

Rahul Jain

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OVERVIEW

I am a PhD student working at intersection of Computer Vision, Machine Learning and Human AI Interaction.

EDUCATION

Purdue University West Lafayette, Indiana, United States PH.D. in Computer Engineering (Area of study: ML, CV and HAI)	2021– Current GPA: 4.0/4.0
Purdue University West Lafayette, Indiana, United States Master of Science in Computer Engineering (Area of study: CV and HAI)	2019 – 2021 GPA: 3.78/4.0
Indian Institute of Technology (IIT) Patna Bachelor of Technology in Civil Engineering (Top 5%)	2015 – 2019 GPA: 8.74/10.0

PROFESSIONAL EXPERIENCE

Fujitsu Research of America Santa Clara, California, United States Computer Vision Research Intern (Manager - Koichiro Niinuma and Aakar Gupta)	Jan – June 2024
Purdue University West Lafayette, Indiana, United States Graduate Research Assistant (Advisor - Dr Karthik Ramani, Co-Advisor - Murat Kocaoglu)	2020 – Present
North Carolina State University Raleigh, North Carolina, United States Summer Research Intern (Advisor - Kevin Han)	May - July 2018
Indian Institute of Technology (IIT) Bombay Bombay, Maharashtra, India Summer Research Intern (Advisor - Dharamveer Singh)	May – July 2017

RESEARCH EXPERIENCE

AdaptiveSliders: User-aligned Semantic Slider-based Editing of Text-to-Image Model Output

(Lead Author) [1]

- Developed AdaptiveSliders, an AI-driven semantic editing tool for **enhanced image generation** and **precise image attributes manipulation** in generated images via **Stable Diffusion through multimodal reasoning**.
- Designed a novel pipeline leveraging language models and vision-language reasoning to **generate intent-aligned images**, identify latent space attribute directions, and establish latent boundaries to **minimize entanglement in the latent space of Stable Diffusion**.
- Conducted experiments for validating initial image generation and latent space boundaries by **developing a customize validation dataset of 100 prompt-image pair through prompting language model**.

CARING AI: Towards Authoring Context-Aware Augmented Reality Instructions through Generative Artificial Intelligence

(Co-Lead Author) [2]

- Designed codeless text-based workflow for generating 3D humanoid instruction in AR using **Generative AI that is aware of context** – human, environment and system.
- Developed **multimodal diffusion model (trajectory-guided and text both as input)** algorithm to generate smooth and continuous sequences of humanoid avatar motion.
- Designed and Developed an AR authoring interface** for visualizing and modifying real-time humanoid context-aware instructions.

Ubi- Touch: Ubiquitous Tangible object utilization through consistent hand-object Interaction in Augmented Reality

(Lead Author) [3]

- Optimized the Megapose (3D object tracking network) and Frankmocap (3D Hand Tracking Network) algorithms** by minimizing interaction, collision and contact loss for state-of-the-art 3D hand object tracking from RGB-D videos.

- Developed an **automatic annotation pipeline** for collecting hand object interaction database that includes Objects 3D CAD, affordances, interactions, hand poses and contact points.
- **Designed and developed AR interface using integration of Front-end UI visuals and backend deep learning AI pipeline** that assist AR users to locate every day real objects as opportunistic tangible proxies for virtual objects guided by hand object interaction constraint.

Interacting Objects: A Dataset of object-object interactions for richer dynamic scene representations

(Co Author) [4]

- Developed novel **human-object-object interactions dataset** based on the taxonomy for understanding spatial-temporal scene representation in the videos for home - industry environment.
- Implemented **feature extraction** pipeline for the entire dataset for benchmarking and downstream applications such as action recognition and classification.

An HCI-Centric Survey and Taxonomy of Human Generative Artificial Intelligence Interactions

(Co-Lead Author) [5]

- Reviewed a **corpus of 291 papers** on human generative AI interactions.
- Developed taxonomy with a **novel design space dimensions** with focus on both human perspective and Generative AI perspective and the interactions between them.
- Discussed open **research questions and future opportunities** based on the insights from the collected corpus.

An Exploratory Study on Multi-modal Generative AI in AR

(Co-Lead Author) [6]

- **Developed a design space for multimodal interactive** storytelling in Augmented Reality by reviewing YouTube videos and past literature.
- Developed an AR interface for **AI-generated multi-model storytelling content** using state-of-the-art generative AI modules for text, audio, images, and 2D animations.
- Conducted an **Exploratory study for the effects of multimodal AI-generated** content on user perception and engagement in AR storytelling.

