Ritesh Sharma

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Research Interests

My research builds *reliability-aware autonomy*: robotic systems that quantify when their own perception, prediction, and control are trustworthy and adapt their behavior accordingly. I anchor reliability in classical geometric quantities (observer geometry, dynamic stability margins, free-space topology) and compose these with learning where it helps, producing uncertainty estimates that are interpretable, composable across sensing modalities, and analyzable under explicit assumptions. Current directions span three thrusts: *navigation geometry and observability* (cooperative multi-robot localization, GDOP-adaptive estimation, formation-aware planning), *geometry-aware mobile manipulation* (ZMP-based stability certification, calibrated base-pose uncertainty, certified safe policy learning), and *reliability-aware perception* (architecture-adaptive uncertainty fusion, conformal calibration under distribution shift, closed-loop sensor selection).

Education

2023 **Ph.D. in Computer Science** — Merced, CA, USA
University of California, Merced
Dissertation: Navigation Structures for Flows, Formations and Decision Making
Advisor: Dr. Marcelo Kallmann

2017 **M.S. in Computer Science** — Corvallis, OR, USA
Oregon State University
Thesis: Interactive Design and Transition Point Analysis of 3D Linear Symmetric Tensor Fields
Advisor: Dr. Eugene Zhang

2010 **B.Tech. in Computer Science & Engineering** — Kolkata, India
West Bengal University of Technology

Academic Appointments

07/2025 – Present **Virginia Commonwealth University** — Richmond, VA
Research Scientist, Department of Electrical and Computer Engineering

12/2024 – 07/2025 **The University of Tulsa** — Tulsa, OK
Postdoctoral Research Associate, The Institute for Robotics and Autonomy

01/2024 – 12/2024 **Missouri University of Science & Technology** — Rolla, MO
Postdoctoral Fellow, Center for Intelligent Infrastructure

05/2020 – 08/2020 **Hasso-Plattner-Institut** — Potsdam, Germany
Visiting PhD Researcher, Human-Computer Interaction Group

Honors and Awards

2023	UC Merced EECS USAP Travel Fellowship
2021/2022	UC Merced GRAD EXCEL Peer Mentorship Award
2019/2020	UC Merced EECS Bobcat Travel Fellowship
2019	Travel Award for NSF-sponsored SOCG, Portland, Oregon
2019	UC Merced EECS Bobcat Summer Fellowship
2018–2023	Graduate Assistantship (Full Tuition & Stipend), University of California, Merced
2017	Honorary Citizenship of Corvallis, Oregon for contributions at Oregon State University
2014–2017	Graduate Assistantship (Full Tuition & Stipend), Oregon State University

Research Grants

Awarded

[1] $25,000, "Geometry-Aware Uncertainty Calibration for Cooperative Multi-Unmanned Aerial Vehicles Tracking," VCU Research and Innovation. Role: PI.

Under Review / Pending Decision

[7] $75,000, "Geometry-Aware Uncertainty Calibration for Cooperative Multi-Unmanned Aerial Vehicles Tracking," VIPC Commonwealth Commercialization Fund. Role: Co-PI. *(Invited finalist for pitch presentation.)*

[6] $50,000, "Making Mobile Manipulation Reliable with Calibrated Uncertainty," Amazon Science Robotics (Spring 2026). Role: PI.

[5] $100,000, "Geometry-Calibrated Safe MARL for Cooperative Multi-UAV Tracking," Commonwealth Cyber Initiative Central Virginia. Role: Co-PI.

[4] $80,000, "Architecture-Adaptive Uncertainty Fusion for Deepfake Detection," Amazon Science (AWS AI for Information Security 2026). Role: Co-PI.

[3] $10,000, "IEEE RAS Richmond Chapter's Robotics Summer School 2027," IEEE RAS Technical Education Program. Role: Co-PI.

[2] $2,000, "IEEE Robotics and Automation Society Richmond Chapter's Initiative Grant," IEEE RAS. Role: Co-PI.

[1] $1,200,000, "Architecture-Adaptive Uncertainty Fusion for Reliable Deepfake Detection," NSF SaTC 2.0 Program. Role: Co-Investigator.

Publications

Peer-Reviewed Conference Articles

[C9] Neha Sharma and Ritesh Sharma. Harmonizing mass-shooting databases for cross-source risk classification: A leave-one-dataset-out study. *IEEE International Conference on Information Reuse and Integration for Data Science*, 2026.

