Tony Dear

tonydear.github.io   email: tony.dear@columbia.edu

Employment	**Columbia University, Department of Computer Science**	
	Lecturer in Discipline	January 2019 - present
	Associate in Discipline	July 2018 - December 2018

Education	**Carnegie Mellon University, The Robotics Institute**	
	Doctor of Philosophy, Robotics	August 2018
	Master of Science, Robotics	May 2015
	- Thesis: Extensions of the Principal Fiber Bundle Model for Locomoting Robots	
	University of California, Berkeley	
	Bachelor of Science, Electrical Engineering and Computer Science (EECS)	May 2012
	- Graduated with highest honors; EECS Honors Program alumnus	

Teaching	**Columbia University**	
	COMS 4701, Artificial Intelligence	Spring 2023
	COMS 3251, Computational Linear Algebra	
	CSOR 4200, Data-Driven Decision Modeling	Fall 2022
	COMS 3203, Discrete Mathematics	
	COMS 4701, Artificial Intelligence	Summer 2022
	COMS 4701, Artificial Intelligence	Spring 2022
	COMS 3251, Computational Linear Algebra	
	COMS 4733, Computational Aspects of Robotics	Fall 2021
	COMS 3251, Computational Linear Algebra	
	COMS 4701, Artificial Intelligence	Summer 2021
	COMS 4733, Computational Aspects of Robotics	Spring 2021
	COMS 3251, Computational Linear Algebra	
	COMS 4701, Artificial Intelligence	Fall 2020
	COMS 3251, Computational Linear Algebra	Spring 2020
	COMS 4701, Artificial Intelligence	Fall 2019
	COMS 4733, Computational Aspects of Robotics	Spring 2019
	COMS 3203, Discrete Mathematics	
	COMS 4701, Artificial Intelligence	Fall 2018
	Carnegie Mellon University	
	16-384, Robot Kinematics and Dynamics	Fall 2013 - Summer 2018
	Online course developer and TA with Prof. Howie Choset.	

Leadership	Columbia Online Artificial Intelligence Executive Education Program Director
	CS@CU MS Bridge Program Director

Grants	**Collaboratory Fellows Fund**	August 2020 - present
	Received $100,000 over three years with Prof. Yi Zhang (Columbia IEOR) for the development of an interdisciplinary, data-driven decision-making course. The course covers ideas and examples from artificial intelligence and business analytics to give students a solid foundation in decision theory, dynamic programming, reinforcement learning, and model estimation. Applications include practice with real data sets for business analytics and a capstone project.	
	Provost's Teaching and Learning Grant for MOOCs	June 2021 - present
	Received support and funding to develop a massive open online course (MOOC) on the subject of *Decision Making and Reinforcement Learning* with Columbia Video Network (CVN). This course will teach sequential decision making and reinforcement learning with an emphasis on theory and algorithms. Assessments will include self-check questions, quizzes, and coding implementations. The course is set to launch on Coursera in Spring 2023.	

Research	**Columbia University**	August 2018 - present

Currently pursuing research related to robot locomotion and reinforcement learning. We are interested in integrating geometric methods with model-based and model-free learning methods. Our ultimate goal is to develop locomoting robots that can learn in real time and in real life.

Carnegie Mellon University   September 2012 - August 2018

Advisor: Prof. Howie Choset. Expanded applicability of geometric methods for modeling and controlling locomoting systems, including wheeled, snake, and swimming robots. We applied intuitive motion planning techniques to systems that deviate from ideal conditions, such as those with passive joints or those that have to coordinate their degrees of freedom with environmental interactions. We also validated the newly established theory through experiments on simple but representative robots, such as a multi-link wheeled snake robot with compliant joints.

University of California, Berkeley   February 2011 - February 2012

Advisor: Prof. Stuart Russell. Developed and tested a seismic inference system in accordance with the Comprehensive Test Ban Treaty Organization (CTBTO) to detect nuclear explosions and seismic events worldwide; first system of its kind to use Bayesian inference. Implemented algorithms and computation through parallel and distributed computing on Amazon EC2, with results of up to 30 times speedup.

Journal Publications

T. Dear, B. Buchanan, R. Abrajan-Guerrero, S. D. Kelly, M. Travers, and H. Choset. "Locomotion of a multi-link non-holonomic snake robot with passive joints". The International Journal of Robotics Research 39(5), 598-616, 2020. https://doi.org/10.1177/0278364919898503

R. L. Hatton, **T. Dear**, and H. Choset. "Kinematic Cartography and the Efficiency of Viscous Swimming". IEEE Transactions on Robotics 33(3), 523-535, 2017.

Conference Publications

J. Shi, **T. Dear**, and S. D. Kelly. "Deep Reinforcement Learning for Snake Robot Locomotion". Proceedings of the 21st IFAC World Congress (virtual), July 2020.

