Curriculum Vitae - Ahmed H. Qureshi

Contact Information

Assistant Professor
Department of Computer Science
Purdue University
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Research Interests

My group performs fundamental and applied research in artificial intelligence, machine learning, and control to design and develop intelligent, human-aware robot systems. Our work addresses various problems, including dextrous manipulation, motion planning and control, visual multi-agent navigation, human-robot collaboration, and autonomous driving. The broader applications of our work are to assist people towards a better quality of life and enhanced workforce efficiency in various economic sectors.

Education

University of California San Diego, USA **2017 - 2021**

PhD, Intelligent Systems, Robotics and Control

- Thesis topic: Differentiable Neural Motion Planning under Task Constraints

Osaka University, Japan **2015 - 2017**

Master of Engineering

- Thesis topic: Deep Reinforcement Learning for Human-Robot Interaction in the Real-World

National University of Sciences and Technology (NUST), Pakistan **2010 - 2014**

Bachelor of Electrical Engineering

- Thesis Topic: Enhanced RRT* for Motion Planning in Complex, Cluttered and Time-varying Environments

Professional Employments

Purdue University **2021 - Present**

West Lafayette, IN, USA

- Assistant Professor, Department of Computer Science
- Director, Cognitive Robot Autonomy & Learning (CoRAL) Lab
- Affiliate Faculty, Purdue Center for Innovation in Control, Optimization, & Networks

Honors and Awards

- Two gold medals for outstanding undergraduate research by Pakistan Book of Records, 2019.
- Outstanding Young Researcher by Heidelberg Laureate Forum, 2018.
- Japanese Government MEXT Scholarship, 2015-2017.
- NUST GPA-based scholarship, 2010-2014.

Publications

My B.S., M.S., and Ph.D. students are indicated with superscripts ^{u}, ^{m}, and ^{p}, respectively.

Patents

P1. M.C.Yip, M.J.Bency, **A.H.Qureshi**. Machine Learning based Fixed-Time Optimal Path Generation, US Patent App. 16/222,706, 2019.

Peer-reviewed Journal

J11. H.Ren[p] and **A.H.Qureshi**. Robot Active Neural Sensing and Planning in Unknown Cluttered Environments, IEEE Transactions on Robotics, 2023. [Invited for presentation at IROS'23]

J10. **A.H.Qureshi**, J.Dong, A.Baig, and M.C.Yip. Constrained Motion Planning Networks X, IEEE Transactions on Robotics 2021. (IF: 6.123)

J9. L.Li, Y.Miao, **A.H.Qureshi**, and M.C.Yip. MPC-MPNet: Model-Predictive Motion Planning Networks for Fast, Near-Optimal Planning under Kinodynamic Constraints, IEEE Robotics and Automation Letters 2021. (IF: 3.608)

J8. **A.H.Qureshi**, J.Dong, A.Choe, and M.C.Yip. Neural Manipulation Planning on the Constraint Manifolds, IEEE/RAS Robotics and Automation Letters 2020. (IF: 3.608)

J7. **A.H.Qureshi**, Y.Miao, A.Simeonov, and M.C.Yip. Motion Planning Networks: Bridging the Gap Between Learning-based and Classical Motion Planners, IEEE Transactions on Robotics 2020. (IF: 6.123)

J6. **A.H.Qureshi**, Y.Nakamura, Y.Yoshikawa and H.Ishiguro. Intrinsically motivated reinforcement learning for humanâ€“robot interaction in the real-world, Neural Networks, Vol 107, pp.23-33, 2018. (IF: 7.197)

J5. Zahid. Tahir, **A.H.Qureshi**, Y.Ayaz and R.Nawaz. Potentially guided bidirectionalized RRT* for fast optimal path planning in cluttered environments, International Journal of Robotics and Autonomous Systems, Elsevier, Vol. 108, pp. 13-27, 2018. (IF: 2.638)

J4. **A.H.Qureshi** and Y.Ayaz. Potential Functions Based Sampling Heuristic for Optimal Motion Planning, Autonomous Robots, DOI 10.1007/s10514-015-9518-0, 2015. (IF: 2.066)

J3. **A.H.Qureshi** and Y.Ayaz. Intelligent Bidirectional Rapidly-Exploring Random Trees for Optimal Motion Planning in Complex Cluttered Environments, International Journal of Robotics and Autonomous Systems, Elsevier, Vol. 68, pp. 1-11, 2015. (IF: 1.256)

J2. **A.H.Qureshi**, S.Mumtaz, Y.Ayaz, O.Hasan, M.S.Muhammad and M.T.Mahmood.Triangular Geometrised Sampling Heuristic For RRT* Motion Planner, International Journal of Advanced Robotic Systems (IJARS), InTech Publishers, 12:10, 2015. (IF: 0.526)

J1. S. A. Khan, Y. Ayaz, M. Jamil, S. O. Gillani, M. Naveed, **A. H. Qureshi** and K. F Iqbal.Collaborative optimal reciprocal collision avoidance for mobile robots, Journal of Control and Automation, 8(8), 203-212.

