Alan Kuntz

Contact Information

School of Computing
University of Utah
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Education

The University of North Carolina at Chapel Hill, North Carolina USA
Ph.D., Computer Science, 2019
Dissertation: *Integrating Optimization and Sampling for Robot Motion Planning with Applications in Healthcare*
Committee: Ron Alterovitz (Chair), Nancy M. Amato, Jessica Burgner-Kahrs, Parasara Sridhar Duggirala, Marc Niethammer

The University of North Carolina at Chapel Hill, North Carolina USA
M.S., Computer Science, 2016

The University of New Mexico, Albuquerque, New Mexico USA
B.S., Computer Science with Mathematics Minor, 2014
Institutional Honors: Cum Laude
Departmental Honors: Summa Cum Laude
Advisor: Lydia Tapia

Central New Mexico Community College, Albuquerque, New Mexico USA
Paramedic Certificate, 2010

Research Interests

Robot Motion Planning, Autonomous Systems, Shared Autonomy in Robotic Systems, Computational Robot Design Optimization, Novel Tentacle-like Surgical Robots

Experience

University of Utah, Salt Lake City, UT

School of Computing and Robotics Center

Assistant Professor **January 2020 - Present**

Vanderbilt University, Nashville, TN

Medical Engineering and Discovery Lab

Postdoctoral Researcher **August 2019 - December 2019**

Designed hardware and software for novel minimally-invasive tentacle-like surgical robot systems with applications in lung cancer diagnosis and treatment. Developed image guidance techniques for surgeon control interfaces in clinically available surgical robots. Assisted in the supervision of seven Ph.D. students across three research projects.

The University of North Carolina at Chapel Hill, Chapel Hill, NC

Computational Robotics Research Group

Graduate Research Assistant **June 2014 - August 2019**

Developed novel algorithms for general manipulator robots and snake-like surgical robots that plan motions to enable the robots to accomplish tasks in their environment while avoiding obstacles. Created new algorithms that combine the separate paradigms of optimization-based and sampling-based motion planning to leverage the benefits of both with respect to computation speed and global optimality. Integrated motion planning into global optimization for patient specific design of parallel surgical manipulators.

The University of New Mexico, Albuquerque, NM

Adaptive Motion Planning Research Group

Undergraduate Research Assistant **May 2012 to May 2014**

Developed novel algorithms to simulate and analyze immune system molecules using motion planning techniques. Projects included the simulation and study of antigen antibody interaction using antigens of varying structure and binding sites, and using graph theory to map simulated protein aggregation structures to structures found in experimental data.

Los Alamos National Laboratory, Los Alamos, NM

Dynamics Summer School

Undergraduate Research Assistant **June 2013 to August 2013**

Designed a graphene-oxide sensor skin for structural health monitoring and developed evolutionary algorithms applied to printed capacitive and resistive sensor shape and circuitry design as part of a highly interdisciplinary research group.

Professional Experience

Albuquerque Ambulance Service, Albuquerque, NM

EMT/Paramedic and EVO Field Instructor **January 2008 to August 2012**

Worked as an Emergency Medical Technician (EMT) and Emergency Vehicle Operator (EVO) and then as a Paramedic in the 911 system of Albuquerque. Provided advanced life support for patients and facilitated interagency communication. Additionally, supervised the field portion of new EMT/EVO training.

Patents

Ron Alterovitz, Richard H. Feins, Bryan I. Hartley, **Alan D. Kuntz**, Erik Lamers, Arthur W. Mahoney, Andria A. Remirez, Philip J. Swaney, and Robert J. Webster III, "Methods, systems, and computer readable media for transoral lung access," United States Patent Application Serial No. 62/165,656, filed May 2015.

Grants

Contributing Author - **NIH R01 EB024864**, 9/15/2017–6/30/2021
"Bronchoscopic Steerable Needles for Transparenchymal Access to Lung Nodules,"
PI - Ron Alterovitz Co-I - Robert J. Webster III, Richard Feins, Yueh Lee, Jason Akulian, Steven Pizer, and Fabien Maldonado
Award (expected total): $2,025,189

ISRR Doctorial Consortium Student Travel Grant, 2017

IROS Student Travel Grant, 2015

Publications in Journals and Refereed Conferences

1. Haonan Chen, Hao Tan, **Alan Kuntz**, Mohit Bansal, and Ron Alterovitz, "Enabling Robots to Understand Incomplete Natural Language Instructions Using Commonsense Reasoning," *IEEE International Conference on Robotics and Automation (ICRA)*, pp. 1963-1969, Paris, France, June 2020.

