

# Anish K. Simhal

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## Research experience

2021 – Present **Postdoctoral Researcher — Medical Physics, Memorial Sloan Kettering Cancer Center**  
– *Advisors:* Allen Tannenbaum & Joseph Deasy

2019 – 2021 **Postdoctoral Fellow — Autism Center, Child Mind Institute**  
– *Advisors:* Adriana Di Martino & Michael Milham

## Education

2014 – 2019 **PhD — Electrical Engineering**  
*Advisor:* Guillermo Sapiro  
Duke University, Durham, NC  
*Pratt School of Engineering — Dept. of Electrical Engineering*

2014 – 2016 **Masters of Science — Electrical Engineering**  
Duke University, Durham, NC  
*Pratt School of Engineering — Dept. of Electrical Engineering*

2010 – 2014 **Bachelor of Science — Electrical Engineering**  
University of Virginia, Charlottesville, VA  
*School of Engineering and Applied Sciences*

## Technical Skills

*Programming languages* Python, MATLAB, C++

*Programming tools* Scikit-learn, OpenCV, PyTorch, TensorFlow, Keras, Amazon Web Services, Git, LaTeX

## Broad areas of experience

*Technical:* Image processing, machine learning, graph theory, bioinformatics

*Imaging:* MRI: resting-state, diffusion, immunofluorescence imaging

*Biology:* Autism spectrum disorder, cancer, brain connectomics

## Publications

- 2023 [12] A.K. Simhal, K.H. Maclachlan, R. Elkin, J. Zhu, L. Norton, J.O. Deasy, J.H. Oh, S.Z. Usmani, A. Tannenbaum. **“Gene interaction network analysis in multiple myeloma detects complex immune dysregulation associated with shorter survival.”** 2023. *bioRxiv*.
- 2023 [11] B. Vibert, ..., A. K. Simhal, ..., A. D. Martino. **“CRISIS AFAR: An International Collaborative Study of the Impact of the COVID-19 Pandemic on Youth with Autism and Neurodevelopmental Conditions.”** 2023. *Molecular Autism*.
- 2022 [10] R.K. Simhal, T.N. Sholklapper, A.K. Simhal, A.L. Zwart, M.T. Danner, D. Kumar, N. Aghdam, S. Suy, R.A. Hankins, K.J. Kowalczyk, S.P. Collins. **“Association of Baseline Self-Reported Fatigue with Overall Survival After Stereotactic Body Radiation Therapy for Localized Prostate Cancer.”** 2022. *Frontiers in Oncology*.

- 2022 [9] A. K. Simhal, K. L. H. Carpenter, J. Kurtzberg, A. Song, A. Tannenbaum, L. Zhang, G. Sapiro, G. Dawson. **“Changes in the geometry and robustness of diffusion tensor imaging networks: secondary analysis from a randomized controlled trial of young autistic children receiving an umbilical cord blood infusion.”** 2022. *Frontiers in Psychiatry*.
- 2021 [8] A. K. Simhal, J. O. A. Filho, P. Segura, J. Cloud, E. Petkova, R. Gallagher, F. X. Castellanos, S. Colcombe, M. P. Milham, A. D. Martino. **“Predicting multiscan MRI outcomes in children with neurodevelopmental conditions following MRI simulator training.”** 2021. *Developmental Cognitive Neuroscience*.
- 2020 [7] A. K. Simhal, K. L. H. Carpenter, S. Nadeem, J. Kurtzberg, A. Song, A. Tannenbaum, G. Sapiro, G. Dawson. **“Measuring robustness of brain networks in autism spectrum disorder with Ricci curvature.”** 2020. *Scientific Reports*.
- 2019 [6] A. K. Simhal, Y. Zuo, M. M. Perez, D. V. Madison, G. Sapiro, and K. D. Micheva. **“Multifaceted changes in synaptic composition and astrocytic involvement in a mouse model of fragile x syndrome.”** 2019. *Scientific Reports*.
- 2018 [5] A. K. Simhal, B. Gong, J. S. Trimmer, R. J. Weinberg, S. J. Smith, G. Sapiro, and K. D. Micheva. **“A computational synaptic antibody characterization tool for array tomography.”** 12, 2018. *Frontiers in Neuroanatomy*.
- 2018 [4] M. N. Asiedu, A. K. Simhal, U. Chaudhary, J. L. Mueller, C. T. Lam, J. W. Schmitt, G. Venegas, G. Sapiro, and N. Ramanujam. **“Development of algorithms for automated detection of cervical pre-cancers with a low-cost, point-of-care, pocket colposcope.”** 2018. *IEEE Transactions on Biomedical Engineering*.
- 2018 [3] M. N. Asiedu, A. K. Simhal, C. T. Lam, J. Mueller, U. Chaudhary, J. W. Schmitt, G. Sapiro, and N. Ramanujam. **“Image processing and machine learning techniques to automate diagnosis of lugol’s iodine cervigrams for a low-cost point-of-care digital colposcope.”** 2018. *Optics and Biophotonics in Low-Resource Settings IV*. Volume 10485. International Society for Optics and Photonics.
- 2017 [2] A. K. Simhal, C. Aguerrebere, F. Collman, J. T. Vogelstein, K. D. Micheva, R. J. Weinberg, S. J. Smith, and G. Sapiro. **“Probabilistic fluorescence-based synapse detection.”** 2017. *PLoS Computational Biology*.
- 2014 [1] A.K. Simhal, V.-G. Kanumuru, A. Holmes, and E. Berger. **“Exploring the use of student taught classes to introduce new technical topics to engineering undergraduates.”** 2014. *Frontiers in Education Conference, IEEE*, pages 1–8.

