# Henry J. Nelson

henrynel17@gmail.com ◇ henryjnelson.com

## CURRENT RESEARCH INTERESTS

**Developing representations for learning on 3D data**
The strength of current deep learning methods has not translated well to 3D data due to its fundamentally different structure. Recently, some methods dealing with 3D data as point clouds or as a function space have shown promising results suggesting that there are probably better ways than extending the grid approach used in the image domain. I am currently exploring novel representations of data to find where such novel approaches should be applied and what new abilities they offer.

**Developing novel reconstruction and segmentation techniques for 3D data**
Current 3D reconstruction and segmentation techniques work well in niche applications or with extremely densely sampled data. In more general instances, dense data is very difficult to obtain and as a result current algorithms are inadequate for a general case. I hope to explore new ways of accurately reconstructing a scene with segmentation in mind and leveraging both processes to benefit the other.

## EDUCATION

**University of Minnesota** Minneapolis, MN — *August 2017 - Present*
PhD in Computer Science

**Grinnell College** Grinnell, IA — *August 2013 - May 2017*
BA in Physics

## RESEARCH EXPERIENCE

**Center for Distributed Robotics** — University of Minnesota
*Graduate Research Assistant* — *May-August 2018, January 2020-present*

Various projects including non-ridged 3D reconstructions from endoscopy videos and species identification of weeds in aerial images of agricultural fields. (PI: Nikolaos Papanikolopoulos, PhD)

**Sentera**
*Computer Vision Engineer* — *May 2019-present*

Algorithm development for automatic analysis of drone imagery for applications in precision agriculture. Experience using both traditional computer vision techniques and deep learning approaches.

**Electronic Detector Group** — Brookhaven National Laboratory
*Student Collaborator* — *May 2016-August 2016*

Characterization and measurement of quantum yield for novel scintillating liquids to evaluate their effectiveness as a detection medium for large scale detectors. (PIs: David Jaffe, PhD. Lindsey Bignell, PhD)

**Scientific Computing Lab** — University of Minnesota
*Research Assistant* — *May-August 2014 and 2015*

Development and testing of novel machine learning algorithms for pattern recognition in images using wavelets, estimation of large matrix properties, and graph-based dimension reduction methods in an academic research lab. (PI: Yousef Saad, PhD)

**Rehabilitation Engineering Research Lab** Minneapolis VA Hospital
*Research Assistant* *July-August 2014*

Software development for interfacing with medical equipment as well as prototype medical device development, eye-tracking systems development, virtual reality graphics programming, and Android app development. (PI: John E. Ferguson, PhD)

## TEACHING EXPERIENCE

**Department of Computer Science** University of Minnesota
*Teaching Assistant* *August 2017-December 2019*

Preparing and giving weekly lectures, managing other TAs, grading, and office hours. For both undergraduate and graduate level courses. Courses: Automata and Formal Languages; Computer Vision; Artificial Intelligence; and Algorithms and Data Structures.

**Department of Computer Science, Department of Physics** Grinnell College
*Teaching Assistant* *August 2016-May 2017*

Instruction of introductory, intermediate, and upper level students in course content, lab preparation, experiment execution, and data analysis in classroom, tutoring, and laboratory settings Courses: Automata, Formal Languages, and Computational Complexity; Mechanics; and Introduction to Electrostatics.

## PUBLICATIONS

**Learning Continuous Object Representations from Point Cloud Data** IROS 2020
*Henry J. Nelson, and Nikolaos Papanikolopoulos* *Accepted*

**A Methodology for the Detection of Nitrogen Deficiency in Corn Fields Using High Resolution RGB Imagery** IEEE Transactions on Automation Science and Engineering
*Dimitris Zermas, Henry J. Nelson, Panagiotis Stanitsas, Vassilios Morellas, David J. Mulla, and Nikolaos Papanikolopoulos* *Accepted*

**Weed Detection and Classification in High Altitude Aerial Images for Robot-Based Precision Agriculture** MED 2019
*Karthik Buddha, Henry Nelson, Dimitris Zermas, and Nikolaos Papanikolopoulos* *Published*

DOI: 10.1109/MED.2019.8798582

## TALKS AND PRESENTATIONS

**Learning Continuous Object Representations from Point Cloud Data**
*IROS 2020* *October 2020*

Henry Nelson, Nikolaos Papanikolopoulos

**Herbicide-Resistant Weed Identification and Classification**
*IUCRC ROSEHUB, Philadelphia* *November 2018*

Henry Nelson, Karthik Buddha

**Weed Identification in Aerial Images of Corn Fields**
*IUCRC ROSEHUB, Minneapolis* *April 2018*

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## AWARDS AND LEADERSHIP

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| **H. George Apostle Prize in Physics** | Grinnell College Department of Physics | *May 2017* |
| **Phi-Beta-Kappa** | Grinnell College | *May 2017* |
| **President of Drone Club** | Grinnell College | *2016-2017* |

## REFEREE SERVICE

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|---|---|
| IEEE International Conference on Robotics and Automation | *2019* |
| IEEE Transactions on Intelligent Transportation Systems | *2019-2020* |
| IEEE/RSJ International Conference on Intelligent Robots and Systems | *2019* |