[C8] Ritesh Sharma, Neha Sharma, Shreyas Harish, Colin Drake, and Yuichi Motai. GDOP based GCP optimization for UAV photogrammetry. In *Proceedings of IGARSS*, 2026.

[C7] Ritesh Sharma, Allen Marshall, David Montgomery, and Rose Gamble. Towards adaptive assistance: A preliminary architecture for dynamic user profiling in social robots. In *Proceedings of the International Conference on Social Robotics*, 2025.

[C6] Woubishet Zewdu Taffese, Ritesh Sharma, Mohammad Hossein Afsharmovahed, Gunasekaran Manogaran, and Genda Chen. Benchmarking YOLOv8 for optimal crack detection in civil infrastructure. In *104th Transportation Research Board Annual Meeting*, 2025.

[C5] Ritesh Sharma, Eric A. Bier, Les Nelson, Mahabir Bhandari, Niraj Kunwar. Automatic digitization and orientation of scanned mesh data for floor plan and 3D model generation. In *Advances in Computer Graphics (CGI 2023)*, LNCS vol. 14496, Springer.

[C4] Eric A. Bier, Alejandro E. Brito, Raman Goyal, Saman Mostafavi, Les Nelson, Ritesh Sharma, Mahabir S. Bhandari, Niraj Kunwar, Shamus Li. Sensorium: Commissioning abundant sensors with augmented reality and QR codes. In *18th International IBPSA Conference and Exhibition, Building Simulation*, 2023.

[C3] Thijs Roumen, Ingo Apel, Thomas Kern, Martin Taraz, Ritesh Sharma, Ole Schlueter, Jeffrey Johnson, Dominik Meier, Conrad Lempert, Patrick Baudisch. Structure-preserving editing of plates and volumes for laser cutting. In *SCF '22: Proceedings of the 7th Annual ACM Symposium on Computational Fabrication*, Article 20, pp. 1–12, 2022.

[C2] Ritesh Sharma, Tomer Weiss, and Marcelo Kallmann. Plane-based local behaviors for multi-agent 3D simulations with position-based dynamics. In *Proceedings of IEEE AIVR*, pp. 214–217, 2020.

[C1] Ritesh Sharma, Shital S. Jadhav, Debabrata Tripathy, Harshala V. Sardar, and Gopal. R. Patil. Virtual laboratory: An alternative approach to urban transportation systems planning lab. In *Transportation Research Board, 93rd Annual Meeting*, Washington, D.C., 2014.

Peer-Reviewed Journal Articles

[J6] Ritesh Sharma, Tomer Weiss, and Marcelo Kallmann. Formation-aware planning and navigation with corridor based shortest path maps. *Computer Graphics Forum*, Vol. 43, Issue 1, 2024.

[J5] Ritesh Sharma and Marcelo Kallmann. Computing and analyzing decision boundaries from shortest path maps. *Computer & Graphics*, Vol. 117, pp. 73–84, 2023. *(Invited for presentation at ACM SIGGRAPH MIG 2024)*

[J4] Ritesh Sharma and Marcelo Kallmann. Spatially distributed lane planning for navigation in 3D environments. *Computer Animation and Virtual Worlds*, Vol. 34, Issue 3–4, e2162, 2023. *(Appeared at CASA 2023)*

[J3] Bernhard Jenny, Daniel M. Stephen, Ian Muehlenhaus, Brooke E. Marston, Ritesh Sharma, Eugene Zhang, and Helen Jenny. Design principles for origin-destination flow maps. *Cartography and Geographic Information Science*, 45.1, pp. 62–75, 2018.

[J2] Bernhard Jenny, Daniel M. Stephen, Ian Muehlenhaus, Brooke E. Marston, Ritesh Sharma, Eugene Zhang, and Helen Jenny. Force-directed layout of origin-destination flow maps. *International Journal of Geographic Information Science*, 31(8), pp. 1521–1540, 2017.