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## Selected Poster Presentations

- 2023 [17] American Association for Cancer Research (2023). **“Protein network analysis uncovers a poor-survival subtype in multiple myeloma.”** A.K. Simhal, K.H. Maclachlan, R. Elkin, J. Zhu, S.Z. Usmani, J.J. Keats, L. Norton, J.O. Deasy, J.H. Oh, A. Tannenbaum.
- 2023 [16] American Association for Cancer Research (2023). **“Deep neural networks using protein-protein network information predict multiple myeloma survival.”** J. Zhu, J.H. Oh, A.K. Simhal, R. Elkin, L. Norton, J.O. Deasy, A. Tannenbaum.
- 2022 [15] American Society of Hematology (2022). **“Geometric network analysis defines poor prognosis subtypes in multiple myeloma.”** A.K. Simhal, K.H. Maclachlan, R. Elkin, J. Zhu, S.Z. Usmani, J.J. Keats, L. Norton, J.O. Deasy, J.H. Oh, A. Tannenbaum.
- 2022 [14] Society of Neuroscience Annual Meeting (2022). **“Conjugate IF-SEM: A tool to provide ground truth for synapse detection and analysis.”** A.K. Simhal, J.L. Schardt, S.J. Smith, R.J. Weinberg, K.D. Micheva.
- 2022 [13] Society of Neuroscience Annual Meeting (2022). **“Collaborative conjugate array tomography to characterize synapses in mouse neocortex.”** J.L. Schardt, A.K. Simhal, K.D. Micheva, S.J. Smith, R.J. Weinberg.
- 2022 [12] International Myeloma Society (2022). **“Network topology analysis reveals unique multiple myeloma genomic subtypes and potential new therapeutic targets.”** A.K. Simhal, K.H. Maclachlan, R. Elkin, J. Zhu, S.Z. Usmani, J.O. Deasy, J. H. Oh, A. Tannenbaum.
- 2022 [11] Annual Meeting of the American Urology Association (2022). **“Baseline self-reported fatigue predicts overall survival after stereotactic body radiation therapy for localized prostate cancer.”** R. Simhal, T. Shoklapper, A.K. Simhal, A. Zwart, M. Danner, D. Kumar, N. Aghdam, S. Suy, R. Hankins, K. Kowalczyk, S. Collins. *Podium presentation*
- 2022 [10] Flux Society (2022). **“Transdiagnostic connectome-based mapping of autistic traits in children with autism and/or attention deficit/hyperactivity disorder.”** P. Segura, J.O.A. Filho, A.K. Simhal, J. Stroud, J. Cloud, S. Bishop, S.H. Kim, C. Lord, F.X. Castellanos, S. Colcombe, M. Milham, A.D. Martino.
- 2021 [9] Microscopy and Microanalysis (2021). **“Electron microscopy explorations of the human brain: using immunofluorescence to address challenges.”** K. Micheva, M. Perez, A.K. Simhal, R. Weinberg, D. Madison.
- 2020 [8] Organization for Human Brain Mapping Annual Meeting (June 2020). **“Mock MRI training impact on MRI scanning in children with neurodevelopmental disorders.”** A. K. Simhal, J. O. A. Filho, P. Segura, J. Cloud, F. X. Castellanos, S. Colcombe, M. P. Milham, A. D. Martino.
- 2019 [7] American Academy of Child & Adolescent Psychiatry Annual Meeting (Oct 2019). **“Graph curvature as a method for discerning robustness in brain networks in autism spectrum disorder.”** K. L. H. Carpenter, A. K. Simhal, S. Nadeem, J. Sun, J. Kurtzberg, A. Song, A. Tannenbaum, G. Sapiro, G. Dawson
- 2018 [6] Society of Neuroscience Annual Meeting (2018). **“An array tomography exploration tool: Exploring synapses from fMRI knockout mice.”** A.K. Simhal, K. D. Micheva, Y. Zuo, R.J. Weinberg, S.J. Smith, G. Sapiro
- 2017 [5] Society of Neuroscience Annual Meeting (2017). **“Automated Antibody Characterization for Array Tomography.”** A.K. Simhal, B. Gong, J. Trimmer, R.J. Weinberg, S.J. Smith, G. Sapiro, K.D. Micheva
- 2017 [4] Society of Neuroscience Annual Meeting (2017). **“Comparing Mouse and Human Synapses with Automated Probabilistic Synapse Analysis.”** K.D. Micheva, A.K. Simhal, J.T. Ting, A.L. Ko, W.W. Seeley, E.F. Chang, A.N. Li, E. Lein, F. Collman, D.V. Madison, R.J. Weinberg, S.J. Smith, G. Sapiro
- 2016 [3] Society of Neuroscience Annual Meeting (2016). **“Probabilistic Synapse Detection in Array Tomography.”** A.K. Simhal, C. Aguerrebere, F. Collman, J.T. Vogelstein, K.D. Micheva, R.J. Weinberg, S.J. Smith, G. Sapiro

