Ariel S. Anders

Ph.D. Candidate at Massachusetts Institute of Technology
Department of Electrical Engineering and Computer Science
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Education

Massachusetts Institute of Technology · Cambridge, MA

Ph.D., Electrical Engineering and Computer Science · Fall 2014 - present

Advisors: Prof. Leslie Kaelbling and Prof. Tomás Lozano Pérez.

Passed the Technical and Research Qualifying Examinations.

Completed minor: Mechanical Engineering/Aeronautics and Astronautics (courses in controls and autonomous vehicles)

Primary research area of planning robust robotic manipulation methods. Completed a variety of projects including: reinforcement learning for bi-manual grasping, multi-robot planning under uncertainty, and reliable robotic assembly methods. Each listed research project has been successfully demonstrated on a real robot (Willow Garage PR2 and TurtleBots).

S.M., Electrical Engineering and Computer Science· Fall 2012 - Spring 2014

Advisors: Prof. Leslie Kaelbling and Prof. Tomás Lozano Pérez.

Masters Thesis: "Learning a Strategy for Whole Arm Grasping"

GPA: 4.9/5.0

Relevant Coursework

6.867: Machine Learning	6.831: User Interface Design and Implementation
6.375: Design of Complex Digital Systems	6.852: Distributed Algorithms
16.31: Feedback and Control Systems	2.166 Autonomous Vehicles

University of California, Santa Cruz · Santa Cruz, CA

B. S., Computer Engineering· Fall 2008 - Spring 2012

University of California Regent Scholar

University Honors: *Summa Cum Laude*, Department Honors: Highest Honors in the major

Senior Design Capstone Project
Team project to improve the performance of arithmetic functions for Oracle numbers within the Oracle Database; this software development project was completely done in C on x86 and ARM processors using code profilers to find performance bottle necks and applying vectorized hardware instructions (SSE) and different number representations to achieve speedup.

GPA: 3.96/4.00

Relevant Coursework

CMPE 215: Models of Robotic Manipulation	CMPE 118: Introduction to Mechatronics
CMPE 121: Microprocessor System Design	CMPE 110: Computer Architecture
CMPE 100: Logic Design	EE 101: Electornic Circuits
AMS 114: Introduction to Dynamical Systems	EE 103: Signals and Systems
EE 154: Feedback Control Systems	CMPS 101: Algorithms and Abstract Data Types

Publications

Ariel S. Anders, Leslie P. Kaelbling, and Tomas Lozano-Perez. Reliably arranging objects in uncertain domains. In *IEEE Conference on Robotics and Automation (ICRA). To appear*, 2018.

Ariel Anders. Robot juggling. In *EAAI-18: The 8th Symposium on Educational Advances in Artificial Intelligence*, 2018.

Ariel Anders, Leslie Kaelbling, and Tomas Lozano-Perez. Planning robust strategies for constructing multi-object arrangements. Technical report, CSAIL MIT, 2017.

Daniel J. Preston, Ariel Anders, Banafsheh Barabadi, Evelyn Tio, Yangying Zhu, DingRan Annie Dai, and Evelyn N. Wang. Electrowetting-on-dielectric actuation of a spatial and angular manipulation mems stage. In *The 30th IEEE International Conference on Micro Electro Mechanical Systems (MEMS 2017)*, 2017.

Sertac Karaman, Ariel Anders, Michael Boulet, Jane Connor, Kenneth Gregson, Winter J Guerra, Owen Guldner, Mubarik Mohamoud, Brian Plancher, Robert Shin, and John Vivilecchia. Project-based, collaborative, algorithmic robotics for high school students: Programming self-driving race cars at MIT. In *2017 IEEE Integrated STEM Education Conference (ISEC) (ISEC'17)*, Princeton, USA, March 2017.

Christopher Amato, George Konidaris, Ariel Anders, Gabriel Cruz, Jonathan P How, and Leslie P Kaelbling. Policy search for multi-robot coordination under uncertainty. *The International Journal of Robotics Research*, 35(14):1760–1778, 2017.

