation, specializing in tactile representation learning. Published at ICRA, IROS, and IEEE RAL; currently extending Vision-Language Models and Vision-Language-Action models (VLMs/VLAs) for tactile-driven multimodal reasoning, resulting in patents and major gains in latency and task success.

## TECHNICAL EXPERTISE

**Research & AI:** Embodied AI, Multimodal Representation Learning, Tactile-sensing, Vision-Language Models (VLMs), Large Language Models (LLMs), Transformers, Dexterous Manipulation, Sim-to-Real Transfer, Graph Neural Networks

**Software & Frameworks:** Python, C++, PyTorch, HuggingFace, CUDA, ROS, Docker, Git

**Simulation & Rendering:** Mujoco, Isaac Sim, Unreal Engine, Gazebo

## WORK EXPERIENCE

### Honda Research Institute (HRI), San Jose, CA

#### Robotics Researcher II

Apr 2024 – Present

- Developed **multimodal learning algorithms (video, tactile, proprioception, language)** for dexterous manipulation with multi-fingered robotic hands.
- Co-designed a multimodal self-attention **Action-Conditioned Model** generating language-based contextual representations from vision, tactile, and proprioception, improving task success by 25%; mentored and supervised an intern.
- Architected a multimodal reasoning system by modifying **Vision-Language Model (VLM)** backbones with custom modality projection layers, reducing reasoning latency by 7x versus state-of-the-art baselines.
- Built **spatio-temporal graph-based representation learning** combining video, depth, proprioception, and taxel-level tactile data, improving pose estimation temporal consistency by **30%**
- Collaborated with cross-functional and international research teams to drive end-to-end project execution.

#### Robotics Researcher I

Sep 2020 – Apr 2024

- Designed and developed a perception pipeline for dexterous in-hand pose estimation under heavy occlusion, covering data collection, algorithm design, and deployment on multiple robot setups.
- Created a 220k-sample **domain-randomized visuotactile dataset** (RGB-D + tactile) using Unreal Engine, enabling robust Sim-to-Real transfer.
- Pioneered hardware-agnostic CNN and **graph-based representations** for **vision-tactile sensor fusion**, improving tactile resolution by **3×** and enabling generalization across multiple robots.
- Achieved substantial improvements over vision-only baselines, reducing position error by ~35% and angular error by ~64%.
- Conducted **100+ real-robot experiments** using multiple robotic platforms, closing the **Sim-to-Real gap** by 65%.
- Authored publications and filed patents, presenting research at top-tier robotics and AI conferences (**ICRA, IROS**).

## EDUCATION

### Worcester Polytechnic Institute (WPI), MA, USA

M.S., Robotics Engineering, GPA: 3.8/4.0

### Pune Institute of Computer Technology, India

B.Eng., Electronics & Telecommunication, Grade: First Class with Distinction

## SELECTED PUBLICATIONS

- S. Dikhale**, et al., *DynastGNN: Dynamic Spatio-Temporal Hierarchical Graph Neural Network for Visuotactile 6D Pose Estimation of an In-Hand Object*, (Submitted to IEEE RAL).
- H. Li, **S. Dikhale**, et al., *HyperTaxel: Hyper-Resolution for Taxel-Based Tactile Signals Through Contrastive Learning*, IROS 2024.
- A. Rezazadeh, **S. Dikhale**, et al., *Hierarchical Graph Neural Networks for Proprioceptive 6D Pose Estimation of In-Hand Objects*, ICRA 2023.
- S. Dikhale**, et al., *Visuotactile 6D Pose Estimation of an In-Hand Object Using Vision and Tactile Sensor Data*, IEEE RAL 2022 (Presented at ICRA 2022).

## SELECTED PATENTS

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- **S. Dikhale**, et al., *Vision-Language Models for Failure Reasoning in Multi-Fingered Dexterous Manipulation*, US Provisional Patent, 2025 (filed).
- A. Shahidzadeh, **S. Dikhale**, et al., *Context-Aware Multimodal Action Planning Using Tactile, Vision, and Language*, US Provisional Patent, 2025 (filed).
- M. Priebe, **S. Dikhale**, et al., *Spatio-temporal graph and message passing*, US Patent App, 18/910,962, 2025.

## ADDITIONAL RESEARCH EXPERIENCE

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- Research Thesis, WPI: Built a simulation and benchmarking framework (Gazebo, MoveIt, Panda Arm, RealSense) to evaluate deep learning grasping algorithms; tested GQCNN and GPD on RGB-D data (78% / 65% success).
- Predicting Building's Energy Consumption using ML, WPI: linear regression, random forest, decision tree, neural networks; RMSE 1.27, top 30% Kaggle.
- Human-Robot Handover, WPI: Designed human-robot experiments using ROS/Python; trained ProMPs to predict Object Transfer Point (RMSE < 0.2 m).
- Simulation of Control Techniques for Baxter Arm: Implemented Robust, PD, and PD+Gravity controllers; evaluated via MATLAB simulations.

## AWARDS & MENTORSHIP

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- WIN Women's Young Investigator Fellowship: Received by the top four graduate female researchers in STEM at WPI.
- Mentor, Women's Research and Mentorship Program, WPI: Mentored one undergraduate and two high school students; led hands-on robotics and 3D printing workshops.
- Reviewer for IEEE RAL journal, ICRA, and IROS conference submissions