

# Troy Anthony McMahon

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CONTACT INFORMATION	Pracsys Lab Computer Science Department Rutgers University New Brunswick, NJ, 2601	<i>Voice:</i> (848) 445-2001 <i>Skype:</i> troy.mcmahon2 <i>E-mail:</i> troymcmahon1@gmail.com <a href="https://robotics.cs.rutgers.edu/troy-mcmahon/">https://robotics.cs.rutgers.edu/troy-mcmahon/</a>
RESEARCH INTERESTS	Motion Planning, Kinodynamics, Artificial Intelligence, Machine Learning, Computational Geometry, Computational Biology, Parallel Algorithms	
EDUCATION	<b>Ph.D., Computer Science, Texas A&amp;M University</b> , August 2016 <ul style="list-style-type: none"><li>• Thesis: Sampling Based Motion Planning With Reachable Volumes</li><li>• Research Focus: Motion planning for constrained systems and high degree of freedom problems</li><li>• Advisor: Nancy M. Amato</li></ul> <b>B.S., Computer Science, Physics, University of Massachusetts</b> , June 2005	
HONORS	<ul style="list-style-type: none"><li>• <i>Travel Scholarship, IEEE Int. Conf. Robot. Autom. (ICRA)</i>, May 2015.</li><li>• <i>Travel Scholarship, IEEE/RSJ Int. Conf. Intel. Rob. Syst. (IROS)</i>, September 2014.</li><li>• <i>Deans List</i>, Fall 2000, Spring 2001, Fall 2001, Fall 2002, Spring 2002, Fall 2003, Spring 2003, Fall 2004</li><li>• <i>Member of Golden Key National Honors Society</i></li></ul>	
EXPERIENCE	<b>Rutgers University</b> , New Brunswick, New Jersey <i>Postdoctoral Research Assistant</i> <b>October 2020 - present</b> Postdoctoral research assistant at the Center for Discrete Mathematics and Theoretical Computer Science (DIMACS) at Rutgers University under the mentorship of Lazaros Gallos. This project applies spatial and probabilistic tools to track and predict the spread of pandemics such as COVID-19.  <i>Postdoctoral Research Assistant</i> <b>January 2020 - present</b> Postdoctoral research assistant for motion planning and machine learning under the mentorship of Kostas Bekris at The Pracsys Lab. This project emphasized the application of machine learning to sampling based motion planning for problems with kinodynamic constraints. We developed a learned model that captured the dynamics of a system, and used it in combination with planning methods such as RRT and DIRT.  <i>Lecturer</i> <b>February 2020 - December 2020</b> I served as the instructor for the undergraduate Artificial Intelligence course at Rutgers University during the Spring and Fall semesters of 2020. During both semesters this course consisted of between 120 and 130 students. The material covered in this course included traditional search algorithms, logic, probability, Bayesian networks, Markov decision processes. I also gave an overview of a number of common learning algorithms such as regression, neural networks and data mining.  <b>The Australian National University</b> , Action, ACT, Australia <i>Postdoctoral Research Assistant</i> <b>February 2019 - August 2019</b> Postdoctoral research assistant for artificial intelligence with an emphasis on developing algorithms for penetration testing.  <b>The University of Queensland</b> , Saint Lucia, QLD, Australia <i>Postdoctoral Research Assistant</i> <b>February 2018 - January 2019</b> Postdoctoral research assistant for artificial intelligence and cyber security with an emphasis on	

planning under uncertainty.

*Head Tutor*

**September 2018 - December 2018**

Head tutor for course in Artificial Intelligence. My duties included lecturing, teaching lab and tutorial sections, and managing the other tutors for this course. My lectures covered material on motion planning as well as partially observable Markov decision processes (POMDPs). During the lab sections I worked with students on the course's programming assignments. During the tutorial sections I reviewed the the material from the week's lecture and went over example problems. My duties also included writing infrastructure code for programming assignments, grading exams and evaluating project submissions.

