Henry J. Nelson

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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 unique 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 point cloud segmentation, 3D model learning, non-ridged 3D reconstructions from agricultural fields and endoscopic videos, and species identification of weeds in aerial crop imagery. (PI: Nikolaos Papanikolopoulos, PhD)

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)

INDUSTRY EXPERIENCE

Sentera
Computer Vision Engineer *May 2019-present*

Deep learning infrastructure and model development. Algorithm development for automatic analysis and interpretation of drone imagery for applications in precision agriculture. Using both traditional computer vision (3D geometry and image processing) and machine learning approaches.

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

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

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*

LANGUAGE AND FRAMEWORK PROFICIENCY

Fluent with Python, C/C++, and MATLAB. Extensive experience with Git, OpenCV, Point Cloud Library (PCL), Tensorflow, and PyTorch.