Daniel J. Preston, Ariel Anders, Banafsheh Barabadi, Evelyn Tio, Yangying Zhu, DingRan Annie Dai, and Evelyn N. Wang. Electrowetting-on-dielectric actuation of a vertical translation and angular manipulation stage. *Applied Physics Letters*, 109(24):244102, 2016.

Ariel Anders and Sertac Karaman. Visual servoing. In *EAAI-17: The 7th Symposium on Educational Advances in Artificial Intelligence*, 2017.

C. Amato, G.D. Konidaris, A. Anders, G. Cruz, J.P. How, and L.P. Kaelbling. Policy search for multi-robot coordination under uncertainty. In *Robotics: Science and Systems XI (RSS)*, 2015.

Ariel S. Anders. Learning a strategy for whole-arm grasping. Master's thesis, Massachusetts Institute of Technology, 2014.

Ariel S. Anders and Jacob Rosen. Dynamic registration for dental robotics. In *National Society of Black Engineers Technical Proceedings*, volume 38, 2012.

Professional Experience

Lead Technology Developer, LEAC MIT · Cambridge, MA · January 2017- Present

The Lab Energy Assessment Center (LEAC) provides low cost and minimally invasive tools to detect and analyze energy inefficiencies. I develop scalable software for wireless power monitoring for tools. All software is available open source at `https://github.com/leac-mit`.

See `https://leac.mit.edu` for more information

Software Engineering Intern, Intel Santa Clara, CA · Summer 2014

Responsibilities included designing, writing, testing, and documenting design automation software that uses machine learning techniques to determine proper and efficient simulation points. These simulation points are used during architecture analysis of future Intel Architecture based products and platforms.

Undergraduate Researcher, Bionics Lab UCSC · Santa Cruz, CA · Summer 2010 - 2012

Advisor: Jacob Rosen (Now at UCLA)

Research focus: CAD/CAM applications in dentistry, autonomous control with mechanical systems, and UI development for robotic programs.

Developed a workflow to execute dental crowning and implant placement procedures on static dental models that I verified experimentally. Worked on a system to implement dynamic dental procedures.

Teaching Experience

ENGR 2340: Dynamics Olin College of Engineering · Fall 2018

Course Description: With an emphasis on understanding fundamental concepts, students will learn to create and analyze mathematical models for mechanical and electromechanical systems that are changing in time. Equations of motion for 3D rigid bodies and systems will be derived using conservation of momentum and energy methods. Concepts involving equilibrium, linearization, and stability will be applied to study dynamic response in both the time and frequency domains through time-integration, transfer function, and state-space analysis. The idea of feedback control is introduced. Coursework and projects will involve examples such as robots, mechanisms, vehicles, and aircraft/spacecraft.

Beaverworks Summer Institute Technical Instructor BeaverWorks · Summer 2017

The Autonomous Mini Grand Prix, is a hands-on, intensive, project-based challenge that demonstrates autonomous mini racecar navigation in a complex environment. In project teams students will use their own RACECAR (Rapid Autonomous Complex- Environment Competing Ackermann-steering Robot), complete with sensors and a NVIDIA computer running on ROS (Robot Operating System), to Move! Explore! Learn! Race! As one of the technical instructors, I provide lectures, lead laboratory exercises, and assist in creating curriculum for the course.

6.141 Robotics: Science and Systems I Teaching Assistant MIT· Spring 2017

Course Description: Presents concepts, principles, and algorithms for sensing and computation related to the physical world. Topics include motion planning, geometric reasoning, kinematics and dynamics, state estimation, tracking, map building, manipulation, human-robot interaction, fault diagnosis, and embedded system development. Students specify and design a small-scale yet complex robot capable of real-time interaction with the natural world.

Beaverworks Summer Institute Lead Associate Instructor BeaverWorks · Summer 2016

The MIT Beaver Works Summer Institute is a 4-week residential STEM-based program for talented rising high school seniors (entering the 12th grade). This years exciting project is the MIT Mini Grand Prix Challenge, a hands-on, intensive 4-week program that will focus on demonstrating fast, autonomous navigation of small racecars in a complex environment. As lead associate instructor I lead a team of 6 associate instructors during the lab portions of the course. Additionally, I assisted in creating lab curriculum throughout the course and lead the material creation for the computer vision session of the course. See racecar.mit.edu for more details.

