# Alap Kshirsagar

E-mail: alapkshirsagar@gmail.com
Webpage: http://alapkshirsagar.github.io/
GitHub: https://github.com/alapkshirsagar

## EDUCATION

**Cornell University,** Ithaca, USA — Aug 2017 – Jul 2022
Doctor of Philosophy, Mechanical Engineering
Minor: Computer Science
Research Area: Human-Robot Interaction
Thesis Committee: Prof. Guy Hoffman (Chair), Prof. Hadas Kress-Gazit, Prof. Mark Campbell
GPA: 4/4
Academic Year 2019-20 at Ben-Gurion University of the Negev (BGU), Israel

**Indian Institute of Technology-Madras,** Chennai, India — Jul 2015 – May 2017
Master of Technology, Mechanical Engineering
Specialization: Mechanical Design
CGPA: 9.07/10
Winter Semester 2016-17 at Rheinisch-Westfälische Technische Hochschule (RWTH) Aachen, Germany

**Indian Institute of Technology-Bombay,** Mumbai, India — Jul 2010 – Apr 2014
Bachelor of Technology, Mechanical Engineering
Minor: Aerospace Engineering
CGPA: 8.78/10

## PUBLICATIONS/PRESENTATIONS

***Book Chapters***

1. G. Hoffman, **A. Kshirsagar** and M. Law. "Human-Robot Interaction Challenges in the Workplace." *S. C. Matz (Ed.), The Psychology of Technology: Social Science Research in the Age of Big Data, American Psychological Association*, 2022

***Journal Articles***

1. B. Dreyfuss, O. Heffetz, G. Ishai, G. Hoffman and **A. Kshirsagar**. "Additive vs. Subtractive Earning in Shared Human-Robot Work Environments." *Journal of Economic Behavior and Organization (JEBO)*, 2024
2. S. Gu*, **A. Kshirsagar***, Y. Du*, G. Chen, J. Peters and A. Knoll. "A Human-Centered Safe Robot Reinforcement Learning Framework with Interactive Behaviors." *Frontiers in Neurorobotics*, 2023 (*co-first author)
3. **A. Kshirsagar**, R. Fortuna, Z. Xie, and G. Hoffman. "Dataset of Bimanual Human-to-Human Object Handovers." *Data in Brief*, 2023
4. T. Faibish*, **A. Kshirsagar***, G. Hoffman and Y. Edan. "Human Preferences for Robot Eye Gaze in Human-to-Robot Handovers." *International Journal of Social Robotics*, 2022 (*co-first author)
5. **A. Kshirsagar**, G. Hoffman and A. Biess. "Evaluating Guided Policy Search for Human-Robot Handovers." *IEEE Robotics and Automation Letters* 6 (2): 3933-3940, 2021 (The contents of this paper were also selected by ICRA'21 Program Committee for presentation at the Conference)
6. **A. Kshirsagar**, M. Lim, S. Christian and G. Hoffman. "Robot Gaze Behaviors in Human-to-Robot Handovers." *IEEE Robotics and Automation Letters* 5(4):6552-6558, 2020 (The contents of this paper were also selected by IROS'20 Program Committee for presentation at the Conference)
7. **A. Kshirsagar** and A. Guha. "Design optimization of rocker bogie system and development of look-up table for reconfigurable wheels for a planetary rover." *International Journal of Vehicle Structures and Systems*, 2016
8. S. Loharkar, **A. Kshirsagar** and R. Pant. "Design and Fabrication of a portable semi-rigid airship." *Annual Technical Volume of Aerospace Engineering Division Board, Institution of Engineers (India)*, 2015-16

***Conference Proceedings***

1. A. Boehm, T. Schneider, B. Belousov, **A. Kshirsagar**, L. Lin, K. Doerschner, K. Drewing, C. Rothkopf, J. Peters. "What Matters for Active Texture Recognition with Vision-Based Tactile Sensors." *IEEE International Conference on Robotics and Automation (ICRA)*, Yokohama, Japan, 13 May – 17 May 2024
2. **A. Kshirsagar***, T. Faibish*, G. Hoffman and A. Biess. "Lessons Learned from Utilizing Guided Policy Search for Human-Robot Handovers with a Collaborative Robot." *International Conference on Robotics, Automation and Artificial Intelligence (RAAI)*, Singapore, 9 December – 11 December 2022 (*co-first author)

