

Nikhil Chavan-Dafle

CONTACT INFORMATION

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SUMMARY

A robotics researcher and technical leader with a 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

2020 - 2024

Led the Robot Perception group and worked with the Samsung HQ to ensure business alignment.

Research Projects - Set the technical direction and contributed with hands-on development.

Shape-and-Action Prediction for Robotic Manipulation [Publications: 1, 2, 3 | 2 Patents]

- Simultaneous shape-and-grasp inference at 30FPS provides high accuracy and success rate.

Scene Reconstruction and Gen-AI [Publications: 1, 2, 3 | 2 Patents - 1 Strategic Patent]

- Vision-Language Model enables generalizable 3D reconstruction for robotics and AR/VR.
- Instance-level shape priors and text prompts provides precise control on image generation.

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

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

Systems and Tools Development - Delivered research outcomes through modules and demos.

- Interactive Floorplan App demonstrated refined floorplan generation from a noisy 1D LiDAR scan from Samsung JetBot. The semantic registration adds 3D features to the map in SmartThings.
- Samsung Robotics Benchmark rigorously tested our autonomous robot system for table bussing and dishwasher loading applications, with the vision of house-help robot - Samsung BotHandy.
- StartUp Kit and Digital Twin platform to facilitate Samsung AI teams' participation in the benchmark.

Graduate Researcher, The Manipulation and Mechanisms Lab, MIT

2014 - 2020

Picking with Purpose: Task-driven and Observable Bi-manual Dexterity

- Trained a robot to grasp objects considering observability and manipulability for a desired task.
- Demonstrated the bi-manual robot 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

2012-2013

Extrinsic Dexterity: Dexterous Manipulation using External Resources

- Presented 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

Summer 2017

SELECTED
PAPERS

(ALL on 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; WACV'25

• 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

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