Dr. Alexandra (Alli) Nilles
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Current Position

Postdoctoral Associate, Cornell University **2021 - present**

Supervisor: Kirstin Petersen, Collective Embodied Intelligence Lab
Electrical and Computer Engineering

August - October 2022: I was honored to serve as interim Principal Investigator for the Collective Embodied Intelligence lab as part of the NSF Career Life Balance program. Primary responsibilities included supervising four PhD students and running weekly group meetings.

Education

University of Illinois at Urbana-Champaign (UIUC) **2015 - 2020**

Degree: Ph.D. in Computer Science
Thesis Title: *Designing Boundary Interactions for Simple Mobile Robots*
Committee: Steven M. LaValle (advisor), Nancy Amato, Sayan Mitra, Todd Murphey (Northwestern University)

Colorado School of Mines (CSM) **2011 - 2015**

Degree: B.S. in Engineering Physics. GPA 3.93/4.0
Minor in Computational and Applied Mathematics
Minor in Public Affairs, McBride Honors Program

Publications

Journal Articles

1. **A. Nilles**, Y. Ren, I. Becerra, S. M. LaValle. "A Visibility-Based Approach to Computing Nondeterministic Bouncing Strategies," in *The International Journal of Robotics Research*, 2021.
2. 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. "Choreographic and Somatic Approaches for the Development of Expressive Robotic Systems," in *MDPI – Arts*, 2018.

Conference Articles

3. **A. Nilles**, S. Ceron, N. Napp, and K. Petersen. "Strain-Based Consensus in Soft, Inflatable Robots," in the *IEEE 5th International Conference on Soft Robotics (RoboSoft)*, 2022.
4. S. Ceron, M. A. Kimmel, **A. Nilles**, and K. Petersen. "Soft Robotic Oscillators With Strain-Based Coordination," in *IEEE Robotics and Automation Letters (RAL),* 2021.
5. **A. Nilles**, A. Pervan, T. Berrueta, T. Murphey, S. M. LaValle. "Information Requirements of Collision-Based Micromanipulation," in the *14th Workshop on the Algorithmic Foundations of Robotics (WAFR)*, 2021.
6. M. Suomalainen, **A. Nilles**, S. M. LaValle. "Virtual Reality for Robots," in *IEEE Conference on Intelligent Robots and Systems (IROS)*, 2020.
7. **A. Nilles**, J. Wasserman, A. Born, C. Horn, J. Born, S. M. LaValle. "A Hardware and Software Testbed for Underactuated Self-Assembling Robots," in the *IEEE International Symposium on Multi-Robot and Multi-Agent Systems (MRS),* 2019.
8. **A. Nilles**, Y. Ren, I. Becerra, S. M. LaValle. "A Visibility-Based Approach to Computing Nondeterministic Bouncing Strategies," in the *13th Annual Workshop on the Algorithmic Foundations of Robotics (WAFR)*, 2018.
9. **A. Nilles**, C. Gladish, M. Beckman, and A. LaViers. "Improv: Live Coding for Robot Motion Design," in *Proceedings of the 5th International Conference on Movement Computing (MOCO)*, ACM. 2018.

10. **A. Nilles**, I. Becerra, and S. M. LaValle. "Periodic Trajectories of Mobile Robots," in *IEEE Conference on Intelligent Robots and Systems (IROS)*, 2017.

Workshop and Poster Presentations

- A. Q. Nilles, S. M. LaValle. "Robust Combinatorial Planning over Simple Boundary Interactions," in *Workshop on Robust Task & Motion Planning* at RSS 2019.
- A. Q. Nilles, D. A. Shell, J. M. O'Kane. "Robot Design: Formalisms, Representations, and the Role of the Designer," in *Workshop on the Autonomous Design of Robots* at ICRA 2018.
- A. Q. Nilles, I. Becerra, and S. M. LaValle. "Controllable Billiards: Characterizing the Paths of Simple Mobile Robots," poster in *Dynamics Days*, 2018.
- A. Q. Nilles, "Partially Coherent Transport: Computational Analysis and Overcoming Anderson Localization," 2014 CSM Physics poster session.
- A. Q. Nilles, "Teaching the Smart Grid: Why Data Management is Essential to the Future of Electricity," WISE Journal of Engineering and Public Policy.

Invited Talks

- "Is Less More? Characterizing resource trade-offs for simple mobile robots with embodied intelligence." Autonomy Talks, Institute for Dynamic Systems and Control, ETH Zürich. 8 February 2021, recording available on ETH Zürich Frazzoli YouTube Channel.
- "Is Less More? Characterizing Resource Trade-offs When Designing Robot-Boundary Interactions." Cornell Robotics Seminar, 12 May 2020, talk given via Zoom.
- "Towards Self-Assembly and Collective Manipulation with Extremely Underactuated Robots," NxR Group Meeting, Northwestern University. 1 March 2019.
- "Interesting Trajectories of Mobile Robots in Polygons," 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," UIUC Robotics Seminar, September 9 2016.