3. **A. Kshirsagar***, R. Ravi*, H. Kress-Gazit and G. Hoffman. "Timing-specified Controllers for Human-Robot Handovers." *IEEE International Conference on Robot & Human Interactive Communication (RO-MAN)*, Naples, Italy, 29 August – 2 September 2022 (*co-first author)
4. **A. Kshirsagar**, H. Kress-Gazit and G. Hoffman. "Specifying and Synthesizing Human-Robot Handovers." *IEEE/RSJ International Conference on Intelligent Systems and Robots (IROS)*, Macau, 4-8 November 2019
5. **A. Kshirsagar**, B. Dreyfuss, G. Ishai, O. Heffetz and G. Hoffman. "Monetary-Incentive Competition between Humans and Robots: Experimental Results." *ACM/IEEE International Conference on Human-Robot Interaction (HRI)*, Daegu, South Korea, 11-14 March 2019
6. **A. Kshirsagar,** R. Pant and K. Bodi. "Dynamic simulation of breakaway aerostat with emergency deflation valves." *16th AIAA Aviation Technology, Integration and Operations Conference*, AIAA Aviation, Washington D.C., USA, 13-17 June 2016
7. **A. Kshirsagar**, D. Harursampath and B. R. Gupta. "VAM applied to Dimensional Reduction of Non-linear Multifunctional Film Fabric Laminates." *12th International Conference of Numerical Analysis and Applied Mathematics*, Rhodes, Greece, 22-28 September 2014
8. **A. Kshirsagar**, A. Tejwani, V. Singh, G. Bhat, N. Singh, A. Yadav, A. Berlia, K. Saboo, U. Patil and S. Prasad. "Mechatronic Design, Fabrication and Analysis of a Small-Size Humanoid Robot-Parinat.", *International Conference on Design, Manufacturing and Mechatronics*, Pune, India, April 2014

***Workshops/Late-breaking Reports***

1. Y. Goeksu, A. Almeida-Correia, V. Prasad, **A. Kshirsagar**, D. Koert, J. Peters, G. Chalvatzaki. "Kinematically Constrained Human-like Bimanual Robot-to-Human Handovers.", *ACM/IEEE International Conference on Human Robot Interaction (HRI) Late Breaking Report*, Boulder, United States, 11 March – 15 March 2024.
2. F. Hahne, V. Prasad, **A. Kshirsagar**, D. Koert, R. M. Stock-Homburg, J. Peters, G. Chalvatzaki. "Transition State Clustering for Interaction Segmentation and Learning", *ACM/IEEE International Conference on Human Robot Interaction (HRI) Late Breaking Report*, Boulder, United States, 11 March – 15 March 2024.
3. A. Boehm, T. Schneider, B. Belousov, **A. Kshirsagar**, L. Lin, K. Doerschner, K. Drewing, C. A. Rothkopf and J. Peters. "Tactile Active Texture Recognition With Vision-Based Tactile Sensors", *NeurIPS Workshop on Touch Processing: a new Sensing Modality for AI*, New Orleans, United States, 25 September 2023
4. **A. Kshirsagar** and G. Hoffman. "Empowering Robots for Object Handovers." *ACM/IEEE International Conference on Human-Robot Interaction (HRI) - Pioneers Workshop*, Online, 7 March 2022
5. **A. Kshirsagar**, H. Kress-Gazit and G. Hoffman. "Human-Robot Handovers with Signal Temporal Logic Specifications." *IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)*, New Delhi, India, 14-18 October 2019 (Best Late Breaking Report Award)
6. **A. Kshirsagar**, V. Sharma and R. S. Pant. "Design and Development of a Dismantable Semi Rigid Remotely Controlled Airship." *10th International Airship Convention and Exhibition*, Friedrichshafen, Germany, 16-18 April 2015
7. A. Rajagopal, P. Bende, S. Yadav, R. Agarwal and A. Sathawane, **A. Kshirsagar**, M.C. Hemanth, N. Kumar, P. Gatkine. "Design, Modelling and Control of a 6 Degrees of Freedom Robotic Arm with specific applications in Planetary Exploration Missions." *65th International Astronautical Congress*, Toronto, Canada, 29 September-3 October 2014