- 2015 [2] NeuroIPS 2015 (Dec 2015). **“Computational statistics for whole brain CLARITY analysis using the Open Connectome Project.”** A.K. Simhal, W.G. Roncal, K.A. Lillaney, K. Kutten, M.I. Miller, J.T. Vogelstein, R. Burns, L. Ye, R. Tomer, K. Deisseroth, G. Sapiro
- 2015 [1] Society of Neuroscience Annual Meeting (2015). **“Computational statistics for whole brain CLARITY analysis using the Open Connectome Project.”** A.K. Simhal, W.G. Roncal, K.A. Lillaney, K. Kutten, M.I. Miller, J.T. Vogelstein, R. Burns, L. Ye, R. Tomer, K. Deisseroth, G. Sapiro

## Selected Talks

- 2018 Simhal, Anish K et al. “A Computational Synaptic Antibody Characterization Tool for Array Tomography.” School of Electrical Engineering, **Tel Aviv University**. 15 October 2018. Tel Aviv, Israel.
- 2018 Simhal, Anish K et al. “A Computational Synaptic Antibody Characterization and Screening Framework for Array Tomography.” Data Dialogue, IID, **Duke University**. 22 March 2018. Durham, North Carolina.
- 2017 Simhal, Anish K et al. “Automated Antibody Characterization and Screening for Array Tomography via Probabilistic Synapse Detection.” Seminario Interdisciplinario Procesamiento y Análisis de Imágenes Biomédicas, **Universidad de la República**. 9 November 2017. Montevideo, Uruguay.
- 2017 Simhal, Anish K et al. “Probabilistic fluorescence-based synapse detection.” Facultad de Ingeniería, **Universidad de la República**. 6 November 2017. Montevideo, Uruguay.

## Leadership Experience

- 2018 – **Bull City Classrooms — Founder, Board of Directors**  
 Present – Created a nonprofit group address the needs of Durham Public Elementary School teachers.  
 – Engaged 400+ volunteers at 15+ events at local elementary schools.  
 – Raised \$2,000+ from community partners to support these efforts.  
 – www.bullcityclassrooms.org
- 2016 – 2018 **Little League Coach, Durham Boys and Girls Club – Head Coach**  
 – Coached twelve children, ages 9-12, for the Durham Bulls Youth Athletic League organization.  
 – During the season, spent 10 hours a week with the children.  
 – Organized practices, recruited assistant coaches, communicated with parents in English and Spanish.

## Awards

- 2019 **Durham Public School Spark Advocate of the Year Award**  
 – Awarded by the Durham Public Schools Board of Education to an individual not affiliated with DPS for exceptional service.
- 2019 **Durham Public School Spark Advocate Award**  
 – Won in recognition of creating a nonprofit to engage the Durham community with Durham Public School teachers and staff.
- 2013 **Microsoft Imagine Cup Entrepreneurship Competition — 1st Place – Innovation**  
 – Created a physical therapy application to provide patients performing exercises and stretches real-time feedback via the Kinect Sensor in C#.  
 – Researched product development strategies, business models, and performed market analysis.
- 2013 **Harrison Undergraduate Research Award**  
 – Won competitive Harrison Award for ‘outstanding undergraduate research,’ which provided substantial research funding. Presented by the Center for Undergraduate Excellence at U.Va.

