NAVEEN KUPPUSWAMY

Senior Research Scientist, Toyota Research Institute

Robot Foundation Models | Tactile & Multimodal Learning | Humanoid Manipulation

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SUMMARY

I build robotic systems that learn from large-scale multimodal data and sense the world through touch, enabling reliable operation in complex human environments. As a Senior Research Scientist at Toyota Research Institute, I explore how tactile and haptic sensing can enhance foundation models for contact-rich manipulation. I previously served as Robot Data Lead for LBM 1.0 and as Tactile Perception & Control Lead. My work spans from designing award-winning tactile sensors (SoftBubble, Punyo, PolyTouch) to developing tactile-informed policies and evaluation frameworks for domestic manipulation.

EXPERIENCE

Toyota Research Institute (TRI)

Senior Research Scientist

2016—Present Cambridge, MA

- **Robot Data Lead, LBM 1.0 (2024–2025):** Leadership of large-scale on-robot data collection strategy and policy evaluation frameworks for contact-rich dexterous manipulation
- **Tactile Perception & Control Lead (2021–2023):** Whole-body tactile sensing algorithm development (*Project Punyo*); next-generation tactile sensors (*SoftBubble*, *PolyTouch*); tactile-informed diffusion policies
- **Strategic Collaborations:** Co-PI on TRI-funded projects with MIT (*Ted Adelson, Pulkit Agrawal, Wojciech Matusik, Sangbae Kim, Alberto Rodriguez*), Stanford (*Shuran Song, Mark Cutkosky, Jeanette Bohg*), GeorgiaTech (*Seth Hutchinson, Charlie Kemp*), U. Michigan (*Dimitry Berenson, Nima Fazelli*)
- Research under Russ Tedrake (SVP, Robotics Research)

Robotics & Perception Group, University of Zürich

Visiting Researcher

2016—2017 Zürich, Switzerland

- Quadrotor nonlinear control & trajectory optimization (host: Prof. Davide Scaramuzza)

Dynamic Interaction Control Lab, iCub Facility (Isituto Italiano di Tecnologia)

Postdoctoral Fellow

2014—2016 Genoa, Italy

- Whole-body state & force estimation for humanoid robots (supervisor: Dr. Francesco Nori)
- Core contributor to iDynTree, wholeBodyInterface, and iCub platform libraries

AI Lab, University of Zürich

Doctoral Student

2009—2014 Zürich, Switzerland

- Reduced-dimensional control and soft continuum robotics (EU: AMARSi, ROBOTDoC, OCTOPUS projects)
- Marie Curie Fellow; supervised MSc theses; TA/guest lectures in Machine Learning & Robotics

Yujin Robot Co. Ltd.

Research Engineer

2007—2008 Seoul, South Korea

- Service robot middleware architecture; computer vision and ML for consumer robots

EDUCATION

University of Zürich
Ph.D. in Artificial Intelligence

2009—2014 | Zürich, Switzerland

- Marie Curie Fellow; Supervisor: Prof. Rolf Pfeifer
- Thesis: *Exploiting reduced dimensionality in the design and control of embodied systems*

KAIST
M.S. in EECS

2005—2007 | Daejeon, South Korea

- Korean Research Foundation (KRF) Scholarship; Supervisor: Prof. Kim Jong-Hwan
- Thesis: *Nonlinear inverse dynamic control of an omnidirectional mobile robot using slip rolling modes*

Anna University (SRM Engg. College)
B.E. in Instrumentation & Control

2001—2005 | Chennai, India

SELECTED PUBLICATIONS

Full list at Google Scholar

- TRI LBM Team et al. (among first authors) — A Careful Examination of Large Behavior Models for Multitask Dexterous Manipulation. *arXiv 2024* (soon to appear in *Science Robotics*)
- Zhao et al. — PolyTouch: A Robust Multi-Modal Tactile Sensor for Contact-rich Manipulation Using Tactile-Diffusion Policies. *ICRA 2025* | **Best Paper Award**
- Liu et al. — ManiWAV: Learning Robot Manipulation from In-the-Wild Audio-Visual Data. *CoRL 2024*
- Hou et al. — Adaptive Compliance Policy: Learning Approximate Compliance for Diffusion Guided Control. *arXiv 2024*
- Goncalves et al. — Punyo-1: Soft tactile-sensing upper-body robot for large object manipulation. *RoboSoft 2022*
- Kuppuswamy et al. — Fast Model-Based Contact Patch and Pose Estimation for Highly Deformable Dense-Geometry Tactile Sensors. *IEEE RA-L 2019* | **Best Paper Award**
- Kuppuswamy et al. — Soft Bubble grippers for robust and perceptive manipulation. *IROS 2020*
- Foehn et al. — Fast trajectory optimization for agile quadrotor maneuvers with a cable-suspended payload. *RSS 2017* | **Best Student Paper Finalist**

IMPACT METRICS

- **1000+ citations** (Google Scholar)
- **17+ issued patents**, 3 under review
- **3 Best Paper Awards**
- **Open source:** Contributions to Drake, iCub, iDynTree, and Punyo

HONORS & AWARDS

- **Best Paper Award**, ICRA Field and Service Robotics (2025) — *PolyTouch tactile sensor for contact-rich manipulation*
- **Best Paper Award**, IEEE Robotics and Automation Letters (2020) — *Contact patch estimation for deformable tactile sensors*
- Best Student Paper Finalist, Robotics: Science and Systems (2017) — *Quadrotor trajectory optimization with cable-suspended payload*
- **Best Paper Award**, 2nd Int. Electronic Conference on Sensors & Applications (2015) - *Force and motion capture system development*
- **Best Documentation Award**, International Microrobot Maze Contest (2004) — *Poochi Microrobot technical report*
- **Fellowships**: Marie Curie (2011–2014), Google RISE (2014), Korean Research Foundation (2005–2007), NCCR Robotics (2016)

TEACHING & MENTORSHIP

- Guest Lectures: UT Austin (2025, Prof. Lilian Chin), UIUC (2025, Prof. Joohying Kim), Stanford (2024, Prof. Shuran Song), MIT (2023, 6.843 - Prof. Russ Tedrake), MIT (2022, 2023, 2024, Prof. Ted Adelson)
- Mentored 7 summer interns at TRI; Supervised 2 BSc, 4 MSc theses; 7 semester projects at IIT and UZH

INVITED TALKS

RAI Zürich (2025); University of Minnesota (2023); Cornell University (2022); Hong Kong University (2021); Univ. Sheffield (2020); Stanford University (2019); ETH Zürich (2017); MIT CSAIL (2016); multiple industry venues on tactile manipulation and LBMs

PROFESSIONAL SERVICE

- Reviewer: IEEE T-RO, IEEE T-IE, IROS, ICRA, Humanoids, RSS
- Review Editor: Frontiers in Bioengineering and Biotechnology
- Leadership: Co-Chair, TRI LGBTQ+ ERG (2018—2021); ICRA 2020 Workshop on Visuotactile sensing organizer

NON-PROFIT LEADERSHIP

Dwengo pzw — Engagement Manager (2013–2016): Robotics education for underprivileged students; Google RISE 2014 recipient

LANGUAGES

English (Fluent) Tamil (Native) German (Intermediate) Korean (Intermediate) Hindi (Advanced) Italian (Beginner)

PROFESSIONAL LINKS

- TRI Profile: tri.global
- Punyo Project: punyo.tech