**Caleb Hallinan**

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**EDUCATION**

**PhD in Biomedical Engineering** *August 2023 – Present*

Johns Hopkins University, Baltimore, MD

**Bachelor of Arts in Statistics and Biology** *August 2017 – May 2021*

University of Virginia, Charlottesville, VA

**RESEARCH EXPERIENCE**

**Biomedical Engineering PhD Candidate** *August 2023 – Present*

*Johns Hopkins University*

*Advisor: Jean Fan, PhD*

* Utilize deep learning to predict spatial gene expression using features learned from histology images

**Research Assistant** **II** *September 2021 – June 2023*

*Boston Children’s Hospital & Harvard Medical School*

*Advisor: Kwonmoo Lee, PhD*

* Developed a feature selection algorithm to discover novel subtypes in gene, protein, and image data
* Investigated live cell images from breast cancer stem cells using machine learning and image analysis techniques
* Employed deep-learning algorithms for cell segmentation and feature extraction
* Managed Linux servers, order materials, and present recent research papers to fellow lab members

**Undergraduate Research Assistant** *May 2020 – August 2021*

*Focused Ultrasound Foundation & University of Virginia*

*Advisors: Frederic Padilla, PhD & Tianxi Li, PhD*

* Performed statistical analysis on flow cytometry data to deduce the effect of focused ultrasound on mice tumors
* Transformed, analyzed, and visualized brain tumor data to distinguish normal brain matter from tumor tissue
* Transferred R-version of the package ‘randnet’ to Python

**TEACHING EXPERIENCES**

**Course Instructor**, Deep Learning for Spatial Transcriptomics *August 2025 – November 2025*

*Biomedical Engineering Department, Johns Hopkins University*

* Designed and taught an original course on deep learning for spatial transcriptomics, blending conceptual lectures with hands-on coding tutorials in PyTorch to support student learning

**Teaching Assistant**, Genomic Data Visualization *January 2025 – March 2025*

*Biomedical Engineering Department, Johns Hopkins University*

* Supported student learning by attending classes, answering questions, and providing individualized guidance during office hours
* Evaluated student progress by grading assignments and offering constructive feedback to enhance their understanding of genomic data visualization techniques

**Teaching Assistant**, Data Science for Public Health I/II *January 2024 – May 2024*

*Biostatistics Department, Johns Hopkins Bloomberg School of Public Health*

* Facilitated student understanding of data science concepts by holding office hours and grading assignments

**Teaching Assistant**, Computational Analysis of Heterogeneity in Cellular Images Nano Course *January 2023*

*Harvard Medical School Curriculum Fellows Program, Harvard Medical School*

* Guided 20 participants in understanding basic algorithms of segmentation, edge detection, and tracking of cells
* Worked with participants in a hands-on experience of analyzing live-cell image datasets

**Teaching Assistant**, Regression Analysis *January 2020 – May 2021*

*Statistics Department, University of Virginia*

* Oversaw 80 students while aiding in their understanding of regression in a SAS, project-based course
* Held office hours, graded assignments, and answered specific questions during class

**Teaching Assistant**, Introduction to Chemistry Lab *September 2019 – December 2019*

*Chemistry Department, University of Virginia*

* Supervised 24 students in weekly labs, designed presentations, graded assignments, and held office hours

**PUBLICATIONS**

**Journal Papers:**

**J6. C. Hallinan**, H.J. Ji, S.L. Salzberg, J. Fan. “Evidence of off-target probe binding in the 10x Genomics Xenium v1 Human Breast Gene Expression Panel compromises accuracy of spatial transcriptomic profiling.” *eLife, 2025.*

**J5.** H. Zhou, P. Panwar, B. Guo, **C. Hallinan**, S. Ghazanfar, SC. Hicks. “Spatial mutual nearest neighbors for spatial transcriptomics data.” *Bioinformatics, 2025.*

**J4.** A. Abul-Basher\*, **C. Hallinan\***, and K. Lee. “Heterogeneity-Preserving Feature Selection for Subtype Discovery.” *Nature Communications, 2025.*

**J3.** S. Busatto, T. Song, HJ. Kim, **C. Hallinan**, …, K. Lee, M. Moses. “Breast Cancer‐Derived Extracellular Vesicles Modulate the Cytoplasmic and Cytoskeletal Dynamics of Blood‐Brain Barrier Endothelial Cells.” *Journal of Extracellular Vesicles, 2025.*

