

# Richard E. L. Higgins

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**About Me** I am a Computer Science and Engineering Ph.D. student (previous M.S. student) at the University of Michigan, advised by David Fouhey. I'm currently working on learning from motion and interaction in video. I've also been working on using neural networks to predict the solar magnetic field.

**Education** **University of Michigan** Ann Arbor, MI  
Ph.D. in Computer Science and Engineering August 2019 – Present  
Advisor: David Fouhey, Ph.D.

**University of Michigan** Ann Arbor, MI  
M.S. in Computer Science and Engineering August 2017 – May 2019  
Mentor: Jia Deng, Ph.D.

**University of Maryland** College Park, MD  
B.S. in Computer Science August 2010 – December 2014  
B.S. in Neurobiology and Physiology

**Research** **Fouhey AI Lab – Department of Computer Science and Engineering**  
Graduate Research, University of Michigan Summer 2019 – Present  
Mentor: David Fouhey  
- I'm working on using the object motion that occurs when people pick things up to perform unsupervised classification and segmentation of objects in videos.  
- I trained a UNet to predict magnetic field parameters on the sun using polarized light (IQUV's) recorded from the Solar Dynamics Observatory's HMI sensor.  
- I designed custom neural networks that incorporate the variable rotations of the sun in order to more accurately train models of solar active region evolution for forecasting.

**Vision & Learning Lab – Department of Computer Science and Engineering**  
Graduate Research, University of Michigan May 2018 – May 2019  
Mentors: Alejandro Newell and Jia Deng  
- I designed new neural networks to apply associative embeddings to scene graphs.

**Athey Lab – Department of Computational Medicine and Bioinformatics**  
Postgraduate Research, University of Michigan August 2016 – October 2016  
- I constructed TADs and analyzed RNA-seq data to identify differential gene expression.

**Quinlan Lab – Neuroscience and Cognitive Sciences Program**  
Undergraduate Research, University of Maryland January 2014 – June 2014  
- I detected seizures in mouse EEG recordings using max-margin techniques in MATLAB.

## Evolution of Visual Communication Lab – Department of Biology

Undergraduate Research, University of Maryland September 2011 – April 2012

- I created false-color images of colorful fish to see how cone opsins effect conspicuity.

### Papers

**Richard E.L. Higgins\***, Dandan Shan\*, and David F. Fouhey

*COHESIV: Contrastive Object and Hand Embeddings for Segmentation In Video*

Accepted to NeurIPS 2021.

**Richard E.L. Higgins**, David F. Fouhey, Spiro K. Antiochos, Graham Barnes, Todd Hoeksema, KD Leka, Yang Liu, Peter W. Schuck, Tamas I. Gombosi

*SynthIA: A Synthetic Inversion Approximation for the Stokes Vector Fusing SDO and Hinode into a Virtual Observatory*

Under Revision to ApJ (June 30th, 2021).

**Richard E.L. Higgins**, David F. Fouhey, Dichang Zhang, Spiro K. Antiochos, Graham Barnes, Todd Hoeksema, KD Leka, Yang Liu, Peter W. Schuck, Tamas I. Gombosi

*Fast and Accurate Emulation of the SDO/HMI Stokes Inversion with Uncertainty Quantification*

The Astrophysical Journal, 2021 Apr; 911(2), 130

AGU, ML in Space Weather, Poster 2020

COSPAR2021, Workshop on ML for Space Sciences, Talk 2021

Gerald A. Higgins, Patrick Georgoff, Vahagn Nikolian Ari Allyn-F Feuer, Brian Pauls,

**Richard E. L. Higgins**, Brian D. Athey, and Hasan E. Alam

*Network Reconstruction Reveals that Valproic Acid Activates Neurogenic Transcriptional Programs in Adult Brain Following Traumatic Injury*

Pharmaceutical Research, 2017 Aug; 34(8): 1658-1672

Sachiko Murase, Crystal Lantz, Eunyoung Kim, Nitin Gupta, **Richard E. L. Higgins**,

