ALEXANDRA (ALLI) NILLES

Contact: nilles2@illinois.edu
My website
Status: PhD Student at UIUC CS Department
Advisor: Steve LaValle

Interests: Developing useful and mathematically sound abstractions for robot design and control. Applying new developments in programming languages and formal methods to robotics software tools.

EDUCATION

University of Illinois (UIUC) (Urbana-Champaign, IL)

Degree: PhD in Computer Science
Dates: Aug 2015 - present

Colorado School of Mines (CSM) (Golden, CO)

Degree: B.S. in Engineering Physics
Minor in Computational and Applied Mathematics
Minor in Public Affairs, from McBride Honors Program
Dates: August 2011 to May 2015
GPA: 3.93

SKILLS

Programming: Skilled in Haskell, Python, C++, embedded programming (mBed, Arduino), MatLab, Mathematica, parallel computing (OpenMPI, OpenMP), shell scripting. Comfortable learning new languages.

Experimental: Comfortable with electronics prototype design and construction. Familiar with electronics lab equipment (oscilloscopes, multimeters, soldering, etc), safety, and troubleshooting techniques.

Computing: Experience in Linux (several distributions, comfortable with the command line), LaTeX, Git, Pandoc, and high performance computing clusters (with Slurm and PBS scheduling software)

Teaching: Paid tutor at Colorado School of Mines math learning center. Volunteer tutor at Python, Linux, and high-performance computing help sessions in the physics department.

RESEARCH

Motion strategies for "bouncing" robots

Description: Imagine a robot that can travel in straight lines until it collides with a wall, then turns to a heading relative to the wall normal before setting off again. By controlling the "bounce angle," we can design motion strategies that maximize "spreading" or "ergodicity" of the robot dynamics. Conversely, we can also design strategies that limit the uncertainty in the robot's dynamics as it converges to an attractor, for certain classes of environments. Work is ongoing.

Dates: January 2016 - present

Petronics internship: Development of small, agile mobile robot

Description: Over the summer, I worked with Petronics to develop hardware and software for their mobile platform. I helped add a wifi module to the robot which streamed data to a ROS server, which I also helped set up and configure. I wrote software for collecting and analyzing the resulting data. The goal was to compare streaming pose estimates from the robot with a ground truth from a motion capture system (also ROS-integrated), to analyze how the robot slipped on different surfaces and learn better controllers.

Dates: May 2016 - August 2016

Rolling robot motion tracking

Description: Combined an Arduino Pro Micro, LiPo battery, SD card reader/writer, and 9 DoF IMU into a stand-alone unit that is very small (approximately 4x2cm) and logs data at about 500 Hz. Wrote introductory guide to the design and construction of the unit.
Took gyro data from sensor fixed to the inside surface of a rolling robot and integrated, combined with physical constraints to reconstruct the path of the robot through the room.

Dates: August 2015 - Jan 2016

UC Davis REU: Implementing Predicted Information Gain Algorithms

Description: While working in Dr. Jim Crutchfield's group, I successfully implemented an information-theoretic learning algorithm for exploratory robots with limited sensing capabilities. I also researched ways to include more memory in the learning algorithm.

Dates: June - Aug 2014

Senior Design: Computational Modelling of Coherent Transport

Description: Researched and modeled the influence of molecular structure on exciton dynamics. Identified structural properties which extend coherent lifetimes in multi-site transport; documented research and passed on to a new senior design student. Worked with Dr. Mark Lusk in the Physics department at CSM.

Dates: April 2013 - May 2014

EMPLOYMENT

Colorado School of Mines Math Learning Center

Description: Tutor five hours a week for all classes in Math department. Primarily calculus, differential equations, and linear algebra.

Dates: Jan 2015 - May 2015

North American Network of Science Labs Online (NANSLO)

Description: Developed, monitored, and troubleshot remote-controlled robotic physics, chemistry, and biology experiments for college students in online classes. Served as a TA and equipment technician while classes were running.

Dates: Feb 2012 - May 2014

Institute of Electrical and Electronics Engineers (IEEE)

Description: Researched smart grid data management and policy alternatives; published an overview and policy recommendation in the *WISE Journal of Engineering and Public Policy*. Was part of the Washington Internships for Students of Engineering (WISE) program.

Dates: June - Aug 2013

PUBLICATIONS/TALKS/WORKSHOPS

- "Choreographic and Somatic Approaches for the Development of Expressive Robotic Systems". A. LaViers, C. Cuan, C. Maguire, K. Bradley, K. B. Mata, A. Nilles, I. Vidrin, N. Chakraborty, M. Heimerdinger, U. Huzaifa, R. McNish, I. Pakrasi, and A. Zurawski. In *MDPI – Arts*, 2018.
- "Controllable Billiards: Characterizing the Paths of Simple Mobile Robots". A. Q. Nilles, I. Becerra, and S. M. LaValle. In *Dynamics Days*, 2018.
- "Periodic Trajectories of Mobile Robots". A. Q. Nilles, I. Becerra, and S. M. LaValle. In *IEEE Conference on Intelligent Robots and Systems (IROS)*, 2017.
- "Minimality and Trade-offs in Automated Robot Design." Co-organizer for 2017 Robotic Science and Systems (RSS) Full-Day workshop. July 16 2017. Website
- "Interesting Trajectories of Mobile Robots in Polygons," talk given at the 2017 Midwest Robotics Workshop (MWRW). May 18 2017.
- "New Developments in Combinatorial Data Structures and Algorithms for Robotic Planning, Filtering and Design." UIUC Theory Seminar, October 3 2016.
- "Case Studies in Robotics Toolchains." Robotics@UIUC internal seminar, September 9 2016.
- "Teaching the Smart Grid: Why Data Management is Essential to the Future of Electricity," WISE Journal of Engineering and Public Policy.
- "Partially Coherent Transport: Computational Analysis and Overcoming Anderson Localization," 2014 CSM Physics poster session.

HONORS

- Saburo Muroga Endowed Fellowship, UIUC CS Department. 2015-2016
- Physics Faculty Distinguished Graduate Award, CSM. May 2015
- Leo Borasio Outstanding Junior Award, McBride Honors Program, CSM. May 2014
- President's Undergraduate Scholarship, CSM. 2011-2015
- ECC Women's Leadership Group Scholarship. 2011

SERVICE

- President of Computer Science Graduate Students Organization (fall 2017 - present). Organize social events and advocate for graduate student needs.
- Head of student committee organizing an internal Robotics@UIUC seminar (Fall 2016).
- Founding member of Equality Through Awareness (ETA), a group promoting diversity in STEM through discussion, mentoring, and invited speakers.
- Society of Physics Students - participated in outreach events such as travelling to local elementary/middle schools to do science demos and promote interest in physics