AWARDS AND HONORS

- Cornell Postdoc Leadership Program 2021-2022
- Mentor Stipend, Illinois Scholars Undergraduate Research Program 2019
- Leung Student Venture Fund Award, UIUC ECE Department 2019
- IEEE MRS (Multi-Robot Systems) Travel Grant 2019
- Workshop on Algorithmic Foundations of Robotics (WAFR) Robot Guru Travel Grant 2018
- 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

TEACHING EXPERIENCE

Teaching Assistant, ECE 470: Introduction to Robotics **Fall 2019**

- One of five TAs for an upper level 90-student class with lecture and lab components, covering topics such as state estimation and filtering, forward and inverse kinematics, motion planning, control, and introductory computer vision.
- Individually supervised a twice-weekly 15-student lab section, using Universal Robots UR3 robot arms and computer vision.

- Gave two 75-minute guest lectures on inverse kinematics for the full ninety-student class.
- Developed homework and test problems using the online learning platform PrairieLearn.

Mentees

- Emily Hall and Max Altman (2019-2020)
  - 4th year undergraduates: supervised on a funded undergraduate research project (a robotic pen), assisted with project transition during onset of pandemic
- Jordan Parker (2018)
  - 1st year undergraduate: worked on Improv, connected her with a paid research position in the RAD Lab
- Chase Gladish (2018)
  - 4th year undergraduate: I supervised her senior thesis on Improv, a live-coding platform for robot motion
  - co-author on 2018 MOCO paper
- Samara (Yingying) Ren (2017-2020)
  - undergraduate: co-author on one WAFR paper and IJRR paper, until she started a graduate degree at EPFL
- Austin Born, John Born, Chris Horn, Justin Wasserman (2017-2019)
  - supervised this team of undergraduates, including recieving a $1000 undergraduate research award, and publishing a 2018 MRS paper
  - J. Wasserman wrote senior thesis on "Controlling, Modeling, and Scaling Underactuated, Non-deterministic Robot Structures"
- Michael Zeng (2016)
  - 3rd year undergraduate: collaborated on dynamical properties of bouncing robots
- Oluwami Dosunmu-Ogunbi (2015-2016)
  - 4th year undergraduate: worked on CAD, microcontrollers, IMU data collection and analysis

Colorado School of Mines Math Learning Center

Description: Tutored 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. This was innovative distance learning research through the Department of Labor.
Dates: Feb 2012 - May 2014

Professional Service

- Head of student committee organizing an internal Robotics@UIUC seminar (Fall 2016).
  - Recruited student speakers, advertised talks, maintained wiki.
- President of Computer Science Graduate Students Organization (2017 - 2018).
  - Organized social events, communicated with department administration about graduate student needs, assisted in organizing annual prospective PhD student visit weekend.
- Reviewer for IROS '17, '18, '19, '20; ICRA '18, '19, '20; EAAI '17; CGTA '19
- Program Committee Member for MRS '19
- Co-organizer for 2017 Robotic Science and Systems (RSS) full day workshop, "Minimality and Trade-offs in Automated Robot Design." July 16 2017.

  - Recruited and communicated with speakers, helped develop materials (The Robot Design Game, http://robot-design.org/), facilitated workshop and discussions.
- Co-organizer for ICRA full day workshop, "Compositional Robotics: Mathematics and Tools," held virtually in 2021 and hybrid in 2022.
- Co-organizer for ICRA full day workshop, "Robotics and Art: Automating Expressions," hybrid workshop, 2022.

OUTREACH AND DIVERSITY SERVICE

- 2019-2020: Mentor for Illinois Scholars Undergraduate Research (ISUR) Program. Supervised two URM undergraduate students in robotics research.
- 2019: WAFR Robot Guru Mentor - six month remote mentorship of undergraduates interested in robotics research
- 2014: Founding member of Equality Through Awareness (ETA) at CSM, a group promoting diversity in STEM through discussion, mentoring, and invited speakers.
  - I facilitated weekly group discussions on articles relevant to underrepresented minorities
  - In 2018, ETA was awarded the Martin Luther King Jr. Recognition Award from CSM
- 2012-2015: Society of Physics Students - participated in outreach events such as interactive physics demonstrations at local elementary and middle schools.

OTHER EMPLOYMENT

Petronics internship: Development of small, agile mobile robot

Description: Worked closely with engineers to develop hardware and software for their mobile platform. Configured a ROS server and added a wifi module to the robot to stream data through ROS. Analyzed the resulting data using Python, to compare streaming pose estimates from the robot with a ground truth from a motion capture system (also ROS-integrated). Analyzed how the robot slipped on different surfaces to help improve low-level controllers.

Dates: May 2016 - August 2016

Complexity Sciences Center, UC Davis

Description: NSF REU with Dr. Jim Crutchfield. 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

Institute of Electrical and Electronics Engineers (IEEE)

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

Dates: June - Aug 2013

REFERENCES

- Professor Steven M. Lavalle
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