[J1] Eugene Zhang, Jonathan Palacios, Harry Yeh, Wenping Wang, Yue Zhang, Bob Laramee, Ritesh Sharma, and Thomas Schultz. Feature surfaces in symmetric tensor fields based on eigenvalue manifold. *IEEE TVCG*, Issue 99, pp. 1248–1260, 2016. *(Appeared at SIGGRAPH ASIA 2016 and IEEE VIS 2016)*

Posters and Extended Abstracts

[E4] Ritesh Sharma, Tomer Weiss, and Marcelo Kallmann. 3D behaviors for multi-agent simulations with position-based dynamics. In *ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games (I3D)*, poster, 2020.

[E3] Ritesh Sharma, Ayme Tomson, Emilio Lobato, Marcelo Kallmann, Lace Padilla. Data driven multi-hazard risk visualization. In *EuroVis 2020*, extended abstract, 2020.

[E2] Ritesh Sharma, Renato Farias, and Marcelo Kallmann. Integrating local collision avoidance with shortest path maps. In *EuroGraphics 2020*, poster, 2020.

[E1] Ritesh Sharma, Shital S. Jadhav, Debabrata Tripathy, Harshala V. Sardar, and Gopal R. Patil. Virtual laboratory on urban transportation system planning. In *10th International Conference on Transportation Planning and Implementation Methodologies for Developing Countries (TPMDC)*, IIT Bombay, India, 2012.

Book Chapters

[B1] Yue Zhang, Lawrence Roy, Ritesh Sharma, and Eugene Zhang. Maximum number of transition points in 3D linear symmetry tensor fields. In *Topological Methods in Data Analysis and Visualization V*, pp. 237–250, 2020. *(Appeared at TopoInVis 2017)*

Patents

[Pat1] System and method for automatic floorplan generation. Inventors: Eric A. Bier and Ritesh Sharma. US Patent App. 18/297,506.

[Pat2] Geometry-aware uncertainty calibration for cooperative multi-UAV tracking via GDOP-adaptive EKF noise scheduling. Inventors: Ritesh Sharma and Yuichi Motai. US Provisional Patent Filed.

[Pat3] End-to-end GDOP-based framework for predictive GCP optimization and quality assessment in UAV photogrammetry. Inventors: Ritesh Sharma and Yuichi Motai. US Provisional Patent Filed.

Technical Reports

[T1] Mohammad H. Afsharmovahed, Kevin Lai, Ritesh Sharma, Genda Chen, and Ruwen Qin. An interactive system for training and assisting bridge inspectors in the inspection video data analytics. *INSPIRE University Transportation Center Report*, 2024.

Industry and Research Positions

05/2023 – 12/2023	**Amazon Robotics** Applied Scientist II Co-op Focus: Uncertainty-aware planning for transient obstacles in warehouse robotics	United States
05/2022 – 08/2022	**Dolby Laboratories** Visual Coding Intern Focus: Neural scene representation for novel view synthesis	United States
05/2021 – 01/2022	**PARC, part of SRI (formerly part of Xerox)** Research Intern Focus: Geometry modeling for automatic floor plan generation	United States
05/2017 – 08/2018	**Passur Aerospace Inc.**	United States

	Senior Graphics Programmer Focus: GUI development for flight tracking systems	
04/2016 – 08/2016	**Wolfram Research Inc.** Intern (Mathematica Algorithm R&D) Focus: Wolfram's Mathematica & Pixar's Renderman Interface	United States
10/2010 – 12/2013	**Indian Institute of Technology Bombay** Research Assistant Focus: Virtual lab for urban transportation system planning	India

Invited Talks

04/2026	Roundtable Research Talk, Commonwealth Cyber Initiative (CCI) Symposium *Correlation-Optimized Fusion for Deepfake Reliability*
03/2026	Hofstra University *Geometric Spatial Intelligence: Algorithms for Navigation, Sensing and Interaction*
08/2025	Virginia Commonwealth University *Invited Lecture for EGRE651*
07/2025	The University of Tulsa, Institute of Robotics and Autonomy *Spatial Intelligence: Reasoning, Representation and Planning*
03/2025	University of Tulsa, Institute of Robotics & Autonomy Seminar *Spatial Intelligence: Reasoning, Representation and Planning*
02/2025	University of Southern Mississippi *Spatial Intelligence: Reasoning, Representation and Planning*
01/2025	Youngstown State University *Spatial Intelligence: Reasoning, Representation and Planning*
06/2024	Oakland University *Spatial Reasoning: Enhancing Flows, Formations, Modeling & Decision Making*
04/2024	Missouri University of Science & Technology *Advancements and Emerging Trends in 3D Reconstruction Techniques*
03/2024	Center for Intelligent Infrastructure, Missouri S&T *Navigation Structures for Flows, Formations and Decision Making*
07/2023	Amazon Robotics *Navigation Structures for Flows, Formations and Decision Making*
02/2023	Lawrence Livermore National Laboratory *Navigation Structures for Flows, Formations and Decision Making*
05/2022	University of California, Merced *Navigation Structures for Flows, Formations and Decision Making*