2. **Alan Kuntz**, Armaan Sethi, Robert J. Webster III, and Ron Alterovitz, "Learning the Complete Shape of Concentric Tube Robots", *IEEE Transactions on Medical Robotics and Bionics*, vol. 2, no. 2, pp. 140-147, May 2020.

3. James M. Ferguson, E. Bryn Pitt, Andria A. Remirez, Michael A. Siebold, **Alan Kuntz**, Nicholas L. Kavoussi, Eric J. Barth, S. Duke Herrell, III, and Robert J. Webster III, "Toward Practical and Accurate Touch-Based Image Guidance for Robotic Partial Nephrectomy," *IEEE Transactions on Medical Robotics and Bionics*, vol. 2, no. 2, pp. 196-205, May 2020.

4. **Alan Kuntz**, Mengyu Fu, and Ron Alterovitz, "Planning High-Quality Motions for Concentric Tube Robots in Point Clouds via Parallel Sampling and Optimization," *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pp. 2205-2212, Macau, China, November 2019.

5. Sherdil Niyaz, **Alan Kuntz**, Oren Salzman, Ron Alterovitz, and Siddhartha S. Srinivasa, "Optimizing Motion-Planning Problem Setup via Bounded Evaluation with Application to Following Surgical Trajectories," *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pp. 1355-1362, Macau, China, November 2019.

6. **Alan Kuntz**, Armaan Sethi, and Ron Alterovitz, "Estimating the Complete Shape of Concentric Tube Robots via Learning," *The Hamlyn Symposium on Medical Robotics*, pp. 43-44, London, United Kingdom, June 2019.

7. Mengyu Fu, **Alan Kuntz**, Oren Salzman, and Ron Alterovitz, "Toward Asymptotically-Optimal Inspection Planning via Efficient Near-Optimal Graph Search," *Robotics: Science and Systems (RSS)*, Freiburg im Breisgau, Germany, June 2019.

8. Sherdil Niyaz, **Alan Kuntz**, Oren Salzman, Ron Alterovitz, and Siddhartha S. Srinivasa, "Following Surgical Trajectories with Concentric Tube Robots via Nearest-Neighbor Graphs," *International Symposium on Experimental Robotics (ISER)*, Buenos Aires, Argentina, November 2018.

9. Mengyu Fu, **Alan Kuntz**, Robert J. Webster III, and Ron Alterovitz, "Safe Motion Planning for Steerable Needles Using Cost Maps Automatically Extracted from Pulmonary Images," *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pp. 4942-4949, Madrid, Spain, October 2018.

10. Patrick Anderson, Tayfun Ertop, **Alan Kuntz**, Fabien Maldonado, Ron Alterovitz, and Robert J. Webster III, "Sand Blasting Inside a Patient: A CRISP Robot for Spraying Powder inside the Chest Cavity to Preclude Lung Collapse," *The Hamlyn Symposium on Medical Robotics*, pp. 121-122, London, United Kingdom, June 2018.

11. **Alan Kuntz**, Chris Bowen, Cenk Baykal, Arthur W. Mahoney, Patrick L. Anderson, Fabien Maldonado, Robert J. Webster III, and Ron Alterovitz, "Kinematic Design Optimization of a Parallel Surgical Robot to Maximize Anatomical Visibility via Motion Planning," *IEEE International Conference on Robotics and Automation (ICRA)*, pp. 926-933, Brisbane, Australia, May 2018.

12. **Alan Kuntz**, Chris Bowen, and Ron Alterovitz, "Fast Anytime Motion Planning in Point Clouds by Interleaving Sampling and Interior Point Optimization," *Proc. International Symposium on Robotics Research (ISRR)*, Puerto Varas, Chile, December 2017.

13. **Alan Kuntz**, Arthur W. Mahoney, Nicolas E. Peckman, Patrick L. Anderson, Fabien Maldonado, Robert J. Webster III, and Ron Alterovitz, "Motion Planning for Continuum Reconfigurable Incisionless Surgical Parallel Robots," *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pp. 6463-6469, Vancouver, BC, Canada, September 2017.

