

# NATHAN T. HATCH

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## EDUCATION

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- University of Washington, Seattle** January 2020 - September 2021  
M.S. in Computer Science & Engineering; Advisor: Dr. Byron Boots
- Georgia Institute of Technology** August 2017 - December 2019  
Ph.D. student in Machine Learning; Advisor: Dr. Byron Boots
- University of Chicago** September 2010 - June 2014  
B.S. in Mathematics with honors  
B.S. in Computer Science with honors

## ROBOTIC SYSTEMS ENGINEERING EXPERIENCE

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**RACER Project, U. of Washington** Seattle, WA  
**Software Team Lead** September 2021 - present

**Develop perception, planning, and control software for ~10 m/s autonomous navigation of a Polaris RZR in off-road terrain including dirt trails, steep hills, tall grass, bushes, trees, water, and rocks**

- Brainstorm and prioritize big projects that might improve autonomous performance (e.g. variable  $dt$ )
- Design and implement features for local planning and control (e.g. attitude costs)
- Design and implement tools for efficient development and field tests (e.g. testing on rosbag replay)
- Curate regression test cases and tune parameters to pass the tests
- Prepare software for weekly field tests (code review, simulation validation, writing field test plan)
- Attend field tests, direct experiments, drive chase vehicle, and assist with recovery after accidents
- Analyze field test results to identify issues and propose solutions (e.g. open-loop execution at waypoints)
- Manage 10-person team (maintain task tracking system, weekly group meeting, and several 1-1s)
- Recruit and interview team members and maintain onboarding materials
- Explain technical progress to stakeholders, including UW PIs and DARPA program manager
- Handle software-related logistics (e.g. data offload, security, shipping computing equipment)

**SARA Project, U. of Washington** Seattle, WA  
**System Engineer** June 2019 - September 2021

- Conducted weekly field experiments with a Clearpath Warthog robot (a.k.a. Argo J5 XTR) outfitted with cameras and an Ouster OS2 LIDAR sensor
- Tested and improved our custom perception, planning, and control stack
- Handled physical and electrical hardware integration for new sensors
- Coordinated tasks for a team of four PIs and half a dozen graduate and undergraduate students
- Conducted biweekly progress update meetings with the Army Research Lab
- Repaired a leaky grease seal with remote support from the manufacturer
- Adapted model-predictive path-integral control to a goal-seeking navigation and mapping stack
- Sped up the LIDAR processing pipeline to 10Hz to support 3m/s vehicle velocities
- Soldered header pins to the motor control circuit board to collect serial debug output

**Husky Robotics Club, U. of Washington** Seattle, WA  
**Software Subsystem Lead** January 2020 - September 2021

- Wrote software for teleoperation and autonomous control of a student-designed and -built Mars rover
- Delegated tasks to prepare for the University Rover Challenge (URC)

- Recruited software team members by writing an application form and reviewing responses
- Implemented a planar navigation simulator with A\* search, and inverse kinematics for the rover arm
- Prepared the software portions of official competition essay and video submissions
- Coordinated with hardware and electrical subsystem leads to mount sensors and motor boards
- Teleoperated the rover during the 2021 virtual URC, in which we placed 3rd globally!

## PUBLICATIONS

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**N. Hatch** and B. Boots. “The Value of Planning for Infinite-Horizon Model Predictive Control.” *Proceedings of the 2021 International Conference on Robotics and Automation (ICRA 2021)*. <https://arxiv.org/abs/2104.02863>.

A. Shaban, C. Cheng, **N. Hatch**, and B. Boots. “Truncated Back-Propagation for Bilevel Optimization.” *Proceedings of the 22nd International Conference on Artificial Intelligence and Statistics (AISTATS 2019)*. <http://proceedings.mlr.press/v89/shaban19a.html>.

**N. Hatch**. “Group Theory: An Introduction and an Application.” *University of Chicago VIGRE REU*; 2011. <http://www.math.uchicago.edu/~may/VIGRE/VIGRE2011/REUPapers/Hatch.pdf>.