## KEY AWARDS/SCHOLARSHIPS

- Postdoctoral Networking Tour in AI Fellowship by 'German Academic Exchange Service (DAAD)' 2022
- Research Academic Internship Scholarship by 'Israeli Council for Higher Education' 2019
- IIT Master Sandwich Scholarship by 'German Academic Exchange Service (DAAD)' 2016
- S.N. Bose Scholarship by 'Indo-US Science and Technology forum' 2016
- Gandhian Young Technological Innovation Award by 'Society for Research and Initiatives for Sustainable Technologies and Institutions, India' 2013
- Institute Technical Special Mention, awarded to 12 out of 7000 students, for notable contribution in robotics activities at IIT Bombay 2012
- *Top 1%* in National Standard Examination in Physics, Chemistry and Astronomy 2010
- KVPY (Kishore Vaigyanik Protsahan Yojana or Young Scientist Initiative) fellowship, initiated by Department of Science and Technology, Govt. of India 2010
- National Talent Search Scholarship by NCERT, Govt. of India, awarded to top 750 students in the country 2008

on the basis of 3 tier examination

## RESEARCH EXPERIENCE

**Postdoctoral Research Assistant, Technische Universität Darmstadt, Germany** July 2022 - Present

- *Robotic Tactile Exploratory Procedures*
  PIs: Prof. Jan Peters (TU Darmstadt), Prof. Katja Doerschner (JLU Giessen), Prof. Knut Drewing (JLU Giessen)
  Developing active exploration techniques for identifying object properties with vision-based tactile sensors
- *Characterizing Fear-induced Adaptation of Balance*
  PIs: Prof. Jan Peters (TU Darmstadt), Prof. Dominik Endres (PU Marburg), Prof. Frank Bremmer (PU Marburg)
  Developing computational model of fear-induced adaptation of balance using inverse reinforcement learning
- *Robotic and Human-Robot Partner Juggling*
  PI: Prof. Jan Peters (TU Darmstadt)
  Developing robot controllers for high acceleration ball toss juggling
- *Robot Gaze Behaviors in Shared Workspaces*
  Investigating robot gaze behaviors for communicating collision avoidance intent in human-robot collaboration
- *Learning Human-Robot Interaction*
  Developing algorithms for learning physical human-robot interactions from human-human demonstrations

**Graduate Research Assistant, Cornell University, USA** Aug 2017 – May 2022

- *Bimanual Human-Robot handovers*
  PI: Prof. Guy Hoffman (Cornell)
  Investigating imitation learning for bimanual reach-to-handover robot motion generation
- *Multi-sensor Datasets of Human-to-Human handovers*
  PI: Prof. Guy Hoffman (Cornell)
  Built two datasets containing skeleton tracking data and RGB-D data in bimanual handovers and shelving tasks
- *Timing-specified Controllers for Human-Robot handovers*
  PIs: Prof. Guy Hoffman (Cornell), Prof. Hadas Kress-Gazit (Cornell)
  Developed and evaluated two model predictive controllers with timing parameters in a packaging task
- *Gaze Behaviours in Human-Human and Human-Robot Handovers*
  PI: Prof. Guy Hoffman (Cornell), Prof. Yael Edan (BGU)
  Investigated the gaze behaviors of receivers in human-to-human and human-to-robot handovers
- *Specifying and Synthesizing Human-Robot Handovers*
  PIs: Prof. Guy Hoffman (Cornell), Prof. Hadas Kress-Gazit (Cornell)
  Proposed a robot controller for human-robot handovers with formal specifications written in STL
- *Interactive Fabrication with Augmented Reality and a Robotic 3D Printer*
  PIs: Dr. Huaishu Peng (Cornell), Prof. François Guimbretière (Cornell), Prof. Guy Hoffman (Cornell)
  Conducted a user study of a prototyping system consisting of AR CAD editor and a robotic 3D printer
- *Economic Decision Making with a Robot*
  PIs: Prof. Guy Hoffman (Cornell), Prof. Ori Heffetz (Cornell and HUJI)
  Investigated human decision making in the presence of robots when there are monetary rewards at stake

**Visiting Doctoral Researcher, BGU, Israel** Oct 2019 – Aug 2020

- *Guided Policy Search for Human-Robot Handovers*
  PIs: Dr. Armin Biess (BGU-Israel), Prof. Guy Hoffman (Cornell)
  Evaluated controllers learnt with Guided Policy Search for human-robot handovers in MuJoCo and with physical Franka-Emika Panda robot

**Master's thesis, RWTH Aachen, Germany and IIT Madras, India** Aug 2016 – May 2017

- *iGPS based motion control of robotic manipulator using Robot Operating System (ROS)*
  PIs: Univ.-Prof. Burkhard Corves (RWTH), Dr. Sourav Rakshit (IITM)
  Devised algorithms for accurate control of robotic manipulators using indoor GPS (iGPS) feedback and tested them in Gazebo and on physical UR-5 robot

**Visiting Student Researcher, University of California Berkeley, USA** May 2016 – Jul 2016

- *Robotic manipulation of deformable objects*
  PI: Prof. Masayoshi Tomizuka (UCB)
  Developed simulation of 1-D deformable object manipulation tasks by industrial robots FANUC LRmate200iD, using Remote Application Programming Interface (API) between V-REP and MATLAB