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## Industry Experience

- June/July 2016 **Allen Institute for Brain Sciences, Synapse Biology — Summer Visitor**  
– Worked with the synapse biology team, led by Dr. Stephen J. Smith, to develop new tools for detection synapses in array tomography data.
- Summer 2013 **Azure Summit Technology — Electrical Engineering Intern**  
– Developed a signal processing GUI in MATLAB to augment spectrogram analysis, digital down conversion, and other signal processing tools.  
– Designed various filters to equalize hardware system channel responses.  
– Learned agile software development.
- Summer 2012 **Decisive Analytics Corporation — Image Processing Intern**  
– Transformed video footage from unmanned aerial vehicles to create panoramic imagery to augment existing map data.  
– Designed and executed object detection algorithms to track vehicles throughout a video using OpenCV libraries; wrote documentation.  
– Implemented and evaluated an image processing research paper in C++.
- Summer 2011 **EOIR Technologies, Inc. — Software Engineering Intern**  
– Developed video analysis software based on the Python and OpenCV libraries to analyze and augment the results of an object tracking algorithm.  
– Collaborated with engineers to develop and manage evolving requirements and specifications; learned the Software Development Life Cycle.

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## Teaching Experience

- Spring 2016, 2017 **Image Processing (Duke ECE 590) — Teaching Assistant**  
– Supported students taking the course in-person at Duke and online via Coursera.
- Spring 2014 **Digital Signal Processing (UVa ECE 4750/6750) — Teaching Assistant**  
– Explained a variety of topics in DSP to both undergraduate and graduate students.  
– Created and graded weekly homework assignments and exams.  
– Held regular office hours attended by an average of 20+ students.
- Fall 2012, 2013 **Circuit Analysis (UVa ECE 2630) — Teaching Assistant**  
– Taught various circuit analysis techniques to second year EE/CPE students.  
– Demonstrated an array of lab skills, including using oscilloscopes.
- Fall 2011 **Engineering Explorations — 1st Year Seminar (UVa ENGR 1595) — Instructor**  
– Introduced and facilitated an “Explorations in Engineering” Seminar to provide 1st year students with an overview of all engineering disciplines – Coordinated with the Dean’s Office to create and manage the curriculum.
- 2008 – 2015 **Smithsonian National Air & Space Museum — Education Volunteer**  
– Dynamically adapted to a wide spectrum of age groups to educate and engage visitors from topics ranging from how an airplane flies to how astronauts live and work in space.

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## Undergraduate Research Experience

- 2014 **Heliotropism in Sunflowers @ VIVA Research Group — Dr. Scott Acton, ECE**  
– Researched and designed an algorithm to track the motion of sunflowers over extended periods of time. It is a fascinating problem due to the constantly evolving shape of the plant and the variety present within the species.  
– Collaborated and implemented the algorithm via MATLAB and delivered GUI to Dr. Blackman, U.Va Biology Dept.
- 2012 – 2014 **Semi-Enclosed Area Occupancy Detection — Dr. Archie Holmes, ECE**  
– Designed an integrated wireless sensor platform to detect occupancy in semi-enclosed area, to help students find an empty study areas via a mobile application.  
– Constructed a full scale prototype by integrating a microprocessor, passive & thermal infrared sensors, and digital radios in a 3D printed custom enclosure.

2012 – 2013 **INTERIA Wireless Health Research — Dr. John Lach, ECE**

- Designed calibration procedure for an Ankle Foot Orthopedic device with multiple sensors and created software tool chain to support it.
- Researched various activity classifications algorithms and created step counter.
- Created program (BodySim) to scan in 3D models of the human body via the Microsoft Kinect in C++ to model human kinematics.

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## Selected News Articles

- 2019 9th Street Journal. “Bull City Classrooms ushers volunteers to Durham elementary schools.” January 25th, 2019.
- 2014 UVA Today. “U.Va. Undergrads Track Foot Traffic to Make Study Areas More Accessible.” March 18th, 2014.
- 2013 UVA Today. “From Programming Languages to Auto Mechanics, Engineering Students Give Teaching a Try.” December 15th, 2013.
- 2013 UVA Today. “U.Va. Engineering Students Earn Microsoft’s Imagine Cup for Innovation.” June 28th, 2013.