

# Vivek Gopalakrishnan

✉ [vivekg@mit.edu](mailto:vivekg@mit.edu)  
📄 <https://vivekg.dev>  
👤 v715

I am an first-year PhD student in Medical Engineering and Medical Physics at the Harvard-MIT Program in Health Sciences and Technology. My past research has focused on the development of computational methods to analyze multi-subject neuroimaging and cardiovascular data. Most recently, I developed statistical graph theory algorithms to perform biomarker discovery in network-valued maps of the brain. I also led a Design Team of undergraduate biomedical engineers to build a dynamic fusion image guidance system for minimally invasive heart surgery.

## Education

- 8/21 – present **Massachusetts Institute of Technology and Harvard Medical School**, Cambridge, MA.  
Doctor of Philosophy (Ph.D.) in Medical Engineering and Medical Physics.  
○ **Advisor:** Professor Polina Golland.  
○ **Concentration Area:** Computer Science.
- 8/20 – 5/21 **Johns Hopkins University**, Baltimore, MD.  
Master of Science and Engineering (M.S.E.) in Biomedical Engineering.  
○ **Advisors:** Professors Joshua T. Vogelstein (primary) and Carey E. Priebe (secondary).  
○ **Concentration Area:** Biomedical Data Science.  
○ **Thesis:** *Multiscale Statistical Hypothesis Testing for k-Sample Graph Inference*.
- 8/17 – 5/21 **Johns Hopkins University**, Baltimore, MD.  
Bachelor of Science (B.S.) in Biomedical Engineering.  
○ **Advisor:** Professor René Vidal.  
○ **Concentration Area:** Biomedical Data Science.

## Research and Engineering Experience

- 1/20 – 5/21 **Design Team Leader**, *Dept. of Biomedical Engineering*, Johns Hopkins University.  
○ Team leader and project manager for a team of eight undergraduate engineers.  
○ Developed a multi-modal spatiotemporal registration algorithm to power a dynamic fusion image guidance system for minimally invasive heart surgery.  
○ **Skills used:** *Computer vision, image registration, cardiology, Python, and Git*.
- 9/18 – 5/21 **Undergraduate Research Assistant**, *Neurodata Lab*, Johns Hopkins University.  
○ Developed novel machine learning methods for analyzing populations of graph-valued objects [3, 1].  
○ Discovered neuro-connectively similar subtypes of autism using joint embeddings of multi-network connectomes [4, 7].  
○ **Skills used:** *Graph theory, statistics, machine learning, Python, and Git*.
- Summer 2018 **Summer Student Researcher**, *Ghebremichael Lab*, Ragon Institute of MGH, MIT and Harvard.  
○ Developed predictive models of disease progression and immune recovery in HIV-positive children with TB co-infection [2].  
○ Identified biomarkers for antiretroviral toxicity by applying machine learning methods to HIV-patient data [5].  
○ **Skills used:** *Survival analysis, ROC models, R, and Git*.

- 12/17 – 5/18 **Design Team Member**, *Dept. of Biomedical Engineering*, Johns Hopkins University.
- Designed and implemented a clinical machine learning algorithm to predict the onset of lung failure in pediatric patients.
  - **Skills used:** *Representation learning, sparse dictionary learning, Python, and Git.*
- 6/17 – 7/17 **Summer Researcher**, *Fondazione Bruno Kessler*, Trento, Italy.
- Implemented a deep learning algorithm to quantitatively assess crop damage from images taken by farmers.
  - **Skills used:** *Computer vision, Keras, Python, and Git.*
- 6/16 – 6/17 **High School Researcher**, *Tufts University BioSeq Program*, Tufts University.
- Used next-generation sequencing (NGS) to generate a novel human oral microbiome data set.
  - Analyzed sequence data using dimensionality reduction and hidden Markov models to identify microbial biomarkers of oral health.
  - Presented at the 2017 Intel International Science and Engineering Fair, Los Angeles, CA.
  - **Skills used:** *DNA library construction, next-generation sequencing, dimensionality reduction, hidden Markov models, and R.*

