

Nikhil Chavan-Dafle

CONTACT INFORMATION

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📍 NYC | Permanent Resident (EB1-A)

SUMMARY

A dynamic leader with solid expertise in technology development and team management for machine learning, computer vision, and robotics applications. Proven track record of delivering impactful research and systems leading to best paper awards, strategic patents, and tech transfer to products.

EDUCATION



PhD - Massachusetts Institute of Technology (MIT)

May 2020

Thesis: Dexterous Manipulation with Simple Grippers

Committee: Alberto Rodriguez (Advisor), Russ Tedrake, Neville Hogan, Matt Mason

MS - Carnegie Mellon University (CMU)

December 2013

Project: Extrinsic Dexterity for In-hand Manipulation

Advisor: Matt Mason, Robotics Institute, CMU

B.Tech - College of Engineering Pune (COEP), India

May 2011

WORK EXPERIENCE



Tech Lead and Staff Research Scientist, Samsung AI Center, NYC

Aug 20 - Present

Managing a team of researchers and engineers to develop robotics technologies and systems.

Technology Research - Coordinated with the Samsung Research HQ to secure business alignment for my team's projects. Led technical direction and contributed with hands-on development.

Shape-and-Action Prediction for Robotic Manipulation [3 Publications, 2 Patents]

- Simultaneous shape-and-grasp prediction at 30 FPS avoids over 95% of false positive grasps.
- The placement affordance estimation using NeRF views speeds up pick-to-place computation.

Scene Reconstruction and Gen-AI [3 Publications, 2 Patents **1 Strategically Important Patent**]

- Integrated visual-language model enables generalizable 3D reconstruction for robotics and AR/VR.
- Instance-level shape priors and text prompts provide unprecedented control over image generation.

Semantic Scene Registration [**Tech Transfer to Product** | 1 Publication, 1 Patent]

- Semantic map creation from RGB video and registration to LiDAR map provides enhanced UX.

Systems and Tools Development - Delivered research outcomes as integrable modules (e.g. Object Pose Labeler, 6DOF Grasp Generator) and system-level applications through the following demos:

- Interactive Floorplan App demonstrated refined floorplan generation from a noisy 1D LiDAR scan from a Samsung JetBot™. The semantic registration further adds 3D features to it for improved UX.
- Samsung Manipulation Benchmark evaluated an autonomous system for restaurant table bussing and dishwasher loading applications. I led and designed the architecture for scene understanding and placement-driven grasp planning. The system was built in ROS2 with the RViz visualizer.
- StartUp Kit and Digital Twin were designed as a modular codebase for other Samsung AI teams competing in the benchmark. Three out of the final five teams developed their code using this kit.

Graduate Researcher, The Manipulation and Mechanisms Lab, MIT

Sept 14 - Jun 20

Picking with Purpose: Task-driven and Observable Manipulation

- Built a system to grasp objects considering observability and manipulability for a desired placement.
- Presented the application of pick-to-place policy for industrial kitting for precise object rearrangement.

Prehensile Pushing: In-hand Manipulation with External Contacts

- Developed algorithms for *motion cones* – efficient dynamics representation of contact-rich tasks.
- Leveraged motion cones for up to 1000x faster in-hand manipulation planning and control.

Graduate Researcher, Manipulation Lab, Robotics Institute, CMU

Aug 12 - Dec 13

Extrinsic Dexterity: Dexterous Manipulation using External Resources

- Demonstrated a novel idea of using gravity, dynamic motions, and environment for dexterity.
- Represented the connectivity of grasps with grasp-graphs for planning in-hand manipulations.

SUMMER
PROJECTS

Amazon Robotics Challenge 🏆 1st in 2017 (Stowing Task) 📺, 3rd in 2016, 2nd in 2015] 🌐
A member of Team MIT-Princeton 2015 - 2017

- Developed a grasping motion primitive to pick up desired objects from a cluttered bin.
- Participated in developing the robot hardware, system setup, and overall task planning.