**Junior Research Fellow, IIT Bombay, India** Sep 2014 – Jun 2015

- *Trajectory simulation of breakaway aerostat*

PI: Prof. Rajkumar Pant (IITB)
Developed MATLAB simulations of ascent and descent trajectory of a tethered aerostat after accidental tether breakage, to predict performance of payload recovery device

— *Design and development of a dismantle-able semi rigid airship*
PI: Prof. Rajkumar Pant (IITB)
Built a prototype of remotely controlled semi-rigid airship with a dismantle-able frame to provide structural strength and ability to mount propulsion units on off-gondola locations

**B.Tech. Project, IIT Bombay, India** Aug 2013 – Apr 2014

— *Design Optimization and Motion Dynamics of Mobility System for Mars Rover*
PI: Prof. Anirban Guha (IITB)
Analysed the effect of wheel dimensions on mobility performance of rocker bogie system and devised look-up tables for autonomous reconfiguration of wheel dimensions

**Summer Research Internship, IISc Bangalore, India** May 2013 – Jul 2013

— *VAM based modelling of Film-Fabric Laminates*
PI: Prof. Dineshkumar Harursampath (IISc)
Developed asymptotically correct constitutive model of multi-layered film-fabric laminates with potential application in reliable design of High-Altitude Airship envelopes

**Student Investigator, IIT Bombay, India** Jan 2012 – Nov 2013

— *Design of Fabric Cutting Machine for Mat-making Handlooms*
PI: Prof. Suhas Joshi (IITB)
Designed and tested various prototypes of human powered as well as electric fabric cutting machine to increase the productivity of mat-making handlooms operated by visually challenged people

## Student Team Projects

**Mars Rover Team, IIT Bombay, India** Feb 2013 – May 2014

- Led the 10-member Mechanical sub-system
- Designed and manufactured rover's mobility system as well as robotic arm to accomplish various mission objectives like astronaut assistance, sample collection, equipment servicing and terrain traversing
- Participated in Arkaroola Mars Robot Challenge-2014, a 14-day expedition organized by Mars Society Australia and Saber Astronautics in Arkaroola Wilderness Sanctuary, Australia

**'Parinat' – Bipedal Robot Team, IIT Bombay, India** Sep 2012 – May 2014

- Led the 12-member Mechanical sub-system
- Conceptualized and built a small size humanoid robot with 12 degrees of freedom

## Teaching/Mentoring Experience

**Teaching Assistant**

— *Mechanical Synthesis, Cornell University* Jan 2021 – May 2021
Instructor: Prof. Guy Hoffman
Taught two topics in the course, supervised team of 15 UG teaching assistants, helped in preparing assignments and demonstration kits, assisted in grading

— *Human-Robot Interaction: Algorithms and Experiments, Cornell University* Aug 2018 – Dec 2018
Instructor: Prof. Guy Hoffman
Helped prepare assignments and exams, held office hours, graded assignments

**Training in Teaching**

— *Course Design Workshop*, Center for Teaching Innovation, Cornell University Jan 2021 – May 2021

— *Theatre Techniques in Teaching*, Cornell University Jan 2018 – May 2018

**Mentored Students in Research**

| | |
|---|---|
| Yasemin Göksu (MSc, Visual Computing, TU Darmstadt) | Nov 2022 – Present |
| Dominik Horstkötter (BSc, Computer Science, TU Darmstadt) | Nov 2022 – Present |
| Frederik Heller (BSc, Computer Science, TU Darmstadt) | Nov 2022 – Present |
| Duc Huy Nguyen (BSc, Computer Science, TU Darmstadt) | Nov 2022 – Present |
| Felix Nonnengießer (MSc, Computer Science, Goethe University) | Dec 2022 – Present |
| Anish Devnoor (BTech, Electronics & Instrumentation, BITS Hyderabad) | Jun 2023 – Present |
| Fabian Hahne (BSc, Computer Science, TU Darmstadt) | Nov 2023 – Present |
| Mengjie Wang (BSc, Computer Science, TU Darmstadt) | Nov 2023 – Present |
| Junyu Zhou (MSc, Mechatronics, TU Darmstadt) | Nov 2023 – Present |
| Antonio De Almeida Correia (MSc, Autonomous Systems, TU Darmstadt) | Nov 2022 – Oct 2023 |
| Aadya Pipersenia (BTech, Energy Science & Engineering, IIT Bombay) | May 2023 – Aug 2023 |
| Li Liu (MSc, Computational Engineering, TU Darmstadt) | Nov 2022 – May 2023 |
| Mario Gomez (BSc, Computer Science, TU Darmstadt) | Nov 2022 – Mar 2023 |

