

# Brian H. Hu

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## Education

### Johns Hopkins University, Baltimore, MD

Ph.D., Biomedical Engineering, October 2017

- Thesis: *Grouping mechanisms for object-based vision and attention*
- Advisor: Ernst Niebur, PhD

### University of Pittsburgh, Pittsburgh, PA

B.S., Bioengineering (Minor in Chemistry), *summa cum laude*, May 2011

GPA: 3.99/4.00

- Swanson School of Engineering Outstanding Senior Award
- Department of Bioengineering Outstanding Student of the Year Award

## Research Experience

### Kitware, Inc., Arlington, VA

Senior Research and Development Engineer, April 2020 - present

- Explainable AI (XAI), human machine teaming, image retrieval, anomaly detection
- Person/vehicle re-identification, small object detection

### Allen Institute for Brain Science, Seattle, WA

Scientist II, January 2020 - March 2020

Scientist I, December 2017 - December 2019

- Short-term synaptic plasticity and memory in neural networks
- Figure-ground representation in deep neural networks
- Convolutional neural networks with extra-classical receptive fields
- Structure and generalization properties of noise
- Generative adversarial networks for inferring cortical learning rules
- Data-driven, predictive models of neural activity

### Computational Neuroscience Laboratory, Johns Hopkins University, Baltimore, MD

Graduate Research Assistant, June 2012 - November 2017

- Biologically-plausible image segmentation and contour detection
- Head movements and visual attention in virtual reality
- Models of 3D visual saliency and eye movements
- Models of 3D surface representation

## Skills

**Programming:** Python, MATLAB, familiar with C/C++, JAVA, LabVIEW

**Other Tools:** PyTorch, Tensorflow, Jupyter, scikit-learn, pandas, Git, L<sup>A</sup>T<sub>E</sub>X, HTCondor, NEST, Neuron

**Operating Systems:** Linux, Windows, Mac OS

## Publications

\* denotes equal contribution

### Peer-Reviewed Journal Articles

1. Iyer, R. , **Hu, B.** , and Mihalas, S. Contextual integration in cortical and convolutional neural networks. *Frontiers in Computational Neuroscience*, 14:31, 2020. doi: 10.3389/fncom.2020.00031

2. **Hu, B.**, von der Heydt, R., and Niebur, E. Figure-ground organization in natural scenes: Performance of a recurrent neural model compared with neurons of area v2. *eNeuro*, 6(3), 2019. doi: 10.1523/ENEURO.0479-18.2019
3. **Hu, B.** and Niebur, E. A recurrent neural model for proto-object based contour integration and figure-ground segregation. *Journal of computational neuroscience*, 43(3):227–242, 2017. doi: 10.1007/s10827-017-0659-3
4. **Hu, B.**, Kane-Jackson, R., and Niebur, E. A proto-object based saliency model in three-dimensional space. *Vision Research*, 119:42–49, 2016. doi: 10.1016/j.visres.2015.12.004

### Conference Proceedings

5. **Hu\*, B.**, Iyer\*, R., and Mihalas, S. Convolutional neural networks with extra-classical receptive fields. In *Thirty-third Conference on Neural Information Processing Systems (NeurIPS)*, Neuro AI Workshop, Vancouver, Canada, 2019. URL <https://openreview.net/forum?id=rkxSEQtLUS>
6. **Hu, B.**, Shang, J., Iyer, R., Siegle, J., and Mihalas, S. Does the neuronal noise in cortex help generalization? In *Thirty-third Conference on Neural Information Processing Systems (NeurIPS)*, Neuro AI Workshop, Vancouver, Canada, 2019. URL <https://openreview.net/forum?id=S1gc4XF8Lr>
7. **Hu, B.**, Khan, S., Niebur, E., and Tripp, B. Figure-ground representation in deep neural networks. In *IEEE CISS-2019 53rd Annual Conference on Information Sciences and Systems*, pages 1–6, Baltimore, MD, 2019. IEEE Information Theory Society. doi: 10.1109/CISS.2019.8693039
8. **Hu, B.**, Johnson-Bey, I., Sharma, M., and Niebur, E. Head movements are correlated with other measures of visual attention at smaller spatial scales. In *IEEE CISS-2018 52nd Annual Conference on Information Sciences and Systems*, pages 1–6, Princeton, NJ, 2018. IEEE Information Theory Society. doi: 10.1109/CISS.2018.8362264
9. **Hu, B.**, Johnson-Bey, I., Sharma, M., and Niebur, E. Head movements during visual exploration of natural images in virtual reality. In *IEEE CISS-2017 51st Annual Conference on Information Sciences and Systems*, pages 1–6, Baltimore, MD, 2017. IEEE Information Theory Society. doi: 10.1109/CISS.2017.7926138
10. **Hu, B.**, von der Heydt, R., and Niebur, E. A neural model for perceptual organization of 3D surfaces. In *IEEE CISS-2015 49th Annual Conference on Information Sciences and Systems*, pages 1–6, Baltimore, MD, 2015. IEEE Information Theory Society. doi: 10.1109/CISS.2015.7086906

### Working Papers

11. Siegle, J. H., Jia, X., ..., **Hu, B.**, ..., Olsen, S. R., and Koch, C. A survey of spiking activity reveals a functional hierarchy of mouse corticothalamic visual areas. Under review at Nature. URL <https://www.biorxiv.org/content/10.1101/805010v1>
12. **Hu, B.**, Garrett, M., Groblewski, P. A., Ollerenshaw, D., Shang, J., Roll, K., Manavi, S., Koch, C., Olsen, S. R., and Mihalas, S. Adaptation supports short-term memory in a visual change detection task. Under review at PLOS Computational Biology. URL <https://www.biorxiv.org/content/10.1101/2020.03.06.977512v2>
13. Wagatsuma, N., **Hu, B.**, von der Heydt, R., and Niebur, E. Interactions between distinct types of feedback signals modulate activity of border ownership selective cells in intermediate-level vision. Under review at PLOS Computational Biology
14. Voina, D., Recanatesi, S., **Hu, B.**, Shea-Brown, E., and Mihalas, S. Single circuit in v1 capable of switching contexts during movement using vip population as a switch. Submitted to PLOS Computational Biology. URL <https://www.biorxiv.org/content/10.1101/2020.03.06.977512v2>

### Honors and Awards

Computational and Systems Neuroscience (Cosyne) Travel Award, 2017  
 OIST Computational Neuroscience Course (OCNC) Travel Award, 2014  
 Visual Neuroscience Training Program Fellowship, 2012–2013  
 Neural Engineering Training Initiative Fellowship, 2011–2012  
 University Honors College Full Tuition Scholarship, 2007–2011

## Professional Service and Activities

Reviewer for *Frontiers in Systems Neuroscience*, *IEEE Transactions on Image Processing*, *Journal of Cognitive Neuroscience*

Member, Organization for Computational Neuroscience, 2018–present

Member, Society for Neuroscience, 2013–present

Last updated: November 1, 2020