Rahul Shome

Postdoctoral Research Associate

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Education

2013 – 2020 **Ph.D, Rutgers University, USA** in Computer Science
The problem of many: efficient multi-arm, multi-object task and motion planning with optimality guarantees. <url>

M.S, Rutgers University, USA in Computer Science.
Anytime and Scalable Motion Planning for Robotic Arms Picking Objects in Clutter.

2008 – 2012 **B.Tech. National Institute of Technology, Durgapur, India.** in Computer Science and Engineering, *Graduated with distinction.*

Publications

Books and Chapters

2020 Bekris, K. E. & **Shome, R.** (2020). Asymptotically optimal sampling-based planners. In M. H. Ang, O. Khatib, & B. Siciliano (Eds.), *Encyclopedia of robotics*. Springer-Verlag Berlin Heidelberg [In Progress]. <url>

Journal Articles

2020 Mitash, C., **Shome, R.**, Wen, B., Boularias, A., & Bekris, K. (2020, July). Task-driven perception and manipulation for constrained placement of unknown objects. *IEEE Robotics and Automation Letters (RA-L)*. <url>

2020 Kimmel, A., **Shome, R.**, & Bekris, K. E. (2020). Anytime motion planning for prehensile manipulation in dense clutter. *Advanced Robotics*. <url>

2019 **Shome, R.**, Solovey, K., Dobson, A., Halperin, D., & Bekris, K. E. (2019, January). dRRT*: scalable and informed asymptotically-optimal multi-robot motion planning. *Autonomous Robots*. <url>

2019 Feld-Cook, E., **Shome, R.**, Zaleski, R., Mohan, K., Kourtev, H., Bekris, K. E., … Shin, J. (2019). Exploring the utility of robots in exposure studies. *Journal of exposure science & environmental epidemiology*.

2018 Dodson, T., Grothues, T. M., Eiler, J. H., Dobarro, J. A., & **Shome, R.** (2018). Acoustic-telemetry payload control of an autonomous underwater vehicle for mapping tagged fish. *Limnology and Oceanography: Methods*, *16*(11), 760–772. <url>

2016 Rennie, C., **Shome, R.**, Bekris, K. E., & Ferreira De Souza, A. (2016, February). A dataset for improved rgbd-based object detection and pose estimation for warehouse pick-and-place. *IEEE Robotics and Automation Letters (RA-L) [Also accepted to appear at the 2016 IEEE International Conference on Robotics and Automation (ICRA)]*, *1*, 1179–1185. <url>

2015 Bekris, K., **Shome, R.**, Krontiris, A., & Dobson, A. (2015). Cloud automation: precomputing roadmaps for flexible manipulation. *IEEE Robotics & Automation Magazine*, *22*(2), 41–50. <url>

Conferences

2020 **Shome, R.** & Bekris, K. E. (2020, June). Synchronized multi-arm rearrangement guided by mode graphs with capacity constraints. In *Workshop on the Algorithmic Foundations of Robotics (WAFR)*. Oulu, Finland. <url>

2020 **Shome**, **R.**, Nakhimovich, D., & Bekris, K. E. (2020, June). Pushing the boundaries of asymptotic optimality in integrated task and motion planning. In *Workshop on the Algorithmic Foundations of Robotics (WAFR)*. Oulu, Finland. <*url*>

2020 Alikhani, M., Khalid, B., **Shome**, **R.**, Mitash, C., Bekris, K. E., & Stone, M. (2020, February). That and there: judging the intent of pointing actions with robotic arms. In *Thirty-fourth AAAI conference on artificial intelligence (AAAI-20)*. New York, NY. <*url*>

2019 **Shome**, **R.** & Bekris, K. E. (2019, August). Anytime multi-arm task and motion planning for pick-and-place of individual objects via handoffs. In *2nd IEEE International Symposium on Multi-Robot and Multi-Agent Systems (MRS)*. New Brunswick, NJ, USA. eprint: arXiv:1905.03179. <*url*>