6.141 Robotics: Science and Systems I Teaching Assistant MIT· Spring 2016

Course Description: Presents concepts, principles, and algorithms for sensing and computation related to the physical world. Topics include motion planning, geometric reasoning, kinematics and dynamics, state estimation, tracking, map building, manipulation, human-robot interaction, fault diagnosis, and embedded system development. Students specify and design a small-scale yet complex robot capable of real-time interaction with the natural world.

Course TA for the first time this course was offered with the new RACECAR platform

6.01 Intro to EECS Teaching Assistant MIT· Spring 2015

Course Description: An integrated introduction to electrical engineering and computer science, taught using substantial laboratory experiments with mobile robots. Key issues in the design of engineered artifacts operating in the natural world: measuring and modeling system behaviors; assessing errors in sensors and effectors; specifying tasks; designing solutions based on analytical and computational models; planning, executing, and evaluating experimental tests of performance; refining models and designs. Issues addressed in the context of computer programs, control systems, probabilistic inference problems, circuits and transducers, which all play important roles in achieving robust operation of a large variety of engineered systems.

Math 3 Precalculus Teaching Assistant UCSC · Spring 2010 & 2011, Fall 2011, Winter 2012

Course Description:Inverse functions and graphs; exponential and logarithmic functions, their graphs, and use in mathematical models of the real world; rates of change; trigonometry, trigonometric functions, and their graphs; and geometric series.

Math 2 College Algebra for Calculus Teaching Assistant UCSC · Fall 2009, Winter 2010

Course Description: Operations on real numbers, complex numbers, polynomials, and rational expressions; exponents and radicals; solving linear and quadratic equations and inequalities; functions, algebra of functions, graphs; conic sections; mathematical models; sequences and series.

Math 2 Stretch Teaching Assistant UCSC · Fall 2010 - Winter 2011

Course Description: This two-credit, stretch course offers students two quarters to master material covered in course 2: operations on real numbers, complex numbers, polynomials, and rational expressions; exponents and radicals; solving linear and quadratic equations and inequalities; functions, algebra of functions, graphs; conic sections; mathematical models; sequences and series. After successful completion of this course in the first quarter, students enroll in course 2 the following quarter to complete the sequence and earn an additional 5 credits.

Course TA for the first time this course was offered

Academic Excellence Co-leader for Math 19A UCSC · Winter 2009

Course Title: Calculus for Science, Engineering, and Mathematics.

Course Description: The limit of a function, calculating limits, continuity, tangents, velocities, and other instantaneous rates of change. Derivatives, the chain rule, implicit differentiation, higher derivatives. Exponential functions, inverse functions, and their derivatives. The mean value theorem, monotonic functions, concavity, and points of inflection. Applied maximum and minimum problems. Inverse functions and graphs; exponential and logarithmic functions, their graphs, and use in mathematical models of the real world; rates of change; trigonometry, trigonometric functions, and their graphs; and geometric series.

See `http://ace.ucsc.edu` for more details.

Academic Excellence Co-leader for Math 3 UCSC · Fall 2008

Course Title: Precalculus

Course Description:Inverse functions and graphs; exponential and logarithmic functions, their graphs, and use in mathematical models of the real world; rates of change; trigonometry, trigonometric functions, and their graphs; and geometric series.

See `http://ace.ucsc.edu` for more details.

Girls in Engineering Robotics Instructor UCSC · Summer 2009

Summercamp for middle school girls to learn how to program Lego Mindstorm Robots. Prepared course material on programming the robots and an introduction to Processing.

Research Fellowships

Graduate Research Fellowships MIT· Cambridge, MA

GEM Ph.D. Engineering Fellowship Sponsored by Intel, Summer 2014

Edwin S. Webster Graduate Fellowship in Electrical Engineering, Spring 2013

Lemelson Minority Graduate Fellowship, Fall 2012

Undergraduate Research Fellowships UCSC · Santa Cruz, CA

Minority Access to Research Careers, Summer 2010- Spring 2012

Summer Undergraduate Research Fellowship in Information Technology, Summer 2010.