Peer-reviewed Conference Proceedings

C21. X. Chen[u], A. Iyer[u], Z. Wang[p], **A.H.Qureshi**. Efficient Q-Learning over Visit Frequency Maps for Multi-agent Exploration of Unknown Environments, IEEE/RSJ International Conference on Intelligent Robot and Systems (IROS), 2023

C20. D.Lawson[u] and **A.H.Qureshi**. Control Transformer: Robot Navigation in Unknown Environments through PRM-Guided Return-Conditioned Sequence Modeling, IEEE/RSJ International Conference on Intelligent Robot and Systems (IROS), 2023

C19. R.Ni[p] and **A.H.Qureshi**. Progressive Learning for Physics-informed Neural Motion Planning, Robotics: Science & Systems, 2023

C18. R.Ni[p] and **A.H.Qureshi**. NTFields: Neural Time Fields for Physics-Informed Robot Motion

Planning, International Conference on Representation Learning (ICLR), 2023 [Spotlight]

C17. A.K.Keshari[m], H.Ren[p], and **A.H.Qureshi**. CoGrasp: 6-DoF Grasp Generation for Human-Robot Collaboration, IEEE/RAS International Conference on Robotics and Automation (ICRA), 2023

C16. Z.Xiong, J.Eappen, **A.H.Qureshi**, and S.Jagannathan. Model-free Neural Lyapunov Control for Safe Robot Navigation, IEEE/RSJ International Conference on Intelligent Robot and Systems (IROS), 2022.

C15. **A.H.Qureshi**, A.Mousavian, C.Paxton, M.C.Yip, and D.Fox. NeRP: Neural Rearrangement Planning for Unknown Objects, Robotics: Science & Systems, 2021.

C14. J.Johnson, L.Li, F.Liu, **A.H.Qureshi**, and M.C.Yip. Dynamically Constrained Motion Planning Networks for Non-Holonomic Robots, Proceedings of IEEE/RSJ International Conference on Intelligent Robot and Systems (IROS), pp. 6937-6943, Las Vegas, USA (Virtual) 2020.

C13. **A.H.Qureshi**, J. J. Johnson, Y. Qin, T. West, B. Boots, and M.C.Yip. Composing Task-Agnostic Policies via Deep Reinforcement Learning, International Conference on Representation Learning (ICLR), 2020.

C12. **A.H.Qureshi**, B. Boots, and M.C.Yip. Adversarial Imitation Via Variational Inverse Reinforcement Learning, International Conference on Representation Learning (ICLR), 2019.

C11. **A.H.Qureshi**, A.Simeonov, M.J.Bency, M.C.Yip. Motion Planning Networks, IEEE/RAS International Conference on Robotics and Automation (ICRA), pp. 2118-2124, Montreal, Canada 2019.

C10. M.J.Bency, **A.H.Qureshi**, M.C.Yip. Neural Path Planning: Fixed Time, Near-Optimal Path Generation via Oracle Imitation, Proceedings of IEEE/RSJ International Conference on Intelligent Robot and Systems (IROS), pp. 3965-3972, Macau 2019.

C9. **A.H.Qureshi** and Michael.C.Yip . Deeply Informed Neural Sampling For Robot Motion Planning, Proceedings of IEEE/RSJ International Conference on Intelligent Robot and Systems (IROS), pp. 6582-6588, Madrid, Spain 2018.

C8. **A.H.Qureshi**, Z.Tahir, G.Tariq, Y.Ayaz. Re-planning Using Delaunay Triangulation for Real Time Motion Planning in Complex Dynamic Environments, IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM), pp. 905-911, Auckland, New Zealand 2018.

C7. **A.H.Qureshi**, Y.Nakamura, Y.Yoshikawa and H.Ishiguro. Show, Attend and Interact: Perceivable Social Human-Robot Interaction through Neural Attention Q-Network, Proceedings of IEEE/RAS International Conference on Robotics and Automation (ICRA), pp.1639-1645, Singapore 2017.