**University of Michigan**, Ann Arbor, Michigan

*Postdoctoral Research Assistant*

**September 2016 - January 2018**

Postdoctoral research assistant for perception and manipulation under the mentorship of Chad Jenkins at The Laboratory for Progress, with an emphasis on developing planning algorithms for manipulation affordances and applying these algorithms to problems such as task and motion planning.

**Texas A&M University**, College Station, Texas

*Research Assistant*

**September 2007 - August 2016**

Research assistant for motion planning with an emphasis on motion planning for constrained systems and high degree of freedom problems with applications in grasping and manipulations, computational biology, graphics, robot design and control, and parallel robotics. Ph.D. research introduces the concept of reachable volumes which illustrates what regions of an environment that a robot can reach. Also present an algorithm for computing reachable volumes and a set of sampling methods that use reachable volumes to generate constraint satisfying samples for high degree of freedom problems.

*Web Developer*

**September 2007 - August 2016**

For the Texas A&M Department of Computer Science and Engineering. Manage and develop software for the One-Stop for Information System (OSIS), a large web-based database application. It is used to support the Texas A&M Computer Science Department's graduate admissions, advising, payroll and annual PhD review. It is also used to support national applications such as the SWSIS and Grace Hopper scholarship applications, as well as to support the graduate, faculty search and REU applications of many departments within our university. My primary responsibilities are to design and program this system and to investigate and repair any bugs that are reported.

PEER REVIEWED  
PUBLICATIONS

- [1] Troy McMahon, Aravind Sivaramakrishnan, Edgar Granados, Kostas E. Bekris, "A Survey on the Integration of Machine Learning with Sampling-based Motion Planning", *Under Review*.
- [2] Troy McMahon, Aravind Sivaramakrishnan, Kushal Kedia, Kostas E. Bekris, "Terrain-Aware Learned Controllers for Kinodynamic Planning over Physically Simulated Terrains", *Under Review*.
- [3] Troy McMahon, Adrian Chan, Shlomo Havlin, and Lazaros K. Gallos, "Spatial correlations in geographical spreading of COVID-19", To appear in *Scientific Reports*.
- [4] Aravind Sivaramakrishnan, Edgar Granados, Seth Karten, Troy McMahon, Kostas E. Bekris, "Improving Kinodynamic Planners for Vehicular Navigation with Learned Goal-Reaching Controllers", 2021 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2021, pp. 9038-9043
- [5] T. McMahon, O. C. Jenkins and N. Amato, "Affordance Wayfields for Task and Motion Planning," 2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2018, pp. 2955-2962, doi: 10.1109/IROS.2018.8594492.

- [6] Troy McMahon, Shawna Thomas, Nancy Amato. Sampling-based motion planning with reachable volumes for high-degree-of-freedom manipulators. *The International Journal of Robotics Research*. 2018;37(7):779-817. doi:10.1177/0278364918779555
- [7] T. McMahon, R. Sandström, S. Thomas and N. M. Amato, "Manipulation planning with directed reachable volumes," 2017 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2017, pp. 4026-4033, doi: 10.1109/IROS.2017.8206257.
- [8] T. McMahon, S. Thomas and N. M. Amato, "Reachable volume RRT," 2015 IEEE International Conference on Robotics and Automation (ICRA), 2015, pp. 2977-2984, doi: 10.1109/ICRA.2015.7139607.
- [9] T. McMahon, S. Thomas and N. M. Amato, "Sampling based motion planning with reachable volumes: Application to manipulators and closed chain systems," 2014 IEEE/RSJ International Conference on Intelligent Robots and Systems, 2014, pp. 3705-3712, doi: 10.1109/IROS.2014.6943082.
- [10] T. McMahon, S. Thomas and N. M. Amato, "Sampling-based motion planning with reachable volumes: Theoretical foundations," 2014 IEEE International Conference on Robotics and Automation (ICRA), 2014, pp. 6514-6521, doi: 10.1109/ICRA.2014.6907820.
- [11] T. McMahon, S. Jacobs, B. Boyd, L. Tapia and N. M. Amato, "Local randomization in neighbor selection improves PRM roadmap quality," 2012 IEEE/RSJ International Conference on Intelligent Robots and Systems, 2012, pp. 4441-4448, doi: 10.1109/IROS.2012.6386061.