14. **Alan Kuntz**, Philip J. Swaney, Arthur Mahoney, Richard H. Feins, Yueh Z. Lee, Robert J. Webster III, and Ron Alterovitz, "Toward Transoral Peripheral Lung Access: Steering Bronchoscope-Deployed Needles through Porcine Lung Tissue," *The Hamlyn Symposium on Medical Robotics*, pp. 9-10, London, United Kingdom, June 2016.

15. **Alan Kuntz**, Luis G. Torres, Richard H. Feins, Robert J. Webster III, and Ron Alterovitz, "Motion Planning for a Three-Stage Multilumen Transoral Lung Access System," *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pp. 3255-3261, Hamburg, Germany, September 2015.

16. Luis G. Torres, **Alan Kuntz**, Hunter B. Gilbert, Philip J. Swaney, Richard J. Hendrick, Robert J. Webster III, and Ron Alterovitz, "A Motion Planning Approach to Automatic Obstacle Avoidance during Concentric Tube Robot Teleoperation," *IEEE International Conference on Robotics and Automation (ICRA)*, pp. 2361-2367, Seattle, WA, USA, May 2015.

17. Nathan Sharp, **Alan Kuntz**, Cole Brubaker, Stephanie Amos, Wei Gao, Gautum Gupta, Charles R. Farrar, David D. Mascarenas, Aditya Mohite, "Crack Detection Sensor Layout and Bus Configuration Analysis," *Smart Materials and Structures*, 23(5):055021, 2014.

18. Nathan Sharp, **Alan Kuntz**, Cole Brubaker, Stephanie Amos, Wei Gao, Gautum Gupta, Aditya Mohite, Charles R. Farrar, David D. Mascarenas, "A Bio-Inspired Asynchronous Skin System for Crack Detection Applications," *Smart Materials and Structures*, 23(5):055020, 2014.

19. Nathan Sharp, **Alan Kuntz**, Cole Brubaker, Stephanie Amos, Wei Gao, Gautum Gupta, Aditya Mohite, Charles Farrar, David Mascarenas, "An Asynchronous Sensor Skin for Structural Health Monitoring Applications," *Conference on Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems*, San Diego, CA, USA, March 2014.

Publications in Workshops and Non-Refereed Conferences

1. Margaret F. Rox, Maxwell Emerson, Tayfun Efe Ertop, Mengyu Fu, Inbar Fried, Janine Hoelscher, **Alan Kuntz**, Josephine Granna, Jason Mitchell, Michael Lester, Fabien Maldonado, Erin Gillaspie, Jason Akulian, Ron Alterovitz, and Robert J. Webster, III, "An Aiming Device for Steerable Needles". *IEEE/ASME International Conference on Advanced Intelligent Mechatronics*, 2020.

2. Maxwell Emerson, Tayfun Efe Ertop, Margaret F. Rox, Mengyu Fu, Inbar Fried, Janine Hoelscher, **Alan Kuntz**, Josephine Granna, Jason Mitchell, Michael Lester, Fabien Maldonado, Erin Gillaspie, Jason Akulian, Ron Alterovitz, and Robert J. Webster, III, "A New Sheath for Highly Curved Steerable Needles". *IEEE/ASME International Conference on Advanced Intelligent Mechatronics*, 2020.

3. Stephanie Amack, Margaret Rox, Jason Mitchell, Maxwell Emerson, **Alan Kuntz**, Ron Alterovitz, Robert J. Webster III, "A New Approach to Homing and Tool Changes in Needle-Like Surgical Robots," *SPIE Medical Imaging*, vol. 10951, San Diego, CA, USA, February, 2019.

4. **Alan Kuntz**, Cole Brubaker, Stephanie Amos, Nathan Sharp, Wei Gao, Gautum Gupta, Aditya Mohite, Charles R. Farrar, David D. Mascarenas, "Endowing Structures with a Nociceptive Sense Enabled by a Graphene-Oxide Sensing Skin," *Structural Health Monitoring, Volume 5*, ser. Conference Proceedings of the Society for Experimental Mechanics Series, pp. 117-123, Orlando, FL, USA, February, 2014.

5. Kasra Manavi, **Alan Kuntz**, Lydia Tapia, "Geometrical Insights into the Process of Antibody Aggregation" In *Proceedings of the AAAI Workshop on Artificial Intelligence and Robotics Methods in Computational Biology (AIRMCB)*, pp. 26-31, Bellevue, WA, USA, July 2013.