## UNPUBLISHED RESEARCH PROJECTS

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**Curriculum-based learning for bipedal locomotion over rough terrain** May 2018 - May 2019

- Extensively studied prior work in locomotion and summarized it in a two-hour lab presentation
- Invented an algorithm to learn a real-time, dynamic bipedal locomotion controller
- Tested the algorithm on challenging “stepping stone” environments using the DART simulator

## PERSONAL PROJECTS

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<a href="https://github.com/nhatch/slam">https://github.com/nhatch/slam</a>	Factor graph SLAM implemented from scratch
<a href="https://github.com/nhatch/rrt">https://github.com/nhatch/rrt</a>	RRT motion planning implemented from scratch
<a href="https://github.com/nhatch/ilqr">https://github.com/nhatch/ilqr</a>	Iterative LQR control implemented from scratch
<a href="https://github.com/nhatch/mcts">https://github.com/nhatch/mcts</a>	A (pretty good) AI for Mancala using Monte Carlo tree search
<a href="https://github.com/nhatch/mnist">https://github.com/nhatch/mnist</a>	Multilayer perceptron for MNIST digit recognition from scratch
<a href="https://github.com/nhatch/casia">https://github.com/nhatch/casia</a>	Convolutional network for CASIA Chinese characters using Keras

## OTHER WORK EXPERIENCE

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**eSpark Learning** Chicago, IL  
**Full-stack software engineer** June 2014 - July 2017

- Led the annual iOS app release, removing 300ms tap delay and rewriting the video uploader
- Increased sales pipeline by 25% by integrating our product with Airwatch
- Improved academic fidelity metric from 80% to 87% by refining our app deployment system
- Implemented Apple’s “Device Assignment” protocol, making our MDM first-to-market (solo project)
- Conducted ~20 interviews and code challenge reviews for recruiting

**Dept. Computer Science, University of Chicago** Chicago, IL  
**chiTCP developer** October 2013 - June 2014

- Implemented a TCP-over-TCP daemon for use in Borja Sotomayor’s networks class

**Mission Street Manufacturing** Santa Barbara, CA  
**Software intern** June - August 2013

- Developed prototype front- and back-end software for consumer-friendly 3D printing

## CLASS PROJECTS

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- A. Fishman, N. Hatch, and Y. Yang. *Navigating Holiday Traffic*. CSE 599 Reinforcement Learning; Autumn 2020.  
Paper: [https://nhatch.github.io/files/Navigating\\_Holiday\\_Traffic.pdf](https://nhatch.github.io/files/Navigating_Holiday_Traffic.pdf)  
Slides: <https://docs.google.com/presentation/d/14OqVKhnbL5BtwnwXD-2FRr80QebtkZjkICApYpljAoGg>
- N. Hatch, G. Parpart, D. Starikov. *Deep Robot Localization*. CSE 571 AI-Based Mobile Robotics; Spring 2020.  
Paper: <https://nhatch.github.io/files/Deep-Robot-Localization.pdf>  
Slides: <https://docs.google.com/presentation/d/1KFFPJaoL5LctJbqo79rDn1qVgsLjKHGr5tkprjcoeVQ>
- A. Baughan, N. Hatch, V. Raganeni, and B. Yang. *Search-Based Testing for Robotic Motion Planning Algorithms*. CSE 503 Software Engineering; Winter 2020.  
Paper: [https://nhatch.github.io/files/Search\\_Based\\_Testing.pdf](https://nhatch.github.io/files/Search_Based_Testing.pdf)  
Slides: [https://docs.google.com/presentation/d/1ER0XtU6asJ3MKk-b1D7mIUPU-lZa2kUanL\\_SibILsW0](https://docs.google.com/presentation/d/1ER0XtU6asJ3MKk-b1D7mIUPU-lZa2kUanL_SibILsW0)
- S. Foley, N. Hatch, and A. Beedu. *A Global Optimal Solution to Non-Minimal Relative Pose Estimation*. ECE 8823 Convex Optimization; Spring 2019.  
PDF: <https://nhatch.github.io/files/FoleyHatchBeeduNotes.pdf>
- N. Hatch and E. Wijmans. *Probabilistic Graphical Modeling of Data-Dependent Annotator Accuracy for Active Learning*. CS 8803 Probabilistic Graphical Models; Spring 2018.  
Paper: [https://nhatch.github.io/files/Hatch\\_Wijmans\\_final\\_report.pdf](https://nhatch.github.io/files/Hatch_Wijmans_final_report.pdf)  
Slides: [https://nhatch.github.io/files/Hatch\\_Wijmans\\_presentation\\_slides\\_v2.pdf](https://nhatch.github.io/files/Hatch_Wijmans_presentation_slides_v2.pdf)
- N. Hatch, A. Sundaresan, M. Dutreix, R. Kuppan, and P. Pattanashetty. *Google Landmark Recognition and Retrieval Challenges*. ECE 6254 Statistical Machine Learning; Spring 2018.  
Paper: [https://nhatch.github.io/files/landmarks\\_report.pdf](https://nhatch.github.io/files/landmarks_report.pdf)  
Poster: [https://nhatch.github.io/files/landmarks\\_poster.pdf](https://nhatch.github.io/files/landmarks_poster.pdf)
- N. Hatch. *Unsupervised Curriculum Learning for Image Clustering*. CS 7643 Deep Learning; Fall 2017.  
Poster: <https://nhatch.github.io/files/image-clustering.pdf>
- Other graduate-level classes (exam-based): Computer Vision, Linear Systems, Theoretical Statistics, Machine Learning Theory, Mathematical Foundations of Machine Learning