J. Grover, J. Zimmer, **T. Dear**, M. Travers, H. Choset, and S. D. Kelly. "Geometric Motion Planning for a Three-Link Swimmer in a Three-Dimensional Low Reynolds-Number Regime". Proceedings of the 2018 American Control Conference. Milwaukee, WI, June 2018.

T. Dear, S. D. Kelly, M. Travers, and H. Choset. "Locomotion of a Multi-link Nonholonomic Snake Robot". Proceedings of the ASME 2017 Dynamic Systems and Control Conference. Tysons Corner, VA, October 2017.

T. Dear, S. D. Kelly, and H. Choset. "Control and Locomotion of Hydrodynamically Coupled Rigid Spheres". Proceedings of the 2017 American Control Conference. Seattle, WA, May 2017.

T. Dear, S. D. Kelly, M. Travers, and H. Choset. "Locomotive Analysis of a Single-Input Three-Link Snake Robot". Proceedings of the 55th IEE Conference on Decision and Control. Las Vegas, NV, December 2016.

H. Salman, **T. Dear**, S. Babikian, E. Shammas, and H. Choset. "A Physical Parameter-Based Skidding Model for the Snakeboard". Proceedings of the 55th IEE Conference on Decision and Control. Las Vegas, NV, December 2016.

A. Agrawal, H. Zaini, **T. Dear**, and H. Choset. "Experimental Gait Analysis of Waveboard Locomotion". Proceedings of the ASME 2016 Dynamic Systems and Control Conference. Minneapolis, MN, October 2016.

T. Dear, S. D. Kelly, and H. Choset. "Variations on the Role of Principal Connections in Robotic Locomotion". Proceedings of the ASME 2016 Dynamic Systems and Control Conference. Minneapolis, MN, October 2016.

R. Shu, A. Siravuru, A. Rai, **T. Dear**, K. Sreenath, and H. Choset. "Optimal Control for Geometric Motion Planning of a Robot Diver". Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems. Daejon, South Korea, October 2016.

T. Dear, S. D. Kelly, M. Travers, and H. Choset. "The Three-Link Nonholonomic Snake as a Hybrid Kinodynamic System". Proceedings of the American Control Conference. Boston, MA, July 2016.

T. Dear, S. D. Kelly, M. Travers, and H. Choset. "Motion Planning and Differential Flatness of Mechanical Systems on Principal Bundles". Proceedings of the ASME 2015 Dynamic Systems and Control Conference. Columbus, OH, October 2015.

J. Dai, M. Travers, **T. Dear**, C. Gong, H. C. Astley, D. I. Goldman, and H. Choset. "Robot-Inspired Biology: The Compound-Wave Control Template". Proceedings of the IEEE International Conference on Robotics and Automation. Seattle, WA, May 2015.

T. Dear, S. D. Kelly, M. Travers, and H. Choset. "Snakeboard Motion Planning with Viscous Friction and Skidding". Proceedings of the IEEE International Conference on Robotics and Automation. Seattle, WA, May 2015.

T. Dear, S. D. Kelly, M. Travers, and H. Choset. "Dissipation-Induced Self-Recovery in Systems on Principal Bundles". Proceedings of the ASME 2014 Dynamic Systems and Control Conference. San Antonio, TX, October 2014.

T. Dear, R. L. Hatton, and H. Choset. "Nonlinear Dimensionality Reduction for Kinematic Cartography with an Application toward Robot Locomotion". Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems. Chicago, IL, September 2014.

T. Dear, R. L. Hatton, M. Travers, and H. Choset. "Snakeboard Motion Planning with Local Trajectory Information". Proceedings of the ASME 2013 Dynamic Systems and Control Conference. Stanford, CA, October 2013. Nominated for Best Student Paper.

T. Dear, S. D. Kelly, M. Travers, and H. Choset. "Mechanics and Control of a Terrestrial Vehicle Exploiting a Nonholonomic Constraint for Fishlike Locomotion". Proceedings of the ASME 2013 Dynamic Systems and Control Conference. Stanford, CA, October 2013.

Fellowships	National Defense Science and Engineering Graduate (NDSEG) Fellowship	2014 - 2017
	Jim & Donna Gray Endowment Award (UC Berkeley)	2011 - 2012

Service   Advisor for Columbia undergraduate student groups, including Application Development Initiative (ADI) Labs and Columbia Space Robotics, as well as undergraduate and MS students on independent research projects

Reviewer for refereed journals, including MDPI Robotics, IEEE T-ASE, and NODY, and refereed conferences, including ICRA, IROS, CDC, ACC, DSCC, among others.

Mentor for undergraduate students (including international) participating in the Robotics Institute Summer Scholars (RISS) program to perform research in the laboratory.

Organized tour groups of Robotics Institute labs, including for K-12 students of the Big Brothers Big Sisters of Greater Pittsburgh program.

Professional   **Tau Beta Pi**, Initiated CA-Alpha Chapter, Fall 2009
Affiliations   **IEEE-Eta Kappa Nu**, Initiated CA-Alpha Chapter, Spring 2009