

## Technical skills

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- **Theory** Bayesian statistics, machine learning, signal processing, time series, neural networks, optimization
- **Languages** Python, Java, R, MATLAB, Swift, HTML/CSS/Javascript

## Experience

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- **Tufts University** Medford, MA
  - **Data Intensive Studies Center**
    - Senior Data Scientist (2020-Present)
      - \* Conducted data-intensive scholarly research, collaborating with researchers in multiple disciplines across the university.
      - \* Developed and taught data science workshops/short courses for faculty, staff and students, including "Probability for Machine Learning", "Version Control for Researchers with Git and GitHub", "Data Visualization with R Shiny", and "Bayesian Modeling"
- **Massachusetts General Hospital, Harvard Medical School** Boston, MA
  - **Department of Neurology** *2019-2020*
    - Postdoctoral Research Fellow (2019-2020)
      - \* Developed statistical methods and machine learning algorithms for rich and interpretable representations of behavior and movement of individuals with neurodegenerative diseases, from wearable sensor data and other data modalities.
      - \* Applied, compared, and synthesized as appropriate a variety of approaches, including those based on feature-construction from time-frequency analyses, state space and autoregressive models, and deep learning, for accurate characterization of disease classification and severity.
      - \* Set and shared processes and standards for the team for version control, unit testing, and continuous integration.
- **Phillips Academy** Andover, MA
  - **Department of Mathematics, Statistics and Computer Science** *2014 – 2019*
    - Chair, Department of Mathematics, Statistics, and Computer Science (2017 – 2019)
      - \* Set department priorities and implemented aligned strategies for departmental development, including major curricular updates and work for equity and inclusion.
      - \* Managed team of 30+ teachers, mentored new teachers, and identified directions of individual professional development.
      - \* Directed scheduling of courses and placement of students in the department.
      - \* Oversaw budget. Conducted planning and prioritization process for important building/classroom renovations.
      - \* Restructured math department search protocols for 2017-2018 hiring to have a more equitable process; these protocols were recommended as an example for other departments.
    - Instructor, Department of Mathematics, Statistics, and Computer Science (2014 – 2019)
      - \* Created and taught new courses: Bayesian Statistics, Mobile App Development, Gerrymandering, Computational Neuroscience.
      - \* Advised independent projects: Mathematics of Elections, Mathematical Biology, Computational Neuroscience, Game Theory and International Relations, Real Analysis, Matrix Decompositions, Number Theory.
      - \* Taught existing courses: AP Computer Science, AP Calculus, Precalculus, Multivariable Calculus and Linear Algebra, Web Development.
      - \* Chaired computer science curriculum redesign committee, improved student experience in CS classes.
    - Residential, athletic, and extracurricular work
      - \* Lived as residential house counselor and advisor in a 21-student ninth grade dorm, mentor, academic advisor, point person for family communication (2015 –2019). Co-directed 3-season outdoor pursuits program, managing staffing, budget, equipment, and maintenance of rock wall and challenge course facilities (2015 – 2017); instructed yoga; advised rock climbing club, assisted math club, co-led Learning in the World program "Lenses on China" - 2.5 week educational travel in China.

## The University of Texas at Austin

Austin, TX

### Mathematics (Ph.D.)

2009 – 2014

- Research and Fellowships
  - \* Graduate research with areas of interest: computational neuroscience, compressed sensing, Bayesian statistics, signal processing, mathematical biology.
  - \* Doctoral thesis: Recovery of Continuous Quantities from Discrete and Binary Data with Applications to Neural Data (advisors Dr. Jonathan Pillow and Dr. Rachel Ward).
  - \* Topology Research Training Group Fellowship (2009 – 2010, F2011)
  - \* Graduate Fellow in Statistical Consulting (2013) - provided statistical assistance to students and faculty for projects via short consulting meetings and longer data analysis project. Explained technical statistical concepts to non-experts, and was invited to co-author paper as a result of data analysis project.
- Teaching and Outreach
  - \* Planned and conducted biweekly discussion sections for undergraduate math courses: Integral Calculus, Honors Differential Equations, and Mathematical Biology
  - \* Organized math department's "Saturday Morning Math Group" - outreach program for middle and high school students. Recruited leaders for weekend talks and math circles, publicized events and increased attendance, hosted American Mathematical Competitions
  - \* Mentored directed reading program, supervising undergraduate student in harmonic analysis project

## Selected Papers and Talks

- Knudson, K. and Gupta, A. (2021) Assessing Cerebellar Disorders With Wearable Inertial Sensor Data Using Time-Frequency and Autoregressive Hidden Markov Model Approaches, <https://arxiv.org/abs/2108.08975> (Preprint)
- Carroll, C. and Knudson, K. (2018) Fighting Gerrymandering with PyMC3, presentation at PyCon
- Knudson, K. (2014) Recovery of continuous quantities from discrete and binary data with applications to neural data (Doctoral dissertation).
- Knudson, K., Saab, R., and Ward, R. (2016) One-Bit Compressive Sensing with Norm Estimation. IEEE Transactions on Information Theory, vol. 62, no. 5, pp. 2748-2758.
- Knudson, K., Yates, J., Huk, A., and Pillow, J. (2014) Inferring Sparse Representations of Continuous Signals with Continuous Orthogonal Matching Pursuit. Advances of Neural Information Processing Systems 27.
- Knudson, K. and Pillow, J.W. (2013). Spike train entropy-rate estimation using hierarchical Dirichlet process priors. Advances of Neural Information Processing Systems 26.
- Adams, C., and Knudson, K. (2013). Unknotting tunnels, bracelets and the elder sibling property for hyperbolic 3-manifolds. Journal of the Australian Mathematical Society: 1-19.

## Education

### The University of Texas at Austin

Austin, TX

#### Ph.D. in Mathematics

2009 – 2014

- Research Interests: computational neuroscience, compressed sensing, Bayesian statistics, signal processing

### Williams College

Williamstown, MA

#### B.A. in Religion and Mathematics (with honors)

2005 – 2009

- Magna Cum Laude, Phi Beta Kappa, Sigma Xi

## Other

**Emergency Medical Technician (EMT) and Wilderness EMT** (2016 – present)

**Languages:** Advanced: German and Spanish

**Athletics:** Varsity Track and Cross Country, Williams College (2005 – 2009) Girls On The Run Head Coach (Fall 2011), 200 hour Yoga Teacher Training (2012), Ironman triathlon (2018), avid marathoner

**Outdoor Leadership:** Outdoor Orientation Trip Leader, Instructor of Leaders at Williams College (2006, 2008), National Outdoor Leadership School (NOLS) backcountry rock climbing course (2005), Residential assistant for high school semester program focused on science, outdoors, and leadership for girls (Spring 2012), summited Denali (2019)