Curriculum Vitae - Ahmed H. Qureshi

Contact Information

Assistant Professor
CS Department, Purdue University
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Research Statement

My research revolves around a broad area of robot learning, from estimating multimodal representations to real-time collaborative robots planning and control, with applications towards daily-life assistive tasks considering human-in-the-loop.

Research Interests

Planning & Control, Manipulation, Reinforcement Learning, Deep Learning, Computer Vision, Active Sensing & Estimation, Human-Robot Interaction, Approximate Inference, Cognitive Science.

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 Positions

Purdue University **2021 - Present**

West Lafayette, IN, USA

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

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

La Jolla, CA, USA

- Graduate Student Researcher

NVIDIA Corporation **2020 - 2021**

Robotics Group, Seattle, USA

- Research Intern

Osaka University **2015**

Toyonaka, Japan

- Visiting Researcher

Robotics and Intelligence System Engineering (RISE) Lab

National University of Science & Technology, Islamabad, Pakistan

- Research Associate **2014 - 2015**
- Research Assistant **2012 - 2014**

Smart Machines and Robotics Technology Lab **2013**

National University of Science & Technology, Islamabad, Pakistan

- Research Intern

Vision Imaging And Signal Processing Lab **2012**

National University of Science & Technology, Islamabad, Pakistan

- Research Intern

Teaching Experience

- **Instructor**, CS592 Introduction to Robot Motion, 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**

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

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 human–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 Publications

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

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.

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.

Mentorship

Ph.D. Thesis Advisor

- Hanwen Ren — Oct 2021 -
- Zhiquan Wang (co-supervised with Bedrich Benes, Christos Mousas) — Sep 2021 -

Research Advisor for Independent Study (Not Counting Ph.D. Thesis advisees)

- 2021- Kendal Norman, Prabhpreet Singh Dir, Daniel Lawson, Jacob Johnson, Xuyang Chen
- 2017-2021 Anthony Simeonov, Mayur Bency, Zaid Tahir, Zhixian Ye, Yinglong Miao, Asfiya Baig, Ayon Biswas, Jiangeng Dong, Linjun Li, Leon Dai, Saurabh Mirani, Austin Choe, Yahsiu Hsieh, Yuhze Qin

Seminar & Talks

- 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.

Professional Activities

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.

Reviewer:

Journals:

- Elsevier Neural Networks;
- IEEE Transactions on Robotics;
- IEEE Robotics and Automation Letters;
- Cambridge Robotica;

Conferences:

- Conference on Neural Information Processing Systems (NeurIPS)
- IEEE International Conference on Robotics and Automation (ICRA)
- IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS).

Technical Skills

- Programming Languages: C/C++, Python, Lua, Cmake, MATLAB etc.
- Machine Learning Tools: TensorFlow, PyTorch, libTorch, Scikit-learn, OpenCV, PyMC3.
- Robotic Software: ROS, Gazebo, OpenRave, OMPL, V-REP, Mujoco, MoveIt.
- Operating Systems: Linux, Macintosh, Windows.

References

Available upon request