2019 **Shome**, **R.**, Tang, W. N., Song, C., Mitash, C., Kourtev, C., Yu, J., … Bekris, K. E. (2019, May). Towards robust product packing with a minimalistic end-effector. In *IEEE International Conference on Robotics and Automation (ICRA)*. Montreal, Canada: [Finalist for Best Paper in Automation Award]. <*url*>

2018 **Shome**, **R.**, Solovey, K., Yu, J., Bekris, K. E., & Halperin, D. (2018, December). Fast and high-quality dual-arm rearrangement in synchronous, monotone tabletop setups. In *Workshop on the Algorithmic Foundations of Robotics (WAFR)*. Mérida, México. <*url*>

2018 Kimmel, A., **Shome**, **R.**, Littlefield, Z., & Bekris, K. E. (2018, November). Fast, anytime motion planning for prehensile manipulation in clutter. In *2018 IEEE-RAS 18th International Conference on Humanoid Robots (Humanoids 2018)*. Beijing, China. <*url*>

2017 Dobson, A., Solovey, K., **Shome**, **R.**, Halperin, D., & Bekris, K. E. (2017, December). Scalable asymptotically-optimal multi-robot motion planning. In *1st IEEE International Symposium on Multi-Robot and Multi-Agent Systems (MRS)*. Los Angeles, CA, USA: [Best Paper Award]. <*url*>

2017 **Shome**, **R.** & Bekris, K. E. (2017, November). Improving the scalability of asymptotically optimal motion planning for humanoid dual-arm manipulators. In *IEEE International Conference on Humanoid Robots*. Birmingham, UK. <*url*>

2016 Littlefield, Z., Zhu, S., Kourtev, C., Psarakis, Z., **Shome**, **R.**, Kimmel, A., … Bekris, K. E. (2016, August). Evaluating end-effector modalities for warehouse picking: a vacuum gripper vs a 3-finger underactuated hand. In *12th IEEE International Conference on Automation Science and Engineering (IEEE CASE)*. Fort Worth, TX. <*url*>

2014 Krontiris, A., **Shome**, **R.**, Dobson, A., Kimmel, A., & Bekris, K. E. (2014, November). Rearranging similar objects with a manipulator using pebble graphs. In *IEEE-RAS International Conference on Humanoid Robots (HUMANOIDS)*. Madrid, Spain. <*url*>

2014 Littlefield, Z., Krontiris, A., Kimmel, A., Dobson, A., **Shome**, **R.**, & Bekris, K. E. (2014, October). An extensible software architecture for composing motion and task planners. In *International Conference on Simulation, Modeling, and Programming for Autonomous Robots (SIMPAR)*. Bergamo, Italy. <*url*>

2014 Zhao, M., **Shome**, **R.**, Yochelson, I., Bekris, K. E., & Kowler, E. (2014, June). An experimental study for identifying features of legible manipulator paths. In *International Symposium on Experimental Robotics (ISER)*. Marrakech/Essaouira, Morocco. <*url*>

2011 Nanadikar, P., **Shome**, **R.**, & Ashish, D. (2011). A potential field based method for autonomous lunar rover navigation in 3d terrain. In *26th International Conference on CAD/CAM and Factories of the Future* (pp. 767–776). Malaysia. <*url*>

Research Projects

Multi-arm Multi-object Task & Motion Planning	Solving integrated task, and motion planning problems with many manipulators, and objects open up rich applications, but poses combinatorial, and planning challenges. (**Shome** et al. 2019, **Shome** et al. 2018, **Shome** et al. 2020)
Multi-robot Motion Planning	Scalable, informed, and asymptotically-optimal approaches can address the explosion in the search space when planning for many high-dimensional robots. (**Shome** et al. 2019, **Shome** et al. 2017, Dobson et al. 2017)
Perception and Planning for Manipulation	Robotic manipulation poses sensing challenges (Rennie et al. 2016), difficulties in planning in the presence of clutter (Kimmel et al. 2018, Kimmel et al. 2020), and the need for careful design of application-driven strategies to address automation challenges like product-packing (**Shome** et al. 2019).
Human-robot Interaction	Collaborative robotics necessitates effective communication between humans and robots motivating interpretations of the legibility of actions (Zhao et al. 2014), and the communication of manipulation tasks (Alikhani et al. 2020).
Applied, and Field Robotics	Uses of robots extend to other scientific applications like environment exposure studies (Feld-Cook et al. 2019), and underwater survey and tracking (Dodson et al. 2018).