C6. **A.H.Qureshi**, Y.Nakamura, Y.Yoshikawa and H.Ishiguro. Robot gains social intelligence through multimodal deep reinforcement learning, Proceedings of IEEE/RAS International Conference on Humanoid Robots, pp. 745-751, Cancun Mexico, 2016.

C5. **A.H.Qureshi**, S.Mumtaz, Y. Ayaz, and O. Hasan. Augmenting RRT*-Planner with Local Trees for Motion Planning in Complex Dynamic Environments, Proceedings of IEEE/RAS 19th International Conference on Methods and Models in Automation and Robotics (MMAR), pp. 657-662, Miedzyzdroje, Poland 2014.

C4. **A.H.Qureshi**, S.Mumtaz, Y.Ayaz, O.Hasan and W.Y.Kim. Adaptive Potential guided directional RRT*, Proceedings of International Conference on Robotics and Biomimetics (ROBIO), pp. 1887-1892, China, 2013.

C3. B.Ali, **A.H.Qureshi**, Y.Ayaz, N.Muhammad and W.Y.Kim. Human tracking by a mobile robot using 3D features, Proceedings of International Conference on Robotics and Biomimetics (ROBIO), pp. 2464-2469, Shenzhen, China, 2013.

C2. **A.H.Qureshi**, K.F.Iqbal, S.M.Qamar, F.Islam, Y.Ayaz and N.Muhammad. Potential guided directional-RRT* for accelerated motion planning in cluttered environments, Proceedings of International Conference on Mechatronics and Automation (ICMA), pp. 519-524, Takamatsu, Japan, 2013.

C1. S. M. Qamar, K. F. Iqbal, **A.H.Qureshi**, N. Muhammad, Y. Ayaz, and A. G. Abbasi A solution to Perceptual Aliasing through Probabilistic Fuzzy Logic and SIFT, Proceedings of IEEE/ASME International Conference on Advanced Intelligent Mechatronics (pp. 1393-1398). IEEE.

Workshop Papers

W5. D.Lawson^{u} and **A.H.Qureshi**. Merging Decision Transformers, ICLR Workshop on Reincarnating Reinforcement Learning 2023. [Spotlight]

W4. R.Ni^{p} and **A.H.Qureshi**. Neural Time Fields for Physics-Informed Motion Planning, ICLR Workshop on Neural Fields across Fields: Methods and Applications of Implicit Neural Representations 2023. [Best Paper]

W3. **A.H.Qureshi**, Y.Miao M.C.Yip. Active Continual Learning for Planning and Navigation, ICML Workshop on Real World Experiment Design and Active Learning 2020.

W2. **A.H.Qureshi**, M.C.Yip. Adversarial Reward and Policy Learning Via Variational Inverse Optimal Control, Bay Area Machine Learning Symposium, August 2018.

W1. **A.H.Qureshi**, Y. Nakamura, Y. Yoshikawa, H. Ishiguro. Robot Learns Responsive Behavior through Interaction with People using Deep Reinforcement Learning, 3rd International Symposium on Cognitive Neuroscience Robotics, Dec 2016.

Preprints

P8. H.Ren^{p} and **A.H.Qureshi**. Multi-Stage Monte Carlo Tree Search for Non-Monotone Object Rearrangement Planning in Narrow Confined Environments, arXiv preprint arXiv:2305.17175 (2023).

P7. Z.Wang^{p} and **A.H.Qureshi**. DeRi-Bot: Learning to Collaboratively Manipulate Rigid Objects via Deformable Objects, arXiv preprint arXiv:2305.13183 (2023).

P6. D.Lawson^{u} and **A.H.Qureshi**. Weight Averaging for Forming Multi-Task Policies, arXiv preprint arXiv:2303.07551 (2023).

P5. V.K.Nivash^{m} and **A.H.Qureshi**. SIMF: Semantics-aware Interactive Motion Forecasting for Autonomous Driving, arXiv preprint arXiv:2306.14941 (2023).

P4. V.Gupta^{m}, P.Dhir^{m}, J.Dani^{u}, and **A.H.Qureshi**. MANER: Multi-Agent Neural Rearrangement Planning of Objects in Cluttered Environments, arXiv preprint arXiv:2306.06543 (2023).