**J2.** J. Jang, Y. Kim, B. Westgate, Y. Zong, **C. Hallinan**, A. Akalin, and K. Lee. “Screening Adequacy of Unstained Fine Needle Aspiration Samples Using a Deep Learning-based Classifier.” *Scientific Reports, 2023.*

**J1.** J. Jang, **C. Hallinan**, and K. Lee. “Protocol for live cell image segmentation to profile cellular morphodynamics using MARS-Net.” *STAR Protocols, 2022.*

**Papers Under Review:**

**P1. C. Hallinan**, CHG. Lucas, J. Fan. “Impact of Data Quality on Deep Learning Prediction of Spatial Transcriptomics from Histology Images.” *2025.*

\*Equal Contributors

**INVITED TALKS AND PRESENTATIONS**

**Poster Presentations:**

**P3.** “Impact of Data Quality on Deep Learning Prediction of Spatial Transcriptomics from Histology Images,” AI in Molecular Biology Keystone Symposia, Eldorado Hotel & Spa, Santa Fe, NM, 2025.

**P2.** “Phenotyping of Heterogenous Live Cell Motility and Morphology,” Dr. M. Judah Folkman Research Day, Boston Children’s Hospital & Harvard Medical School, Boston, MA, 2023.

**P1.** “Deep-Hetero: A Deep Metric Learning with UMAP-based Clustering Approach for Identifying Heterogeneity in Cells,” Dr. M. Judah Folkman Research Day, Boston Children’s Hospital & Harvard Medical School, Boston, MA, 2022.

**Oral Presentations:**

**O3.** “Deconvolution of Cellular Heterogeneity for Sub-Type Discovery by Analyzing Feature Variation,” Vascular Biology Program Work in Progress, Boston Children’s Hospital & Harvard Medical School, Boston, MA, 2022.

**O2. “**Machine Learning Approaches Applied to the Prediction of Covid-19 Spread and Cell Motility Phenotyping,” Vascular Biology Program Work in Progress, Boston Children’s Hospital & Harvard Medical School, Boston, MA, 2022.

**O1. “**Ultrasound Microbubble Tumor Analysis,” Focused Ultrasound Foundation Summer Intern Presentations, Focused Ultrasound Foundation, Charlottesville, VA, 2021.

**VOLUNTEERING AND OUTREACH**

**Hopkins Biomedical Engineering Application Assistance Program (BMEAAP)** *November 2023 - Present*

*Biomedical Engineering Department, Johns Hopkins University*

* Mentor underrepresented JHU BME PhD applicants by providing CV/personal-statement feedback and mock interview coaching

**Johns Hopkins Biomedical Engineering Student Council** *September 2023 - Present*

*Biomedical Engineering Department, Johns Hopkins University*

* Serving as co-President, representing over 200+ doctoral students across Johns Hopkins University
* Coordinate council meetings, spearhead initiatives to enhance the student experience, and serve as a liaison between students, faculty, and administration

**Statistics Alumni Panel & Biostatistics Symposium** *October 2022*

*Statistics Department, University of Virginia*

* Talked about experiences at UVA Statistics Department to 250+ college students
* Engaged with audience regarding questions post graduating and current research work

**Lee Lab Diversity Outreach Video** *March 2022*

*Boston Children’s Hospital & Harvard Medical School*

* Designed and produced a five-minute multimedia overview combining lab footage, graphics, and AI-narration to introduce the Lee Lab research to a diverse local high school

**Volunteer Leader** *March 2018 – May 2021*

*Young Life, University of Virginia*

* Lead a collaborative, volunteer leadership team providing guidance to students at The Covenant School
* Coordinated and executed events by creating a safe and encouraging environment for more than 100 students

**HONORS AND AWARDS**

* Graduated with Distinction – Highest Honors Possible*May 2021*
* Dean’s List – 4/5 Possible Semesters*January 2018 – December 2019*

**SKILLS**

* Proficient in: Python, R, R Markdown, TensorFlow, Pytorch, Shell Script, Word, Excel, ImageJ and PowerPoint
* Experience with: SQL, Git, MATLAB, SAS, Mathematica, LaTeX, HTML, CSS, and C
* Machine Learning, Deep Learning, AI, Statistical Analysis, Data Science, Cell Biology, Omics Analysis

**REFERENCES**

References available upon request.