

# NATHANIEL J. HANSON

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## EDUCATION

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### Northeastern University

Ph.D. Computer Engineering

*Research Advisor:* Dr. Taşkın Padır

*Research Interests:* Multi-sensor fusion, mapping, integration of multi and hyperspectral imaging into machine vision, terrain aware trajectory planning

*August 2020 - Present*

Expected 2023

### Boston University

M.S. Computer Science

*Focus:* Big data analysis and machine learning methods with applications focused on emergent humanitarian crises to assist with COVID-19 relief work undertaken at MIT.

*June 2019 - August 2020*

### University of Notre Dame

B.S. Computer Engineering

*Capstone Project:* Software and hardware architecture for control of Unmanned Aerial Systems via brokered Message Queuing Telemetry Transport (MQTT) protocol over LTE cellular network. Project enabled beyond visual line of sight control for fleet of unmanned drones via fault-tolerant network

*August 2015 - May 2019*

### Shandong University

Certificate Mandarin Chinese

Selected as foreign language training candidate for cultural and language immersion among competitive nationwide Air Force cadet corps.

*May 2017 - August 2017*

## WORK EXPERIENCE

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### Northeastern University

*Graduate Research Assistant*

August 2020 - Present

- Member of the Robotics and Intelligent Vehicles (RIVeR) laboratory
- *Current Research*
- Development of novel gripper designs embedding visible to near infrared (VNIR) spectroscopic probes to acquire in-hand material readings
- Extending standard RGB machine vision into higher dimensional space via inclusion of visible and short wave infrared imaging systems
- Fusing of LIDAR with hyperspectral datacubes to create spatial-material representations of the world
- *Past Research*
- Applying robotic control of 6 DoF arm to create precise 3D shapes with high volume cold spray additive manufacturing and measure depositions with laser profilometer
- Developing procedures and computational models to decompose CAD drawings into finite elements with safe tool routes for continuously applied cold spray

### MIT Lincoln Laboratory

*Software Developer and Researcher*

June 2019 - Present

- Work with team of research engineers to develop technologies pertinent to US government humanitarian and disaster remediation goals
- Developed end-to-end tropical storm simulation software used by emergency managers to train and execute realistic preparedness exercises

- Built application to leverage cell phone Bluetooth capabilities to register with beacons placed around campus for fast quantification of signal propagation characteristics and anonymous identification of group gatherings during COVID 19 pandemic
- Innovated faster solutions to COVID 19 contact tracing at the height of the pandemic
- Assisted in setup and execution of airborne LIDAR acquisition flights to develop automated solutions to detect natural disaster damage

### **DeLive Aerial Systems**

January 2018 - March 2020

*Chief Technical Officer & Technical Advisor*

- Co-founded a drone technologies company to provide aerial delivery of emergency medicine in conjunction with the city of South Bend
- Custom designed drone to fit mission requirements including communications module and release mechanisms
- Created web application to enable emergency management call centers to dispatch UAV to incident scene with GIS enabled platform

### **Software Engineering and Requirements Center**

August 2018 - May 2019

*Undergraduate Research Assistant*

- Assisted in robotics lab developing software control systems for coordinated search and rescue UAV platform (Dronology)
- Transitioned code base to run as decentralized nodes over LTE communication protocol developed for undergraduate capstone

### **IronNet CyberSecurity**

August 2018 - May 2018

*Cyber Operations Center/Data Science Intern*

- Built out a comprehensive network devices classifier to ingest data from PCAP data and generate asset classification labels (e.g. server, proxy, endpoint) with confidence metrics for integration into larger threat analysis framework
- Contributed to new data visualization system utilizing Golang and Kubernetes to provide real-time analysis of product efficacy

## **TEACHING EXPERIENCE**

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### **Massachusetts Institute of Technology**

January 2020 - Present

*Leader Instructor - BeaverWorks Summer Institute*

- Teach rising high school seniors from around the world concepts from machine learning, computer vision, and UAV control at an undergraduate level
- Transitioned in-person course curriculum to fully online format with simulation environments and individualized projects in response to the COVID-19 pandemic.