OTHER  
PUBLICATIONS,  
POSTERS,  
ETC.(SELECTED)

- [1] Troy McMAHON, Terrain-Aware Motion Planning for Physically Simulated Systems, Rutgers Robotics Workshop, Rutgers University, NJ, USA, Sept 2021.
- [2] Troy McMAHON, Odest Chadwicke JENKINS, Affordance Wayfields for Task and Motion Planning, Human in-the-loop Manipulation: on the Influence of the Human Role Workshop Poster, Vancouver, Canada, Sept 2017.
- [3] Troy McMAHON, Shawna THOMAS, Nancy M. AMATO, Directed Reachable Volumes, Late Breaking Results Poster, *IEEE Int. Conf. Robot. Autom. (ICRA)*, Seattle, WA, USA, May 2015.
- [4] Troy McMAHON, Sampling Based Motion Planning with Reachable Volumes, Ph.D. Forum Poster, *IEEE Int. Conf. Robot. Autom. (ICRA)*, Seattle, WA, USA, May 2015.
- [5] Troy McMAHON, Shawna THOMAS, Nancy M. AMATO, Sampling-Based Motion Planning with Reachable Volumes, Technical Report TR14-003, Feb 2014.
- [6] Chinwe EKENNA, Troy McMAHON, Shuvra NATH, Jory DENNY, Shawna THOMAS, Nancy M. AMATO, A Hierarchical Neighbor Finding Strategy for Sampling-Based Motion Planning, Technical Report TR12-006, Apr 2012.
- [7] Troy McMAHON, Sam JACOBS, Bryan BOYD, Lydia TAPIA, Nancy M. AMATO, Local Randomization in Neighbor Selection Improves PRM Roadmap Quality(Full Version), Technical Report TR12-002, Jan 2012.

PROFESSIONAL  
ACTIVITIES

**Mentoring:** Mentored a number of other students, including PhD students Chinwe Ekenna, Sam Jacobs, Ali-akbar Agha-mohammadi, Daniel Tomkins and Zhefan Ye, Masters students Andrew Giese, Shuvra Nath and Dielli Hoxha, and undergraduate Juan Burgos.

**Reviewer for Scientific Conferences and Journals:** Reviewed papers for conferences and journals including the International Conference on Robotics and Automation (ICRA), the International Workshop on the Algorithmic Foundations of Robotics (WAFR), the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Robotics: Science and Systems (RSS), the International Journal of Robotics Research (IJRR), and the Special Interest Group on Graphics and Interactive Techniques (SIGGRAPH).

**Volunteer**, The International Conference on Robotics and Automation (ICRA), Brisbane, Queensland, Australia, 2018

**Program Committee**, The International Workshop on the Algorithmic Foundations of Robotics (WAFR).

**Judge**, REU poster competition, Dwight Look College of Engineering, Texas A&M University, College Station, TX, Aug. 2014

**Student Volunteer**, Shape Modeling International (SMI), Texas A&M University, College Station, TX, May, 2012

**Student Volunteer**, Workshop on Quality Software: A Festschrift for Bjarne Stroustrup, Texas A&M University, College Station, TX, April 27-28, 2012

**Student Volunteer**, Workshop on Intelligent Systems: A Festschrift for Richard Volz, Texas A&M University, College Station, TX April 8-10, 2010

**Future Faculty Seminar**, Texas A&M University, College Station, TX Fall 2015

## SKILLS

Operating Systems: Linux (Ubuntu, CentOS), Microsoft Windows, Robot Operating System (ros and ros2)

Languages: C++, C, STL, Boost, CMake, Java, Matlab, PHP, Scheme, Pascal, HTML, Javascript, SQL, Perl, Haskell, Python, Fortran

Other Applications: Bullet Physics Engine, PyTorch, GIT, SVN, LaTeX, Apache, phpMyAdmin, CGAL, Gnuplot, X-fig.