Invited Presentations

"A Continuum Robot for Lung Tumor Biopsy," Robot Guru II Workshop, *Robotics Science and Systems*, Ann Arbor, MI, USA, May 2016.

Teaching Experience

Courses Taught

- CS 4300, Introduction to Artificial Intelligence, University of Utah, Spring 2020, 118 students.

Students Advised

- Michael Bentley, PhD student
- Sarvenaz Chaeibakhsh, PhD student (co-advised)
- Rahul Thomas Benny, MS student
- Laura Brannan, BS student
- Aidan Copinga, BS student

Ongoing Mentorship of Graduate Student Researchers:

- Maxwell Emerson
- Tayfun Ertop
- Margaret Rox
- E. Bryn Pitt
- James Ferguson
- Patrick L. Anderson
- Andria A. Remirez

Mentorship of Undergraduate Student Researchers:

- Armaan Sethi, ongoing
- Nicolas E. Peckman, 2017–2018, Graduated and is now a Software Developer at Extron Electronics
- Cenk Baykal, 2014–2015, Graduated and is now a PhD student at MIT CSAIL

Field Instructor for new EMT Basics and Intermediates at Albuquerque Ambulance Service, 2009–2012

Honors and Awards

- Thomas S. Kenan III Graduate Fellow, Awarded to 10 exceptional graduate students in UNC's College of Arts and Sciences, 2018
- Timothy L. Quigg Student Inventor of the Year, Awarded to the student who has demonstrated the highest inventive skills and entrepreneurship in UNC CS, 2018
- NSF Graduate Research Fellowship–Honorable Mention, 2016
- Finalist (One of Three Males Nationally)–Computing Research Association Outstanding Undergraduate Researcher, 2014
- Honorable Mention (One of Fourty-One Males Nationally)–Computing Research Association Outstanding Undergraduate Researcher, 2013
- Van Dyke Software Engineering Scholarship (Full Tuition Award), an award given to high achieving undergraduates in Computer Science at UNM, 2012–2014

Professional and Service Activities

Program Committee Member, *Workshop on Machine Learning in Planning and Control of Robot Motion (MLPC)*, ICRA 2020

Program Committee Member, *Workshop on the Algorithmic Foundations of Robotics (WAFR)*, 2020

Program Committee Member, *Robotics:Science and Systems (RSS)*, 2020

Associate Editor, *IEEE International Conference on Robotics and Automation (ICRA)*, 2020.

Panel Member on advice for continuing robotics education targeted at undergraduate and community college students, Robot Guru II Workshop, *Robotics Science and Systems*, Ann Arbor, MI, May 2016.

Computer Science Student Association Officer—a representative for the graduate student body at UNC CS. Personally organized initiatives including a first year graduate student mentorship program and represented the graduate students at faculty meetings, 2017–2018

Invited to Peer-Review Papers for Journal Publications and Conference Proceedings:

- International Journal of Robotics Research (IJRR)
- IEEE Transactions on Robotics (T-RO)
- IEEE Robotics and Automation Letters (RA-L)
- IEEE Transactions on Biomedical Engineering
- International Journal of Computer Assisted Radiology and Surgery (IJCARS)
- IEEE Transactions on Control Systems Technology
- Journal of Medical Robotics Research (JMRR)
- International Symposium on Experimental Robotics (ISER)
- Robotics: Science and Systems Conference (RSS)
- Workshop on the Algorithmic Foundations of Robotics (WAFR)
- IEEE International Conference on Robotics and Automation (ICRA)
- IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
- Robotics and Autonomous Systems
- ACM/IEEE International Conference on Human Robot Interaction
- Computer-Aided Design
- Simulation: Transactions of the Society for Modeling and Simulation International

Outreach involving Computer Science and Robotics Demonstrations at:

- UNC Science Expos in 2015, 2016, and 2018
- UNC Department of Computer Science 50^{th} Anniversary
- UNC Department of Computer Science Open House for 6^{th}-12^{th} grade students 2015–2018
- Southwestern Indian Polytechnique Institute
- Albuquerque Institute of Math and Science
- New Mexico Supercomputing Challenge
- Dennis Chavez Elementary School with continued student correspondence regarding Computer Science education and career opportunities