Research Accomplishment and Future Research Activity

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During my IPAI Postdoctoral Fellowship, I developed a research program in tactile-centric multimodal robot learning that connects benchmark design, simulation and real-world validation, open research infrastructure, collaborative publications, and externally recognized scholarly work.

ManiFeel: A Foundation for Visuotactile Robot Learning

My principal accomplishment was leading the development of ManiFeel, a scalable and reproducible benchmark for systematically studying how vision and touch complement one another in learning contact-rich robot manipulation [1]. It enables controlled comparisons among vision-only policies and policies augmented with tactile feedback, while supporting multiple learning architectures. The benchmark's experiments show that tactile sensing can substantially improve robustness and precision when visual information is insufficient, and that the most useful tactile representation depends on the task: force-field information is especially valuable for alignment, fitting, and force regulation, whereas high-resolution contact geometries are advantageous for geometry- and texture-sensitive exploration. Parallel physical experiments further demonstrate that these modality-specific trends transfer from simulation to real robot systems. The ManiFeel manuscript is available as an arXiv preprint and is currently under review. In 2026, ManiFeel received the Best Paper Award at the Sense of Touch Workshop at CVPR 2026, further recognizing the benchmark's contribution to multimodal sensing and robot learning.

Beyond the paper itself, ManiFeel established an open and reusable research foundation for studying embodied multimodal reasoning. The work was presented at the RSS 2025 Benchmarking Robot Manipulation Workshop, the 2025 Midwest Robotics Workshop, and the New England Manipulation Symposium at MIT. It also attracted interest from external faculty and students seeking to reproduce the benchmark and use its codebase.

Research Recognition and Collaborative Impact

ManiFeel was selected for the **Best Paper Award** at the Sense of Touch Workshop at CVPR 2026. The workshop's official awards page lists ManiFeel among the Best Paper recipients (official awards page). In addition, the ManiFeel research directly supported our **successful NVIDIA Academic Research Grant Award**. Prof. Yu She served as principal investigator, while I led the proposal development and project writing. The award recognized the broader potential of tactile-enabled simulation and learning to advance robust physical and embodied AI. Prof. She publicly announced the award and its research vision in a LinkedIn post: Dr. Yu She's announcement. **These achievements highlighted the work's novelty, potential long-term impact, community engagement, and direct alignment with IPAI's mission in Physical AI.**

ManiFeel also became a technical and conceptual foundation for a growing portfolio of collaborative projects in the lab. I worked closely with students and colleagues on tactile representation, contact-aware learning, multimodal sensing, and contact-rich manipulation. These collaborations have already contributed to two papers accepted to IEEE/RSJ IROS 2026, one manuscript under review, two manuscripts in preparation, and a provisional patent application [2-6].

Future Research Activity

In Fall 2026, I will join the Department of Electrical and Computer Engineering at the University of Nebraska-Lincoln as a tenure-track Assistant Professor and establish the Physical Embodied AI and Robotics Laboratory (PEARL). PEARL will develop soft and intelligent robotic components with tactile-centric multimodal sensing, together with physics-informed and learning-based methods for robot perception and control using touch, vision, language, and proprioception. By integrating mechanically intelligent hardware with computational intelligence, the lab will pursue the development of physical AI systems that can operate safely, adaptively, and dexterously in unstructured and contact-rich environments.

References and Publication Status

[1] Q. K. Luu, P. Zhou, Z. Xu, Z. Zhang, Q. Qiu, and Y. She, "ManiFeel: Benchmarking and Understanding Visuotactile Manipulation Policy Learning," arXiv:2505.18472, 2025. Preprint; under review.

[2] Y. Saka, J. C. Hu, A. Desai, Z. Zhang, B. Zhang, Q. K. Luu, et al., "CONTACT: CONtact-aware TACTile Learning for Robotic Disassembly," arXiv:2603.08560, 2026. Accepted to IEEE/RSJ IROS 2026.

[3] P. Zhou, Y. Zhou, Q. Luu, S. Han, H. Zhang, B. Huang, et al., "Learning Tactile-Aware Quadrupedal Loco-Manipulation Policies," arXiv:2604.27224, 2026. Accepted to IEEE/RSJ IROS 2026.

[4] Z. Zhang, A. Desai, J. C. Hu, Y. Saka, Q. K. Luu, et al., "Imagining the Sense of Touch: Touch-Informed Manipulation via Imagined Tactile Representations," arXiv:2607.01684, 2026. Under review.

[5] S. Athar, Q. Luu, Z. Zhang, M. R. I. Prince, M. Reed, Z. Tescher, et al., "TriSense: A Unified Visual-Tactile-Auditory Robotic Finger for Learning-Enhanced Contact-Rich Manipulation." In preparation. Provisional Patent Application No. 64/092,935.

[6] M. R. I. Prince, Q. K. Luu, Z. Hu, Z. Xu, S. Athar, J. Kim, et al., "Beyond Deformation: Photoelastic Vision-Based Tactile Sensing for Robotic Manipulation." In preparation.