Professional Activities and Service

Conference and Journal Reviewer

- Robotics: Science and Systems (RSS)

- ACM/IEEE International Conference on Human-Robot Interaction (HRI)
- ACM International Conference on Multimodal Interaction (ICMI)
- International Conference on Human-Agent Interaction (HAI)
- AAAI Conference on Artificial Intelligence (AAAI)
- ACM CHI Conference on Human Factors in Computing Systems (SIGCHI)
- ACM SIGGRAPH Conference on Motion, Interaction, and Games (MIG)
- IEEE Transactions on Visualization and Computer Graphics (TVCG)
- IEEE Visualization Conference (VIS)
- IEEE Pacific Visualization Conference (PACIFIC VIS)
- Eurographics Conference on Visualization (EuroVIS)
- Computer Graphics Forum (CGF)
- International Conference on Computer Animation and Social Agents (CASA)
- ACM SIGGRAPH / Eurographics Symposium on Computer Animation (SCA)
- International Conference on Automated Planning and Scheduling (ICAPS)
- European Association for Computer Graphics (EuroGraphics)
- IEEE International Conference on Information Reuse and Integration for Data Science (IRI)

Service

- Treasurer, IEEE Robotics and Automation Society (RAS) Richmond Chapter
- Judge, Graduate Research Symposium, Virginia Commonwealth University, 2026
- Program Committee Member, 40th Annual AAAI Conference on Artificial Intelligence (AAAI-2026)
- Peer Mentor, UC Merced GRAD-EXCEL Peer Mentor Program (2020–2022)
- Secretary, Merced Indian Graduate Student Association (MIGSA), UC Merced (2019–2020)
- Student Volunteer, ACM SIGGRAPH 2019

Teaching Experience

Teaching Assistant

Fall 2018 – Dec 2022	**University of California, Merced** Intro to Computing I (Java), Advanced Programming (C++), Data Structures, Algorithm Design & Analysis (C++), Intro to OOP (C++), Computer Graphics (C++)
Jan 2014 – Mar 2017	**Oregon State University** Analysis of Algorithms, Intro to Databases, Operating Systems I, Translators
Aug 2021	**Summer Geometry Institute** Organized by the Geometry Group at MIT

Mentorship and Student Supervision

2025 – Present	Shreyas Harish, Undergraduate, Virginia Commonwealth University
2025	Daevin Oey, Undergraduate, Virginia Commonwealth University
2025	Sreepada Vallab Kandi, M.S. Student, Virginia Commonwealth University
2024 – 2025	Baqer Hassani, Undergraduate, University of Tulsa
2024	Kevin Lai, Undergraduate, Missouri University of Science & Technology
2015	Victoria Nelson, Undergraduate, Northwestern University *(NSF REU)*

Certification

KUKA College's LBR iiwa (Intelligent Industrial Work Assistant) certificate for completing a 5-day training program on KUKA's robotic manipulator, Shelby Township, Michigan.

Technical Skills

Programming: C, C++, Python, GLSL, PHP, HTML, CSS, JavaScript, JQuery, Wolfram Language
Frameworks: wxWidgets, QT, OpenGL, OpenCV, OpenMP, OpenCL, EmberJS, React, Redux, ROS/ROS2, AWS
Machine Learning: Scikit-learn, Keras, TensorFlow, PyTorch, LLMs, GANs, CNNs, Transformers
Hardware: Hello Robot Stretch 3, KUKA iiwa 7/14, X-arm, UR5e, Agilex Tracer, Nvidia Jetson Orin Nano, ModalAi Starling Drone, Zed2i Camera, LiDAR (Ouster, Velodyne, Livox)
Software: MATLAB, Renderman, Mathematica, Unity3D, Unreal Engine, PyBullet, IsaacSim, AirSim