## AWARDS AND HONORS

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Georgia Institute of Technology, Presidential Fellowship	2017 - 2019
University of Chicago, Dean's List	2010 - 2014
University of Chicago, University Scholarship	2010 - 2014
University of Chicago, National Merit Scholarship	2010 - 2014
University of Chicago, Student Marshal	2013
Phi Beta Kappa	2013
University of Chicago, Fulton Prize for Orchestral Excellence	2012

## TEACHING EXPERIENCE

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<b>Dept. Computer Science and Engineering, U. of Washington</b>	Seattle, WA
<b>Head Teaching Assistant, undergraduate machine learning</b>	Winter 2021
· Held weekly recitations, wrote and graded homeworks, and managed 10 TAs for a class of 150 students	
· Dealt with academic misconduct investigations for a dozen students	
<b>College of Computing, Georgia Tech</b>	Atlanta, GA
<b>Teaching Assistant, undergraduate machine learning</b>	Fall 2019

- Graded homework, held weekly office hours, answered Piazza questions, and wrote the final project

**Insight Tutoring**  
**Volunteer tutor**

Chicago, IL  
 January 2015 - May 2017

- Reviewed homework and class material for three economically disadvantaged sixth-grade students
- Periodically revisited old material for spaced retrieval practice

**Dept. Computer Science, U. of Chicago**  
**Homework grader, graduate discrete mathematics**

Chicago, IL  
 October - December 2012

- Graded twice-weekly problem sets for Laszlo Babai's graduate-level class

**Dept. Mathematics, U. of Chicago**  
**SESAME Teaching Assistant**

Chicago, IL  
 July 2012

- Assisted teaching a class for middle school math teachers on "problem-based learning"

**Dept. Mathematics, U. of Chicago**  
**Young Scholars Program Counselor**

Chicago, IL  
 June - July 2012

- Tutored four 9th/10th-grade math students in an advanced summer math program
- Assisted teaching a class in basic computer programming
- Gave weekly reports on student progress, including helping to write a diagnostic exam

## PROFESSIONAL SERVICE

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**Dept. Computer Science and Engineering, U. of Washington**  
**Organizer for New Grad Orientation**

Seattle, WA  
 Fall 2020

- With two co-organizers, planned two days of orientation activities for new CSE PhD students
- Updated last year's orientation materials to a virtual format due to the COVID-19 pandemic
- Coordinated faculty course pitches, logistical information, and a scavenger hunt

**Georgia Tech Machine Learning (ML@GT)**  
**Co-creator of Machine Learning Student Seminar**

Atlanta, GA  
 Fall 2019

- With one co-organizer, started a new seminar with eight presentations to a 25-student audience
- Invited presenters, including five faculty lightning talks
- Organized catering, room reservations, and publicity

## TECHNICAL STRENGTHS

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<b>Programming Languages</b>	Python, C++, Javascript/HTML/CSS, Ruby
<b>Robotics and Simulation Software</b>	ROS, Gazebo, DART
<b>Deep Learning Frameworks</b>	PyTorch, TorchScript, TensorFlow
<b>Tools</b>	Git, Vim, LaTeX
<b>Foreign Languages</b>	Spanish

## HOBBIES

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<b>Places visited</b>	Spain, United Kingdom, Japan, Argentina, Brazil, Taiwan, Hong Kong, Singapore, China, Peru, South Africa, Namibia, Botswana, Zimbabwe, Turkey
<b>Other interests</b>	viola performance, rock climbing, go (the board game)