

# Brian H. Hu

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## Work Experience

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

Scientist I, December 2017-present

- Developing data-driven, hierarchical models of visual processing
- Integrating Bayesian computation into deep learning models

## 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: 3.99/4.0

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

## 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

## Research Experience

**Computational Neuroscience Laboratory**, Graduate Research Assistant Jun 2012–Nov 2017

Advisor: Dr. Ernst Niebur (Johns Hopkins University)

Developed models of object-based vision and attention related to 3D surface perception, visual saliency, contour detection, and figure-ground segmentation

**Connor Lab**, Rotation Student Jan 2012–Jun 2012

Advisor: Dr. Ed Connor (Johns Hopkins University)

Designed novel visual stimuli used in a behavioral task to test for inferotemporal cortex neurons that code for both object identity and object value

**Computer Integrated Interventional Systems Laboratory**, Rotation Student Aug 2011–Jan 2012

Advisor: Dr. Russell Taylor (Johns Hopkins University)

Developed a microcannula system to assess differences in freehand and robot-assisted in vivo retinal vein cannulation in a rabbit animal model

**Sensory Motor Integration Laboratory**, Undergraduate Research Assistant

Apr 2009–Apr 2011

Advisor: Dr. Aaron Batista (University of Pittsburgh)

Developed an algorithm to detect changes in monkey reach trajectories, which was used to automatically sort reaches and characterize reaction times to visual and vibrotactile stimuli

## Publications

### Peer-Reviewed Journal Articles

1. **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
2. **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
3. **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

4. **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
5. **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
6. **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
7. **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

8. **Hu, B.**, Shang, J., Iyer, R., Siegle, J., and Mihalas, S. Does the neuronal noise in cortex help generalization? *bioRxiv*, 2019. doi: 10.1101/676999
9. **Hu, B.** and Mihalas, S. Convolutional neural networks with extra-classical receptive fields. *arXiv preprint arXiv:1810.11594*, 2018
10. **Hu, B.**, Garrett, M., Valley, M. T., Groblewski, P. A., Ollerenshaw, D., Shang, J., Roll, K., Manavi, S., Javadi, P., Waters, J., Koch, C., Olsen, S. R., and Mihalas, S. Unconverging the mechanisms of short-term memory in a visual change detection task. In preparation
11. Wagatsuma, N., **Hu, B.**, von der Heydt, R., and Niebur, E. Interactions between spatial and object-based attention modulate spike synchrony in the visual cortex for figure-ground organization. In preparation

## Skills

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

**Other Tools:** Git, L<sup>A</sup>T<sub>E</sub>X, HTCondor, NEST, Neuron

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

## Professional Service and Activities

Project Mentor, High School/Undergraduate Students, 2014-2016

Teaching Assistant, Modeling and Design (Fall 2013) and Networks (Fall 2014)

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

Member, Society for Neuroscience, 2013–present

Last updated: September 9, 2019