Trajectory Optimization for Industrial Assembly Operations

Research Intern, ABB Corporate Research Center, Västerås, Sweden

Jun 17 - Aug 17

SELECTED
PAPERS

(ALL on G Scholar)

Samsung AI Center

- FineControlNet: Fine-level Text Control for Image Generation with Spatially Aligned Text Control; H. Choi, I. Kasahara, S. Engin, M. Graule, N. Chavan-Dafle, V. Isler; CVPR'24 [Submitted] 📄 🌐
- RIC: Rotate-Inpaint-Complete for Generalizable Scene Reconstruction; I. Kasahara, S. Agrawal, S. Engin, S. Song, N. Chavan-Dafle, V. Isler; ICRA'24 📄 🌐
- HandNeRF: Learning to Reconstruct Hand-Object Interaction Scene from a Single RGB Image; H. Choi, N. Chavan-Dafle, J. Yuan, V. Isler, H. Park; ICRA'24 📄 🌐
- ViolA: Aligning Videos to 2D LiDAR Scans; J. Chao, S. Engin, N. Chavan-Dafle, et al.; ICRA'24 📄 🌐
- Real-time Simultaneous Multi-Object 3D Shape Reconstruction, 6DoF Pose Estimation and Dense Grasp Prediction; S. Agarwal, N. Chavan-Dafle, I. Kasahara, S. Engin, J. Huh, V. Isler; IROS'23 📄 🌐
- Pick2Place: Task-aware 6DoF Grasp Estimation via Object-Centric Perspective Affordance; Z. He, N. Chavan-Dafle, J. Huh, S. Song, V. Isler; ICRA'23 📄
- Simultaneous Object Reconstruction and Grasp Prediction using a Camera-centric Object Shell Representation; N. Chavan-Dafle, S. Popovych, S. Agrawal, D. Lee, and V. Isler; IROS'22 📄 🌐 📺

MIT and CMU

- Robotic Pick-and-Place of Novel Objects in Clutter with Multi-Affordance Grasping and Cross-Domain Image Matching; A. Zheng et al. including N. Chavan-Dafle; IJRR'19, ICRA'18
 (🏆 *Amazon Robotics Best Systems Paper Award in Manipulation*) 📄 🌐
- Planar In-Hand Manipulation via Motion Cones; N. Chavan-Dafle, R. Holladay, and A. Rodriguez; IJRR'19 [Invited paper], RSS'18 (🏆 *Best Student Paper Award*) 📄 📺
- Extrinsic Dexterity: In-Hand Manipulation with External Forces; N. Chavan-Dafle et al.; ICRA'14
 (🏆 *Best Research Video Award Finalist*) 📄 📺

SELECTED
PATENTS
(LEAD INVENTOR)

Two-Phase Gripper to Reorient and Grasp (US 9808936 B2)
 Robotic Manipulation of Objects for Grip Adjustment (PCT/US2019/046771)
 PnuGrip: An Active Two-Phase Gripper for Dexterous Manipulation (US2022/0105642A1)
 Object Shell Reconstruction for Precise Grasping (US11741670B2)
 Synergies between Pick and Place: Task-aware Grasp Estimation(WA-202303-021-1-US0)

SKILLS



Leadership: Team Building, Project Management, Technical Direction, Business Communication
Libraries and Frameworks: PyTorch, Tensorflow, OpenCV, Open3D, PCL, ROS, ABB RAPID
Software Tools: PyBullet, MuJoCo, Blender, SolidWorks, OnShape, Adobe CC
Technical Languages: Python, C++, Matlab/Simulink

HONORS
& AWARDS

A four-year funding award from Lenovo, Delta Electronics, and HKUST-MIT Research Alliance to develop dexterous manipulation capability for flexible manufacturing automation 2016-20
 Karl Chang Innovation Fund award (MIT Institute Funding) for my PhD research project 2014-16
 Featured on the homepage of MIT twice and on TechCrunch, and many other media networks for my work on dexterous manipulation with simple grippers
 NSF and IEEE Robotics and Automation Society conference travel awards for CASE 2018, ICRA 2018, ISRR 2017, IROS 2015, and CASE 2015