

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), ethical AI, saliency algorithms
- Human-machine teaming, image and video retrieval, anomaly detection
- Small object detection, person/vehicle re-identification

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, \LaTeX , HTCondor, NEST, Neuron

Operating Systems: Linux, Windows, Mac OS

Publications

* denotes equal contribution

Peer-Reviewed Journal Articles

1. **Hu, B.** , Tunison, P. , Vasu, B. , Menon, N. , Collins, R. , and Hoogs, A. XAITK: The Explainable AI Toolkit. *Applied AI Letters*, page e40. doi: <https://doi.org/10.1002/ail2.40>
2. Vasu, B. , **Hu, B.** , Dong, B. , Collins, R. , and Hoogs, A. Explainable, Interactive Content-Based Image Retrieval. *Applied AI Letters*, page e41. doi: <https://doi.org/10.1002/ail2.41>
3. **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. *PLoS computational biology*, 17(9):e1009246, 2021
4. Wagatsuma, N. , **Hu, B.** , von der Heydt, R. , and Niebur, E. Analysis of spiking synchrony in visual cortex reveals distinct types of top-down modulation signals for spatial and object-based attention. *PLoS computational biology*, 17(3):e1008829, 2021
5. Siegle, J. H. , Jia, X. , ... , **Hu, B.** , ... , Olsen, S. R. , and Koch, C. Survey of spiking in the mouse visual system reveals functional hierarchy. *Nature*, pages 1–7, 2021
6. 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](https://doi.org/10.3389/fncom.2020.00031)
7. **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](https://doi.org/10.1523/ENEURO.0479-18.2019)
8. **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](https://doi.org/10.1007/s10827-017-0659-3)
9. **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](https://doi.org/10.1016/j.visres.2015.12.004)

Conference Proceedings

10. **Hu, B.** , Vasu, B. , and Hoogs, A. X-MIR: Explainable Medical Image Retrieval. In *Proceedings of the IEEE/CVF Winter Conference on Applications of Computer Vision (WACV)*, January 2022
11. **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>
12. **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>
13. **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](https://doi.org/10.1109/CISS.2019.8693039)
14. **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](https://doi.org/10.1109/CISS.2018.8362264)
15. **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](https://doi.org/10.1109/CISS.2017.7926138)
16. **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](https://doi.org/10.1109/CISS.2015.7086906)

Working Papers

17. Schneider-Mizell, C. M. , Bodor, A. L. , Collman, F. , Brittain, D. , Bleckert, A. A. , Dorkenwald, S. , Turner, N. L. , Macrina, T. , Lee, K. , Lu, R. , Wu, J. , ... , **Hu, B.** , ... , and de Costa, N. M. Chandelier cell anatomy and function reveal a variably distributed but common signal. Submitted to eLife. URL <https://www.biorxiv.org/content/10.1101/2020.03.31.018952v1.full>
18. 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 Neural Computation. URL <https://www.biorxiv.org/content/10.1101/2020.09.24.309500v1>

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 *Journal of Cognitive Neuroscience*, *Frontiers in Systems Neuroscience*, *IEEE Transactions on Image Processing*, *CVPR*, *ICCV*, *WACV*
Member, Organization for Computational Neuroscience, 2018–2020
Member, Society for Neuroscience, 2013–2020

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