# KARTIK RAMACHANDRUNI

# PhD student in Robotics, Georgia Tech Email: kvr6 [at] gatech [dot] edu & Website: kartikvrama.github.io

### **EDUCATION**

<b>Ph.D. Student, Robotics</b> School of Interactive Computing, Georgia Tech Advisor: Sonia Chernova GPA: 4.0/4.0	2021-Present
<b>B.Tech, Mechanical Engineering (ME)</b> Indian Institute of Technology (IIT) Jodhpur GPA: 9.59/10.0	2014-18
PROFESSIONAL EXPERIENCE	
Student Researcher (Summer Internship) Google Cerebra	Summer of 2023
Graduate Research Assistant School of Interactive Computing, Georgia Tech	2021-Present
Robotics ResearcherTCS Research & Innovation Labs, Bangalore	2018-2021
Undergraduate Researcher Indian Institute of Technology (IIT) Jodhpur	2015-18

# **RESEARCH PROJECTS**

# PARSEC: Preference Adaptation for Robotic Object Rearrangement from ScenE Context 2023-2025

RAIL Lab, Georgia Tech

Prof. Sonia Chernova

- · Constructed a novel object tidying benchmark and dataset that addresses the practical challenges of personalized object tidying. PARSEC encompasses adaptation to real user preferences, object placement in partially arranged environments, and generalization to unseen objects and environments.
- Collected a crowdsourced dataset of 110K evaluation examples collected from 72 real users arranging objects in environment resembling actual homes, spanning 93 household objects and 15 environment instances.
- Conducted a crowdsourced user evaluation with 108 online raters assessing the alignment of different model predictions to user preferences. Our user evaluation highlights challenges associated with modeling environment semantics across different environment categories and provides recommendations for future work.
- Proposed ContextSortLM, an LLM-based rearrangement model that places objects in partially arranged environments by adapting to user preferences from prior and current scene context while accounting for multiple valid placements. ContextSortLM outperforms other models in placing objects to replicate the target user's arrangement and ranks among the top two in all three environment categories, as rated by online evaluators.

#### 2022-2023 Personalized Object Rearrangement in Partially Arranged Environments RAIL Lab, Georgia Tech Prof. Sonia Chernova

- · Developed ConSOR, a user-personalized object rearrangement framework to assist users in human-organized environments without any user goal specification by leveraging contextual cues from partially arranged environments (e.g., a half-empty kitchen cabinet or a fridge half-filled with groceries).
- Generated a novel dataset of object arrangements generated across four different organizational styles that mimic how humans typically arrange objects. ConSOR outperforms both a GPT-3.5 Large Language Model (LLM) and an item recommender baseline (IROS 2023)

#### UHTP: User-aware Hierarchical Task Planning Framework for Communication-Free, Mutually-2021-2022 Adaptive Human-Robot Collaboration

RAIL Lab, Georgia Tech

Prof. Sonia Chernova

· Developed UHTP or User-aware Hierarchical Task Planner for human-robot collaborative manipulation tasks that minimizes overall task execution time while allowing the human and robot to adapt to each other's action preferences without explicitly communicating with one another.

 $\cdot$  Conducted an in-person user study to validate the proposed planning framework in which participants worked together with a JACO 7-DOF robotic arm to assemble power drills. (ACM THRI 2023)

#### **INTERNSHIP PROJECTS**

Detecting Decision Uncertainty in Black-Box UI Automation agents Google Cerebra Summer of 2023 Dr. William Bishop

- Formulated the research problem of agent decision uncertainty in UI Automation tasks due to extrinsic factors such as under-specified task goals or un-afforded actions within the plan and created a taxonomy of extrinsic uncertain scenarios in UI automation.
- Proposed a novel uncertainty detection technique for Large Language Model (LLM) based agents based on in-context learning and chain-of-thought prompting. I benchmarked the performance of this framework against prior work by evaluating on a custom dataset of extrinsic uncertain scenarios in UI automation.

#### **RESEARCH PUBLICATIONS**

 $\cdot$  K. Ramachandruni and S. Chernova, "The SemPReP Benchmark: Semantic-driven Personalized Object Rearrangement in Partially-Arranged Environments," Under review at *IEEE RA-L*, 2024

· K. Ramachandruni, M. Zuo, and S. Chernova, "ConSOR: A Context-Aware Semantic Object Rearrangement Framework for Partially Arranged Scenes," in *IEEE IROS*, 2023 (*Paper*)

• K. Ramachandruni<sup>\*</sup>, C. Kent<sup>\*</sup>, and S. Chernova, "UHTP: A User-Aware Hierarchical Task Planning Framework for Communication-Free, Mutually-Adaptive Human-Robot Collaboration," in *ACM Transactions on Human-Robot Interaction*, 2023.(*Paper*)

· W. Liu<sup>\*</sup>, A. Daruna<sup>\*</sup>, M. Patel<sup>\*\*</sup>, **K. Ramachandruni**<sup>\*\*</sup>, and S. Chernova, "A Survey of Semantic Reasoning Frameworks for Robotic Systems," in *RAS*, 2022 (*Paper*)

· K. Ramachandruni, M. Vankadari, A. Majumder, S. Dutta and S. Kumar, "Attentive task-net: Self supervised task-attention network for imitation learning using video demonstration," in *IEEE ICRA*, 2020. (*Paper*)

• K. Ramachandruni, S. Jaiswal and S. V. Shah, "Vision-based control of UR5 robot to track a moving object under occlusion using Adaptive Kalman Filter," in *ACM Advances in Robotics*, 2019. (*Paper*)

#### TEACHING EXPERIENCE

TA for CS 7633 (2024): Currently a co-TA for the Human-Robot Interaction Grad course at Georgia Tech (80 students). Guiding multiple student teams of 2-4 to complete semester-wide research projects. BridgeUP STEM Program 2023, 2024: Volunteered and taught in the Bridge-up STEM program to introduce basic AI concepts to select female high-school students from various schools across Atlanta. TA for CS 6601 (2023): Worked as a TA for the Introductory Grad AI course at Georgia Tech and conducted extra classes for undergraduate AI students on course-relevant research in robotics.

## PROFESSIONAL SERVICE

Reviewed for: CHI 2024, HRI 2024, ISRR 2024, IEEE T-RO 2024, IROS 2023, President's Undergraduate Research Awards (PURA) 2023.

#### ACADEMIC ACHIEVEMENTS

Board of Governors Prize, 2018: Best academic performance in graduating class of 2018 of B.Tech. ME program, IIT Jodhpur

Academic Distinction Award, 2015-18: Best academic performance in Semesters I-VII among B.Tech. ME students, IIT Jodhpur

# **RELATED COURSEWORK/SKILLS**

 $\cdot$  Graduate courses: Intro to Artificial Intelligence, Machine Learning, Computer Vision, Intro to Deep Learning, Evaluation of Human-Integrated Systems, Human-Robot Interaction, Intro to Robotics Research, Introduction to Graduate Algorithms

 $\cdot$  Software experience: Python (including OpenCV, Numpy, Tensorflow, Pytorch), ROS (including Gazebo, MoveIt)

 $\cdot$  Robot experience: Stretch Mobile Manipulator, Kinova JACO, UR5, Fetch mobile manipulator