P3. J.J.Johnson, **A.H.Qureshi**, and M.C.Yip. Learning Sampling Dictionaries for Efficient and Generalizable Robot Motion Planning with Transformers, arXiv preprint arXiv:2306.00851 (2023).

P2. J.Johnson, U.Kalra, A.Bhatia, L.Li, **A.H.Qureshi**, and M.C.Yip. Motion Planning Transformers: One Model to Plan Them All, arXiv preprint arXiv:2106.02791 (2023).

P1. Z.Xiong, J.Eappen, D.Lawson, **A.H.Qureshi**, and S.Jagannathan. Co-learning Planning and Control Policies Using Differentiable Formal Task Constraints, arXiv preprint arXiv:2303.01346 (2023).

Seminar and Talks

- Visual Robot Learning for Planning & Control in Unknown Environments, Robotics and Automation Society Chapter of IEEE Eastern North Carolina Section, Mar 2022.
- Neural Task and Motion Planning in Unknown Environments, Brown University, Nov 2021.
- Emergence of a Mutualistic Relationship between Motion Planning and Machine Learning for Scalable Robot Control, Neural Computation Chalk Talk Series, UC San Diego, Oct 2020.
- Motion Planning Networks, University of Toronto, Canada (Virtual), Sep 2020.
- Deep Learning For Robotics, Neural Computing & Deep Learning Workshop, 6th Heidelberg Laureate Forum, Germany, Sep 2018.
- Learning-based motion planning and control, CRI Seminars, University of California San Diego, May 2018.
- Intrinsically Motivated Reinforcement Learning for Human-Robot Interaction in the Real-World, Artificial Intelligence Seminars, Osaka University, Japan, Nov 2017.
- Living with Robots- The Next Generation of Intelligent Machines, Information Technology University, Pakistan, Mar 2016.
- Sampling-based motion planning algorithms, Topics in Robotics Session, Osaka University, Japan, Apr 2015.

Research Group

Current Ph.D. Students

- Hanwen Ren, CS, Purdue University — Jan 2022 - Present
- Zixing Wang, CS, Purdue University — Jan 2022 - Present
- Ruiqi Ni, CS, Purdue University — Jan 2022 - Present
- Syed Talha Bukhari, CS, Purdue University — Aug 2022 - Present

Current Visiting Ph.D. Students

- Zikang Xiong, CS, Purdue University — Jan 2022 - Present
  − co-advised with Prof. Suresh Jagannathan
- Jacob Johnson, ECE, UCSD — Aug 2021 - Present
  − co-advised with Prof. Michael Yip (ECE, UCSD)

Current M.S. Students

- Gabriella Giachini, ME, Purdue University — Jun 2023 - Present
- Shivam Bhat, CS, Purdue University — May 2023 - Present
- Veera Adithya Dittakavi, ECE, Purdue University — May 2023 - Present
- Joseph P. Kawiecki, ECE, Purdue University — Jan 2023 - Present
- Shyamvanshikumar Singh, CS, Purdue University — Nov 2022 - Present
- Krishnan N. Vidyaa, ECE, Purdue University — Aug 2022 - Present

Current B.S. Students

- Ashvin Iyer, CS, Purdue University — May 2022 - Present
- Daniel Chen, CS, Purdue University — Mar 2022 - Present
- Daniel Lawson, CS, Purdue University — Aug 2021 - Present

- Xuyang Chen, CS, Purdue University — Sep 2021 - Present
- Jacob Zietek, CS, Purdue University — Nov 2022 - Present
- Guna Avula, CS, Purdue University — Jan 2023 - Present

Visiting Ph.D. Students Alumni

- Manav Kulshrestha, CS, Purdue University — Aug 2022 - Jun 2023
- Zhiquan Wang, CS, Purdue University — Sep 2021 - Sep 2022
  – co-advised with Prof. Bedrich Benes

M.S. Thesis Students Alumni

- Abhinav K. Keshari, ECE, Purdue University — Oct 2021 - Apr 2023
  – Title: Vision-Language Model for Robot Grasping
- Kendal Norman, CS, Purdue University — Aug 2021 - Jul 2023
  – Title: Analysis of Continuous Learning Models For Trajectory Representation
- Vivek Gupta, CS, Purdue University — May 2022 - Jul 2023
  – Title: Multi-agent Neural Rearrangement Planning of Objects in Cluttered Environments

M.S. Students Alumni

- Prabhpreet Singh Dir, AAE, Purdue University — Sep 2021 - Dec 2022
- Kartik A. Pant, AAE, Purdue University — Oct 2021 - May 2022
- Akshaj Uppala, CS, Purdue University — Aug 2022 - May 2023