| | |
|---|---|
| Irina Rath (BSc, Computer Science, TU Darmstadt) | Nov 2022 – Mar 2023 |
| Christoph Dickmanns (BSc, Computer Science, TU Darmstadt) | Nov 2022 – Mar 2023 |
| Hanjo Schnellbächer (MSc, Computer Science, TU Darmstadt) | Nov 2022 – Mar 2023 |
| Zeyuan Sun (MSc, Computer Science, TU Darmstadt) | Nov 2022 – Mar 2023 |
| Alina Boehm (BSc, Cognitive Science, TU Darmstadt) | Sep 2022 – Mar 2023 |
| Raphael Fortuna (BS, Electrical Engineering, Cornell) | Sep 2021 – Jul 2022 |
| Zhiming Xie (MEng, Mechanical Engineering, Cornell) | Jan 2022 – Jul 2022 |
| Tair Faibish (MSc, Industrial Engineering, BGU) | Jan 2020 – Dec 2021 |
| Rahul Kumar Ravi (MS, Mechanical Engineering, Cornell) | Jan 2021 – Dec 2021 |
| Jordana Socher (BS, Computer Science, Cornell) | Mar 2021 – Dec 2021 |
| David Bruk-Rodriguez (BS, Biomedical Engineering, Cornell) | Mar 2021 – Dec 2021 |
| Sophie Keller (BS, Computer Science, Cornell) | Sep 2021 – Dec 2021 |
| Cole Dawson (BS, Mechanical Engineering, Cornell) | Mar 2021 – May 2021 |
| Mohammad Ali Moghaddasi (BS, Mechanical, Cornell) | Mar 2021 – May 2021 |
| Melanie Lim (MEng, Systems Engineering, Cornell) | Apr 2019 – Apr 2020 |
| Shemar Christian (BS, Mechanical Engineering, Cornell) | Apr 2019 – Apr 2020 |
| Julie Katz (MPS, Information Science, Cornell) | Feb 2019 – May 2019 |
| Song Ye (MPS, Information Science, Cornell) | Feb 2019 – May 2019 |
| Lucia Gomez (BS, Computer Science, Cornell) | Sep 2018 – Dec 2018 |

## Service

**Peer-Review**

| | |
|---|---|
| ACM/IEEE International Conference on Human-Robot Interaction (HRI) (**special recognition**) | 2024 |
| Conference on Robot Learning (CoRL) | 2023 |
| IEEE Robotics and Automation Letters | 2023 |
| IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) | 2023 |
| IEEE International Conference on Advanced Robotics and Its Social Impacts (ARSO) | 2023 |
| ACM/IEEE International Conference on Human-Robot Interaction (HRI) | 2023 |
| IEEE International Conference on Robotics and Automation (ICRA) | 2023 |
| International Conference on Social Robotics (ICSR) | 2022 |
| International Journal of Social Robotics | 2022 |
| Robotics: Science and Systems (RSS) Pioneers | 2022 |
| IEEE Transactions on Instrumentation & Measurement (TIM) | 2021 |
| IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) | 2021 |
| IEEE RAS/EMBS International Conference for Biomedical Robotics and Biomechatronics (BioRob) | 2020 |
| ACM/IEEE International Conference on Human-Robot Interaction (HRI) Late Breaking Reports | 2020 |
| Robotics: Science and Systems (RSS) Pioneers | 2019 |

**Volunteering**

| | |
|---|---|
| Board Member, Society for Promotion of Indian Classical Music and Culture Among Youth (SPICMACAY) - Cornell Chapter, USA | Aug 2018 – Jun 2022 |
| Leadership Team Member, Science and Research Opportunities in India (Sci-ROI), USA | Jan 2021 – Aug 2022 |
| Volunteer, Group for Rural Activities IIT Bombay, India | Aug 2011 – Apr 2013 |

## Technical Skills

| | |
|---|---|
| Programming | Robot Operating System, Python, C++, MATLAB, Mathematica, Arduino |
| Robots | Kinova Gen3, Kinova Jaco2, Franka-Emika Panda, Barrett WAM, Sawyer, UR-5, WidowX Mark III |
| CAD packages | Solidworks, Autodesk Inventor, AutoCAD |
| Simulation tools | NVIDIA Omniverse, MuJoCo, Gazebo, V-REP, Autodesk Nastran, Ansys, Autodesk Simulation Multiphysics, MSC/ Adams View |
| Documentation | LaTeX |
| Languages | English (Fluent), Hindi (Fluent), Marathi (Native), Sanskrit (Beginner) |