Visualizing Causality in Mixed Reality for Manual Task Learning: A Study

(Lead Author) [7]

- Conducted the user study using 48 participants to evaluate the **effect of causality in task learning**.
- Developed a **visualization interface for causality** in instruction for learning the content in Unity3D.
- Implemented an authoring interface for creating **causality-aware AR humanoid instruction** tutorials from embodied demonstration by the author using hand and object tracking algorithms.
- Detailed **design recommendations** for incorporating causality in authoring content for learning tasks.

PATENTS

[P1] Generative Artificial Intelligence (AI)-Based Image Generation using Attribute-based Slider Controls.

[P2] System and Method for Authoring Context-Aware Augmented Reality Instruction through Generative Artificial Intelligence. US Patent App. 63/622,351

[P3] Ubi-TOUCH: Ubiquitous Tangible Object Utilization through Consistent Hand-object interaction in Augmented Reality. US Patent App. 63/543,930

[P4] Visualizing Causality in Mixed Reality for Manual Task Learning. US Patent App. 18492156

[P5] Virtual Reality based Robotics Surgical Training Systems. US Patent App. 63/640,019

SKILLS SET

Technical: TensorFlow, PyTorch, OpenCV, Python, Numpy, Pandas, Scipy C, C++, R, PyQt, SQL, Nodejs, MATLAB, Hadoop, AWS, Docker, CUDA, Git, TensorRT, Unity HTML, CSS, Javascript, HoloLens and Quest Series, Machine Learning Libraries and Deep Learning Libraries.

Abilities: Excellent verbal, written and interpersonal skills, Team Player, Strong Organizational skills, Positive attitude, and desire to learn, Ability to work in deadline driven environment, Ability to work and succeed in diverse teams

ACADEMIC SERVICES

- Review at CHI, UIST, CSCW, and IEEE VR.
- Mentoring two master's students – Hyungjun Doh and Heesoo Kim.
- Graduate Mentor at Summer Undergraduate Research Fellowship (SURF) 2021,2023 and 2024.

AWARDS

- Honored with “Excellence Award” in IPC-SHM (International Competition) for project detecting damages in structures using Deep Learning.
- Selected for fully funded Internship in Summer 2018 at NC State University through RISE Program.
- Selected for Summer Research Fellowship Program (INSA-NASI-IASc) which is India national internship program.

PUBLICATION

*Equal contribution

1. **Jain, R.**, Goel, A., Ninuuma, K., & Gupta, A. AdaptiveSliders: User-aligned Semantic Slider-based Editing of Text-to-Image Model Output. **(Accepted CHI 2025)**
2. Shi, J.*, **Jain, R.***, Chi, S.*, Doh, H., Chi, H., & Ramani, K. CARING AI: Towards Authoring Context-Aware Augmented Reality Instructions through Generative Artificial Intelligence. <https://arxiv.org/pdf/2501.16557> **(Accepted CHI 2025)**
3. **Jain, R.***, Shi, J.*, Duan, R., Zhu, Z., Qian, X., & Ramani, K. (2023, October). Ubi-TOUCH: Ubiquitous Tangible Object Utilization through Consistent Hand-object interaction in Augmented Reality. In Proceedings of the 36th Annual ACM Symposium on User Interface Software and Technology (pp. 1-18).
4. Unmesh, A., **Jain, R.**, Shi, J., Manam, V., Chi H., Chidambaram, S., Quinn, A., & Ramani, K. (2023). Interacting Objects: A dataset of object-object interactions for richer dynamic scene representations. Robotics and Automation Letter 2023.
5. Shi, J.*, **Jain, R.***, Doh, H., Suzuki, R., & Ramani, K. (2025). An HCI-Centric Survey and Taxonomy of Human-Generative-AI Interactions. arXiv preprint arXiv:2310.07127. **(Submitted ACM Computing Survey)**
6. Doh, H.*, Shi, J.*, **Jain, R.***, Kim, H., Ramani, K. (2025). An Exploratory Study on Multi-modal Generative AI in AR. **(Submitted DIS 2025)**
7. **Jain, R.***, Shi, J.*, Benton, A., Rasheed, M., Chidambaram, S., & Ramani, K. (2023). Visualizing Causality in Mixed Reality for Manual Task Learning: An Exploratory Study. arXiv preprint arXiv:2310.13167. **(Accepted TVCG)**