B.S. Students Alumni

- Shyawn Zahid, CS, Purdue University — Feb 2022 - May 2022
- Latif Adurzada, Math, Purdue University — Feb 2022 - May 2022
- Vlada Volyanskaya, CS, Purdue University — May 2022 - Aug 2022
- Andrew Showalter, ME, Purdue University — Aug 2022 - Dec 2022
- Jeegn Dani, CS, Purdue University — Jan 2022 - Dec 2022

Grants

External (Current)

- NSF IIS (FRR): Small: Human-centered Robot Manipulation Planning for Solving Object Handover Tasks in the Real-World. Role: PI (Solo). Budget: $389,468. Sep 2022 - Aug 2025

Teaching

- **Instructor**, CS49000 Introduction to Robotics, Purdue University — Fall, 2023
- **Instructor**, CS593000 Robotics, Purdue University — Spring, 2023
- **Guest Lecturer**, CS197: Honors Seminar, Purdue University — Spring, 2023
- **Instructor**, CS49000 Introduction to Robotics, Purdue University — Fall, 2022
- **Guest Lecturer**, CS397: Honors Seminar, Purdue University — Fall, 2022
- **Instructor**, CS593000 Robotics, Purdue University — Spring, 2022
- **Instructor**, CS592 Introduction to Robot Motion, Purdue University — Fall, 2021
- **Guest Lecturer**, CS397: Honors Seminar, Purdue University — Fall, 2021
- **Guest Lecturer**, CS591: Research Seminar, Purdue University — Fall, 2021
- **Teaching Assistant**, Advances in Robot Manipulation, UC San Diego — Spring, 2020
- **Co-Instructor**, Robot Reinforcement Learning, UC San Diego — Fall, 2019
- **Teaching Assistant**, Cognitive Neuroscience Robotics, Osaka University — Feb, 2016 - 2017
- **Teaching Assistant**, Circuits Analysis, National University of Sciences & Technology — Fall, 2011

Professional Activities

University Service:

- Purdue CS Faculty Search, 2022
- Purdue CS Ph.D. Graduate Admissions, 2021, 2022

- Purdue CS Space Management Committee, 2021

Ph.D. Committees
- Charles W Christoffer, CS PhD Preliminary Exam (July. 2022), Purdue University
- Md Masudur Rahman, CS PhD Preliminary Exam (Mar. 2023), Purdue University

M.S. Committees
- Vivek Gupta, MS Thesis (Jul. 2023), CS, Purdue University (Chair)
- Kendal Norman, MS Thesis (Apr. 2023), CS, Purdue University (Chair)
- Abhinav K. Keshari, MS Thesis (Apr. 2023), ECE, Purdue University (Chair)

Journal and Conference Organization:
- Associate Editor, IEEE Transactions on Robotics (TRO) 2023-24.
- Area Chair, International Conference on Robot Learning 2023.
- Associate Editor, IEEE International Conference on Intelligent Robots and Systems (IROS) 2023.
- Associate Editor, IEEE Robotics and Automation Letters (RA-L) (2022, 2023).
- Associate Editor, IEEE International Conference on Robotics and Automation (ICRA) 2023.

Workshop Organization:
- Co-organizer, workshop on Machine Learning for Motion Planning, International Conference on Robotics and Automation (ICRA), May 2021.
- Organizer, workshop on Learning Representations for Planning and Control, IEEE/RSJ International Conference on Intelligent Robot and Systems (IROS), Macau, China, Nov 2019.

Government Activities:
- NSF IIS Panelist: 2022

Reviewer:

Journals:
- IEEE Transactions on Robotics 2021, 2022
- IEEE Robotics and Automation Letters 2020, 2022
- Cambridge Robotica 2014

Conferences:
- Conference on Neural Information Processing Systems (NeurIPS) 2021, 2022
- IEEE International Conference on Representation Learning (ICLR) 2019, 2020, 2021, 2022
- IEEE International Conference on Robotics and Automation (ICRA) 2019, 2020, 2022
- IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2018, 2020, 2022
- Robotics: Science and Systems (RSS) 2021, 2022
- Thirty-Seventh AAAI Conference on Artificial Intelligence 2022

Society Membership:
- IEEE, Robotics and Automation Society 2021 - Present
- IEEE, Member 2021 - Present

References

Available upon request