*Robotics Engineer NEET Course 16.84*

- Mentor senior capstone design course in design, construction, and evaluation of an autonomous sailboat.
- Provide practical engineering leadership lessons in how to appropriately design project scope and properly conduct literature reviews on the current State of the Art (SOTA).

### **University of Notre Dame**

August 2018 - May 2019

*Undergraduate Teaching Assistant*

- *CSE 30246* Assisted with the teaching and grading of an undergraduate level database and web development course

- *CSE 40773* - Helped debug drone control code and advised students on planning and executing final projects

## AWARDS & HONORS

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National Hurricane Conference Outstanding Achievement Award - for developing a state of the art tool to enable emergency managers to develop simulated tropical cyclone scenarios to test a range of response and recovery situations

Department of Energy E-Robot Finalist - developed holistic robotic solution to support home crawlspace retrofit. Included in top 10/67 submissions

MIT Team Award (2021) - for rapid curriculum redevelopment efforts in support of the BeaverWorks Summer Institute

MIT Team Award (2020) - for outstanding service to MIT LL COVID-19 relief efforts

ACC Inventure Prize Finalist - Startup DeLive recognized as one of the top three startups among schools in the Atlantic Coast Conference through public competition

McCloskey Prize Finalist - Selected from +130 startup companies in the South Bend/Notre Dame community as a top 7 team for our combination of technical development, business plan, and overall ideation

Project Global Officer Awardee - Selected to receive intensive foreign language training at internationally regarded universities in the United States and abroad

University of Notre Dame Engineering Scholars Program - 1/19 students selected for advanced interdisciplinary studies in College of Engineering's class of 2019

## RELEVANT COURSEWORK

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### Core Courses

Mobile Robotics  
Field Robotics  
Hyperspectral Imaging  
Robotic Science & Systems  
Robotics, Sensing, & Navigation  
Software Development for Unmanned Aerial Systems

### Other Courses

Machine Learning  
Remote Sensing  
Reinforcement Learning  
Analysis of Algorithms  
Artificial Intelligence  
Software Engineering

## PUBLICATIONS & PRESENTATIONS

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### Poster Presentations

**Hanson, Nathaniel;** Padir, Taskin. Pregrasp Object Material Classification by a Novel Gripper Designs with Integrated Spectroscopy - A Precursor to Materially Aware Robotics. Poster presented at: Northeastern University PhD Expo; March 2022; Boston, MA

**Hanson, Nathaniel;** Julien, Scott; Ozan, Ozdemir; Muftu, Sinan; Padir, Taskin. In Situ Characterization of Fundamental Building Blocks for Cold Spray Additive Manufacturing. Poster presented at: Cold Spray Action Team; June 2021; Leominster, MA

### Publications

**Hanson, Nathaniel;** Hochsztein, Hillel; Vaidya, Akshay; Willick, Joel; Dorsey, Kristen; Padir, Taşkın. In-Hand Object Recognition with Innervated Fiber Optic Spectroscopy for Soft Grippers. IEEE 5th International Conference on Soft Robotics (RoboSoft).

**Hanson, Nathaniel;** Keleştemur, Tarık; Erdoğan, Deniz; Padır, Taşkın. Pregrasp Object Material Classification by a Novel Gripper Design with Integrated Spectroscopy. Under Peer Review. *Preprint available on request.*

## **TECHNICAL SKILLS**

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<b>Computer Languages</b>	C/C++, MATLAB, Python, Java, Scala, JavaScript
<b>Software &amp; Tools</b>	ROS, ArcGIS, Gazebo, Jupyter Notebook, LaTeX
<b>Skills</b>	System Design, Software Architecture, Sensor Integration, Computer Vision

## **EXTRACURRICULAR ACTIVITIES**

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Volunteer, St. Mary of the Assumption Catholic Parish, Brookline, Massachusetts

Mentor, ESTEEM Master's degree program, University of Notre Dame

Musician, Band of the Fighting Irish, Marching Band