Mark Stopfer, Dax A. Hoffman, and Elizabeth M. Quinlan

*Matrix Metalloproteinase-9 Regulates Neuronal Circuit Development and Excitability*

Journal of Molecular Neurobiology, 2016 Jul; 53(5): 3477–3493

### Mentees

Dichang Zhang, UM CSE Undergraduate student

Winter 2020 - Present

Yige Liu, UM CSE Undergraduate student

August 2019 - Spring 2020

*Next Position: Masters Student, Stanford CSE*

### Teaching

**Department of Computer Science and Engineering**

University of Michigan

Graduate Student Instructor

December 2018 - May 2019

EECS 442: Computer Vision

- I led discussions, created assignments with Numpy and Pytorch in Python, graded projects, and hosted office hours for +300 upper-level CS students.

|                               |  |                                    |
|-------------------------------|--|------------------------------------|
|                               | <b>Department of Biology</b>   | University of Maryland             |
|                               | Teaching Assistant   | January 2014 - June 2014           |
|                               | BSCI 440: Mammalian Physiology   |                                    |
|                               | - I instructed multi-hour discussions on cardiac function, renal system, nervous system, pharmacology, digestion, and more.  |                                    |
| <b>Outreach &amp; Service</b> | <b>AI Lab Blog</b> , Co-Editor, University of Michigan   | Summer 2020 - Summer 2021          |
|                               | - I solicit and edit blog posts for the AI Lab Blog in the Computer Science department.                                      |                                    |
|                               | <b>AI4ALL</b> , Instructor, University of Michigan,  | Summer 2019, Summer 2020 (virtual) |
|                               | - I taught high school students introductory programming and artificial intelligence material during a two-week summer camp. |                                    |
|                               | <b>Discover Engineering</b> , Volunteer, University of Michigan  | Summer 2019                        |
|                               | - I volunteered at a summer program teaching children about Computer Science.  |                                    |
|                               | <b>Hackathon Mentorship</b>  | 2014 - Ongoing                     |
|                               | - I mentor both at hackathons and digitally through Facebook's mentorship program.   |                                    |
| <b>Work</b>                   | <b>Voxel 51</b>  | Ann Arbor, MI                      |
|                               | Computer Vision Engineering Intern   | November 2018 - March 2019         |
|                               | - I integrated object detection into a video platform analyzing dashcam footage.   |                                    |
|                               | <b>Gigster</b>   | San Francisco, CA                  |
|                               | Software Engineering Consultant  | August 2016 - July 2018            |
|                               | - I built a style-transfer service that processed millions of images/day.  |                                    |
|                               | - I built a GAN that performs face attribute transformation for a social media company.                                      |                                    |
|                               | - I built a CNN backend to provide object recognition in a Fortune 500 company iOS app.                                      |                                    |
|                               | - I designed many CNN computer vision systems for Fortune 500 clients across industries.                                     |                                    |
|                               | <b>Unscan</b>  | New York, NY                       |
|                               | Founder  | August 2015 - May 2016             |
|                               | - We developed a scanned-document OCR data extraction system using custom LSTMs.   |                                    |
|                               | <b>Redspread</b>   | San Francisco, CA                  |
|                               | First Engineer   | March 2015 - August 2015           |
|                               | - I developed ML tools to automatically scale Kubernetes pods based on resource usage.                                       |                                    |
|                               | - Part of the founding team of a Y Combinator company acquired by CoreOS.  |                                    |
|                               | <b>Cooperative Housing University of Maryland</b>  | College Park, MD                   |
|                               | Housing Chair, Finance Manager   | August 2011 - June 2013            |
|                               | - I found and arranged housing for the co-operative, as well as handled house finances.                                      |                                    |
| <b>Awards</b>                 | Presidential Scholarship (Merit), University of Maryland   | 2010                               |

Citation in Life Sciences, University of Maryland  
Finalist, HackMIT

2012  
2013