Honors and Awards

Grant Recipient

2017 Earth Day Mini Grant
Award for developing new fume hood technologies, in partnership with LEAC at MIT.

2017 MIT Green Labs Innovation Award
$5000 Award received in collaboration with Daniel Preston and the Device Research Lab for developing most innovative technology to improve sustainability efforts at campus at MIT.

2016 MIT EHS Green Labs Award
Received $1000 in seed funding to create green lab technology. Award received in collaboration with Daniel Preston and the Device Research Lab.

MindHandHeart Innovation Fund Grant Recipient, Fall 2015
"Removing SAD from Winter", *Planning for public artificial lightbox locations on campus for people with Seasonal Affective Disorder*

University Center of Exemplary Mentoring at MIT Scholar, Innaugural class of 2015.

Academic Honors and Scholarships

MIT EECS Frederick C. Hennie III Teaching Award, Spring 2017

MIT Graduate Women of Excellence, class of 2017 Honorees

University of California Regent Scholarship, Fall 2010-Spring 2012

Google Travel Scholarship for NSBE, Winter 2012

Mantey Undergraduate Leadership Award, Spring 2011

ARGV Scholarship, Spring 2010

Science Learning Community GPA Award, Spring 2009

Travel Scholarship Recipient for SACNAS, Fall 2008

Research Presentation Awards

1st Place Poster Presentation, NSBE Technical Research Exhibit, NSBE Annual conference 2012

Special Merit in Research Award, 2011 CAMP Symposium

National Poster Presentation Award, 2010 ABRCMS Annual Conference

Best Poster Design, UCSC, 2010 Undergraduate Research Symposium

Tech Competitions

Boop, 4th place Assitive Technology Hackathon, Spring 2016

lingui-sense, 1st place at Make Cool Shmit, Spring 2016

Haptic++, 2nd place at Meet++ Hackathon, Spring 2016

Beer Bots, 2nd place at CSAIL Research Highlights, Spring 2015

Service and Leadership Activities

Student Organization Activities

MIT EECS Robotic RAISINS Coordinator 2016

RoboCon 2016 Committee Chairperson

CSAIL Student Committee, President, AI Representative, Publicity Czar

MIT Concert Band, Vice President and Tour Manager

Ashdown House Officer, Coffee Hour Officer, Events Committee Officer

MIT EECS Prospective Students volunteer (Robotics RAISINS Organizer)

MIT Rowing Club, Avid Rower

MIT GSC Activities Committee, Committee Member

CSAIL Student Workshop 2012 & 2013, Committee Chairperson

UCSC National Society of Black Engineers, President (2 years), Peer Adviser

UCSC Society of Women Engineers , Treasurer, Undergrad Hardware Lab Representative

UCSC Tau Beta Pi, Corresponding Secretary, Exec. Board Member

Volunteer Activities

AAAI Student Volunteer 2017 and 2018

LIS Robot Tour Guide 2012-present

MIT EECS Student Visit Day Volunteer 2013-present

UCSC NSBE Math Boot Camp Tutor 2012

UCSC Google Student Ambassador 2009-2011

Mathematics Engineering and Science Achievement Judge 2009-2011

Expanding Your Horizons Conference Workshop Liaison 2009-2010

Computer Skills

Languages Python, C, C++, Java, Matlab, Perl, HTML, shell script, Javascript

Software Robot Operating System, SolidWorks, Simics, BlueSpec, Wincaps

OSs Unix, Linux, Mac, Windows

Robot platforms Denso VM-series, PR2, TurtleBot, DuckieBot, 6.141 Racecar

Embedded Systems Arduino, Raspberry Pi, Jetson TX1 and TK1, Pandaboard, Microchip PIC 32, Virtex5 FPGA, and 68HC11E1 Microcontroller

Personal Projects Portfolio

RACECAR Web designer: `http://racecar.mit.edu`

Boop Light Detector, iOS phone app (4+ stars, over 6000 downloads)

Green Net - reducing energy consumption at MIT

RoboCon 2016 Web Designer: `http://robocon.mit.edu/`

Ariel Anders personal webpage: `http://people.csail.mit.edu/aanders/`

More projects listed at `http://people.csail.mit.edu/aanders/projects.html`:

Open source software: `https://github.com/arii`

Miscellaneous

Born in California, USA. United States citizen.