---

## Publications and Preprints

- [1] Jaewon Chung, Eric Bridgeford, Jesus Arroyo, Benjamin D. Pedigo, Ali Saad-Eldin, **Vivek Gopalakrishnan**, Liang Xiang, Carey E Priebe, and Joshua T Vogelstein. “Statistical Connectomics”. *Annual Review of Statistics and Its Application* (Mar. 2021). DOI: <https://doi.org/10.1146/annurev-statistics-042720-023234>.
- [2] **Vivek Gopalakrishnan**, Eliezer Bose, Usha Nair, Yuwei Cheng, and Musie Ghebremichael. “Pre-HAART CD4+ T-Lymphocytes as Biomarkers of Post-HAART Immune Recovery in HIV-Infected Children with or without TB Co-Infection”. *BMC Infectious Diseases* (Oct. 2020). DOI: [10.1186/s12879-020-05458-w](https://doi.org/10.1186/s12879-020-05458-w).
- [3] **Vivek Gopalakrishnan**, Jaewon Chung, Eric Bridgeford, Benjamin D. Pedigo, Jesús Arroyo, Lucy Upchurch, G. Allan Johnson, Nian Wang, Youngser Park, Carey E. Priebe, and Joshua T. Vogelstein. “Multiscale Comparative Connectomics”. *arXiv:2011.14990* (Nov. 2020). arXiv: [2011.14990](https://arxiv.org/abs/2011.14990).
- [4] Nian Wang, Robert J Anderson, David G Ashbrook, **Vivek Gopalakrishnan**, Youngser Park, Carey E Priebe, Yi Qi, Rick Laoprasert, Joshua T Vogelstein, Robert W Williams, and G Allan Johnson. “Variability and Heritability of Mouse Brain Structure: Microscopic MRI Atlases and Connectomes for Diverse Strains”. *NeuroImage* (Aug. 2020). DOI: [10.1016/j.neuroimage.2020.117274](https://doi.org/10.1016/j.neuroimage.2020.117274).
- [5] Jong Soo Lee, Elijah Paintsil, **Vivek Gopalakrishnan**, and Musie Ghebremichael. “A Comparison of Machine Learning Techniques for Classification of HIV Patients with Antiretroviral Therapy-Induced Mitochondrial Toxicity from Those Without Mitochondrial Toxicity”. *BMC Medical Research Methodology* (Nov. 2019). DOI: [10.1186/s12874-019-0848-z](https://doi.org/10.1186/s12874-019-0848-z).

---

## Conference Presentations

- [6] **Vivek Gopalakrishnan** and Joshua T Vogelstein. “Statistical Methods for Multiscale Comparative Connectomics”. *NeuroMatch*. Oct. 2020. URL: [https://www.neuromatch.io/abstract?submission\\_id=recARY71P6SjXY3xK](https://www.neuromatch.io/abstract?submission_id=recARY71P6SjXY3xK).
- [7] **Vivek Gopalakrishnan** and Joshua T Vogelstein. “Towards Discovering Heterogeneity in Autism via Multi-Network Connectomics”. *Biomedical Engineering Society (BMES)*. Philadelphia, PA, Oct. 2019.

---

## Skills

Programming Python, R, Julia, git,  $\text{\LaTeX}$

DevOps    GitHub, AWS, Docker

APIs    Python Data Science Stack, Tensorflow, PyTorch

Bioinformatics    Microbiome and B-/T-cell repertoire analysis

Wet Lab    Microfabrication, 3-D tissue culture, NGS library construction

---

## Teaching

- Spring '21    **Head TA – NeuroData Design II**, *EN.BME.438/638*, Johns Hopkins University.
- Fall '20    **Head TA – NeuroData Design I**, *EN.BME.437/637*, Johns Hopkins University.
- Fall '20    **TA – Linear Algebra**, *AS.MATH.201*, Johns Hopkins University.
- Fall '20    **TA – Computational Cardiology Lab**, *EN.BME.487*, Johns Hopkins University.
- Fall '18    **Head PILOT Leader**, *Dept. of Academic Support*, Johns Hopkins University.
- to Spring '20
  - Led group tutoring sessions ( $\approx 10$  students/group), and wrote weekly problem sets and lectures.
  - Led weekly meetings to train junior PILOT leaders in mathematics and pedagogy.

---

## Fellowships and Awards

- 2020    **Provost's Undergraduate Research Award**, *Office of Undergraduate Research*, Johns Hopkins University.
- 2019    **INBT Research Award**, *Institute for NanoBioTechnology*, Johns Hopkins University.
- 2019    **Joseph C. Pistritto Research Fellowship**, *Dept. of Computer Science*, Johns Hopkins University.
- 2018    **AWS Cloud Credits for Research Grant**, *Dept. of Computer Science*, Johns Hopkins University.
- 2017    **Second Place Winner**, *Intel International Science and Engineering Fair (ISEF)*, Category: Microbiology.
- 2017    **Internship Award**, *Intel ISEF Special Award*, Fondazione Bruno Kessler.
- 2017    **Semi-Finalist**, *Regeneron Science Talent Search*, Microbiology.
- 2017    **Second Place Winner**, *Massachusetts State Science & Engineering Fair*.
- 2016    **Second Place Winner**, *Massachusetts State Science & Engineering Fair*.