Teaching Experience

Instructor	Introduction to Artificial Intelligence, Summer 2018 *In charge of undergraduate course with 54 students. Duties included designing the course, creating assignments and evaluations, being the sole instructor, and managing teaching assistants.*
	Introduction to Artificial Intelligence, Summer 2016 *In charge of undergraduate course with 26 students. Duties included designing the course, creating and grading assignments, and being the sole instructor.*
Teaching Assistant	Data Structures and Algorithms, Introduction to Discrete Structures, Topics in Robotics, Introduction to Artificial Intelligence

Employment History

2020 – · · ·	**Postdoctoral Research Associate**, Department of Computer Science, Rice University, Houston, USA.
2019	**Robotics Consultant**, Pickr AI, Norway. *Led development of core manipulation manipulation capabilities, and optimization for warehouse automation at an automation start-up.*
2014 – 2020	**Graduate Research Assistant**, Department of Computer Science, Rutgers University, New Jersey, USA.
2013 – 2020	**Teaching Assistant**, Department of Computer Science, Rutgers University, New Jersey, USA.
2016, 2018	**Instructor**, Department of Computer Science, Rutgers University, New Jersey, USA. *Course: Introduction to Artificial Intelligence*
2012 – 2013	**Associate Software Developer**, Novell IDC, Bangalore, India. *Worked on the development team of an enterprise security software product, Sentinel*
2009, 2011	**Research Intern**, Indian Institute of Technology, Kanpur, India. *Worked on lunar rover project commissioned by Indian Space Research Organization.*

Skills

Coding	</>	C++, C, Python, Java
Robotics Software	</>	Proficient in ROS. Involved in development of motion, and task planning library, Pracsys Operational experience with MoveIt!, OMPL, Openrave, Gazebo
Robotic Platforms	</>	Kuka IIWA14, Motoman SDA10f, Baxter, Turtlebot
Sensing Software	</>	Operational experience with Point Cloud Library, OpenCV
Sensors	</>	Intel Realsense, Microsoft Kinect
Misc.	</>	Html, css, PHP, jQuery, Javascript, MySQL, Android SDK

Awards and Recognitions

- 2020 — Awarded the Rice Academy Postdoctoral Fellowship, Rice University
- 2019 — **Finalist for Best Paper in Automation Award** for *Towards Robust Product Packing with a Minimalistic End-Effector* at *IEEE International Conference on Robotics and Automation (ICRA) 2019*
- 2017 — **Best Paper Award** for *Scalable asymptotically-optimal multi-robot motion planning* at 1^{st} *IEEE International Symposium on Multi-robot and Multi-agent Systems*
- 2008 — Ranked in the top 4 percentile in the All India Engineering Entrance Examination
- 2006, 2008 — Awarded for Academic Excellence by the Hon'b Governor of West Bengal
- Ranked in top 4 in tenth, and twelfth standard qualifying examination conducted by the Indian School Certification board

Miscellaneous Experience

Peer Reviews

- 2014 – ··· — **Primary reviewer:** RA-L, IEEE Access
- **Assisted reviews:** RA-L, ACM, IEEE Access, IJRR

Positions of Responsibility

- 2019 — **Website Chair, Session Chair, and Local Organizer**, 2^{nd} *IEEE International Symposium on Multi-robot and Multi-agent Systems*
- 2011 – 2012 — **Vice-President**, *Literary Circle*, National Institute of Technology, Durgapur

References

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Rutgers University.
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Dan Halperin
Professor
Tel Aviv University.
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Lydia Kavraki
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