

Gyanig Kumar

<https://gyanigk.github.io>

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Education	University of Colorado, Boulder , Boulder, CO, United States Masters in Computer Science Relevant Coursework: Advanced Robotics, Machine Learning, Computer Vision GPA: overall 3.91/4.0;	August 2024-Present Graduation: May 2026
Publications	M. Mitra, Gyanig Kumar, P.P. Chakrabarti, P. Biswas. <i>Investigating Inverse Reinforcement Learning during Rapid Aiming Movement in Extended Reality and Human-Robot Interaction</i>. ACM Transactions on Human-Robot Interaction (THRI), 2025. S. Raj, B. Karmakar, Gyanig Kumar, ... , P. Biswas. <i>Comparing computer vision models for low resource dataset to develop a mixed reality based manual assembly assistant</i>. Discover Robotics. M. Mitra, Gyanig Kumar, P.P. Chakrabarti, P. Biswas. <i>Enhanced human-robot collaboration with intent prediction using deep inverse reinforcement learning</i>. 2024 IEEE International Conference on Robotics and Automation (ICRA'24) M. Mitra, A.A. Patil, G. Mothish, Gyanig Kumar, ... ,P. Biswas. <i>Multimodal target prediction for rapid human-robot interaction</i>. Companion proceedings of the 29th international conference on intelligent user interfaces (IUI '24) L.R.D. Murthy, Gyanig Kumar, P. Biswas, M. Madan, S. Deshmukh. <i>Efficient interaction with automotive heads-up displays using appearance-based gaze tracking</i>. Adjunct Proceedings of the 14th International Conference on Automotive User Interfaces and Interactive Vehicular Applications	
In Submission	Yi-shiuan*, Gyanig Kumar*, Alessandro Roncone, Bradley Hayes. <i>SAWO: A Framework for Workspace Optimization to Enhance Intent Recognition in Shared Autonomy</i> at HRI Short Papers 2025[†] Yi-shiuan, Gyanig Kumar, Alessandro Roncone, Bradley Hayes. <i>CRED: Counterfactual Reasoning and Environment Design for Generalizable Active Preference Learning</i> at ICRA 2026[†] *Equal contribution. †Under review.	
Presentations	Co-presented a poster on "Efficient interaction with automotive heads-up displays using appearance-based gaze tracking," Work in progress track at AutoUI' 22 Conference Presented research paper discussion on "End-to-end Frame-to-gaze Estimation" with live demonstration of appearance-based gaze estimation, CUB CSCI 7000 Recent Adv. in Computer Vision	
Research Experience	CUB CAIRO Lab with Dr. Bradley Hayes Working on developing <i>Robotics Shared Control</i> projects.	September 2024–Present
	• Leading as first author on a shared autonomy project, developing a Vision-Language Multi-Modal Framework using OpenAI, integrating gaze estimation to enable adaptive, variable-horizon robotic task planning for efficient human-robot interaction. • Designed and implemented a custom ROS package for the Sawyer Manipulator, leveraging a multi-RGBD camera system for dynamic scene analysis, automated eye-hand calibration with the camera system, and motion planning and motion primitives actions to enable real-time assistive feeding demonstrations. • Integrated Tobii Glasses 3 eye-tracking python data integration pipeline with the Sawyer Manipulator, conducting comparative studies on gaze-based intent recognition versus traditional keyboard/joystick teleoperation to enhance robotic manipulation efficiency. • Partnered with a PhD scholar on an evaluation study, contributed to writing new environment framework compatible with the Webots & CARLA driving simulator, enabling training preference learning algorithms for active preference learning in human-in-the-loop scenarios, with a focus on analysing human vs scene feature impact through simulation.	

- Collaborated on integrating a **gaze estimation mapping module for an inverse RL study**, achieving 5% statistical increase on intent recognition accuracy compared to traditional camera-based hand recognition in predicting user intent during assistive pick-and-place tasks.
- Conducted experiments with over 5k single-object varied scene images, utilising SOTA Generative Adversarial Network models to **translate CAD-generated Unity 3D scenes into realistic object detection datasets**, eliminating the need for manual bounding box labelling.
- Partnered with a Phd scholar on building a newer architecture for training and designing a lightweight eye gaze Estimation model, inspired by the I2D-Net, **reducing model parameters by 0.5x** and subpar accuracy, enabling faster gaze tracking model compatible with interactive automotive Heads-Up Display Systems.
- Collected, extracted and cleaned over **200+ GB of the user study collected video+gaze dataset** for building a dataset for an ingenious mobile, inexpensive Eye tracker for manufacturing and space applications

Grad Course
Projects

Advanced Robotics, Instructor: Dr. Leopold Beuken

Spring 2025

- Collaborated with a team of four graduate students to design, develop, and compete in a week-long autonomous driving bot challenge, implementing an image-based lane recognition module to enable precise navigation.
- Investigated advanced robotic localization and navigation techniques, including Simultaneous Localization and Mapping (SLAM), Extended Kalman Filters, and Particle Filters, within a controlled indoor environment.

Recent Advancements in Computer Vision, Instructor: Dr. Danna Gurari

Fall 2024

- Curated a dataset of over 5,000 simulated manufacturing part images, performing outlier detection and developing normalized image attributes to optimize training efficiency for a diffusion model.
- Leveraged pretrained Stable Diffusion models to generate a dataset incorporating natural scene attributes, combining curated simulated images with real-world manufacturing scenes for enhanced model robustness.

Industry
Experience

Collins Aerospace & Faurecia

July 2022-March 2024

Funded Research Collaborator

- Partnered with Collins Aerospace to develop a mixed reality-based assembly system using custom-trained object detection models with tailored eye gaze and hand tracking for efficient, real-time assembly guidance.
- Partnered with Faurecia on building Heads-up Display solutions with Eye gaze tracking for distraction detection and multi-modal user interactive infotainment systems

Other
Experience

CS3155 Principles of Programming Languages, *Teaching Assistant*

Summer 2025

CS3302 Introduction to Robotics, *Course Manager*

Spring 2025

CS2824 Discrete Structures *Course Grader*

Fall 2024

Awards

2025 Tata Millennium Scholarship – \$800

2025 HackCU11 AI Track – Ranked 2/15

2025 AWS Amazon Hackathon – Ranked 2/25

Community
Involvement

ACC Conference, Denver, *Student Volunteer*

July 2025

CUB CS-Graduate Student Association, *Vice Chair*

May 2025

CUB CS-Graduate Professional Development Club, *Coordinator*

August 2024-May 2025

CUB CS Tea Time, *Coordinator*

January 2025

References

Dr. Pradipta Biswas

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