

# ARCHANA VENKATARAMAN

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<http://engineering.jhu.edu/nsa/>

## EDUCATION

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### Massachusetts Institute of Technology, Cambridge, MA

- Ph.D.**, Electrical Engineering Sept 2007 – Sept 2012  
Thesis Title: Generative Models of Brain Connectivity for Population Studies  
Thesis Supervisor: Polina Golland
- M. Eng.**, Electrical Engineering Sept 2006 – Sept 2007  
Thesis Title: Signal Approximation using the Bilinear Transform  
Thesis Supervisor: Alan V. Oppenheim
- S.B.**, Electrical Engineering Sept 2003 – June 2006  
Concentration: Communications, Controls and Signal Processing

## ACADEMIC AND RESEARCH POSITIONS

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- John C. Malone Assistant Professor, Johns Hopkins, Baltimore MD** Aug 2016 – Present  
Department of Electrical and Computer Engineering  
Department of Computer Science (Secondary)  
Malone Center for Engineering in Healthcare (Core Faculty)  
Mathematical Institute for Data Science (Core Faculty)
- Research Assistant Professor, Johns Hopkins, Baltimore MD** April 2016 – Aug 2016  
Department of Electrical and Computer Engineering
- Postdoctoral Associate, Yale School of Medicine, New Haven CT** Jan 2014 – April 2016  
Department of Diagnostic Radiology  
Yale Image Processing and Analysis Group  
*Faculty Supervisor: James S. Duncan*
- Postdoctoral Fellow, MIT, Cambridge MA** Sept 2012 – Dec 2013  
Department of Electrical Engineering and Computer Science  
MIT Medical Vision Group  
*Faculty Supervisor: Polina Golland*
- Graduate Research Assistant (PhD), MIT, Cambridge MA** Jan 2008 – Aug 2012  
Department of Electrical Engineering and Computer Science  
MIT Medical Vision Group  
*Faculty Supervisor: Polina Golland*
- Graduate Research Assistant (MS), MIT, Cambridge MA** Jan 2006 – Dec 2007  
Department of Electrical Engineering and Computer Science  
Digital Signal Processing Group  
*Faculty Supervisor: Alan V. Oppenheim*
- Undergraduate Research Assistant, MIT, Cambridge MA** Sept 2004 – Jan 2006  
Department of Electrical Engineering and Computer Science  
Microsystems Technology Laboratory  
*Faculty Supervisor: Anantha P. Chandrakasan*

**Undergraduate Research Assistant, MIT, Cambridge MA**  
Department of Electrical Engineering and Computer Science  
MIT Nanostructures Laboratory  
*Faculty Supervisor: Henry I. Smith*

Sept 2003 – June 2004

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## INDUSTRY EXPERIENCE

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**Technical Consultant, Vixiar Medical, Annapolis MD**

May 2018 – Present

**Intern, MIT Lincoln Laboratory, Lexington MA**

Advanced Sensor Techniques Group (103)  
*Supervisor: Dr. Andrew McKellips*

June 2006 – Aug 2006

**Intern, Xerox Corporation, Rochester NY**

XCEL Summer Internship Program

June 2004 – Aug 2004

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## AWARDS AND HONORS

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**MIT Technology Review: 35 Innovators Under 35**

**June 2019**

**NSF CAREER Award**

**Feb 2019**

**John C. Malone Assistant Professorship**

**April 2017**

Council of Early Career Investigators in Imaging (CECI<sup>2</sup>) Travel Award

April 2016

CHDI Grant, Network Models of Brain Connectivity for Huntington's Disease

2013 – 2014

MIT Lincoln Lab Campus Collaboration Award

2012 – 2014

Advanced Multimodal Neuroimaging Training Program (NIH)

2011 – 2012

**National Defense Science and Engineering Graduate Fellowship (NDSEG)**

**2007 – 2010**

MICCAI Student Travel Award (\$500)

Sept 2010

**Siebel Scholarship (\$20,000)**

**2007 – 2008**

**MIT Provost Presidential Fellowship**

**2006 – 2007**

Morris Joseph Levin Award, Best Thesis Presentation (M.Eng.)

May 2007

Association of MIT Alumnae, Senior Academic Achievement Award (\$500)

May 2006

Xerox Technical Minority Scholarship (\$10,000)

Jan 2006

Maletta Foundation Scholarship, Rochester Engineering Society (\$2500)

Jan 2005

Semiconductor Research Corporation Undergraduate Research Award (\$18,000)

2004 – 2005

Xerox Technical Minority Scholarship (\$2,500)

Dec 2004

National Merit Scholarship (\$2,500)

Sept 2003

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## BOOK CHAPTERS AND VOLUMES

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- [B1] **A. Venkataraman**. *Autism Spectrum Disorders: Unbiased Functional Connectomics Provide New Insights into a Multifaceted Neurodevelopmental Disorder*. Connectomics: Methods, Mathematical Models and Applications, Eds. B. Munsel, G. Wu, and P. Laurienti, Elsevier Academic Press, 2018.
- [B2] T. Schultz, G. Nedjati-Gilani, **A. Venkataraman**, L. O'Donnell and E. Panagiotaki (Eds.). *Computational Diffusion MRI and Brain Connectivity: MICCAI Workshops, Nagoya, Japan*, January 2014.

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## JOURNAL ARTICLES

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- [J1] **J. Craley**, E. Johnson, **A. Venkataraman**. *A Spatio-Temporal Model of Seizure Propagation in Focal Epilepsy*. Under Revision for IEEE Transactions on Medical Imaging, 2019.
- [J2] **N.S. D'Souza**, N. Wymbs, M.B. Nebel, S. Mostofsky and **A. Venkataraman**. *A Joint Network Optimization Framework to Predict Clinical Severity from Resting State fMRI Data*. Under Revision for NeuroImage, 2019.
- [J3] D. Rangaprakash, M.N. Dretsch, **A. Venkataraman**, J.S. Katz, T.S. Denney Jr. and G. Deshpande. *Identifying Disease Foci from Static and Dynamic Effective Connectivity Networks: Illustration in Soldiers with*

*Trauma. Human Brain Mapping*, 39(1):264-287, 2018.

- [J4] S. Zhao, D. Rangaprakash, **A. Venkataraman**, P. Liang and G. Deshpande. *Investigating Focal Connectivity Deficits in Alzheimer's Disease using Directional Brain Networks Derived from Resting-State fMRI*. *Frontiers on Aging Neuroscience*, 9:1-12, 2017.
- [J5] S. van Noordt, J. Wu, **A. Venkataraman**, M.J. Larson, M. South and M.J. Crowley. *Inter-trial Coherence of Medial Frontal Theta Oscillations Linked to Differential Feedback Processing in High-Functioning Autism*. *Research in Autism Spectrum Disorders*, 37:1-10, 2017.
- [J6] **A. Venkataraman**, D. Yang, N. Dvornek, L.H. Staib, J.S. Duncan, K.A. Pelphrey and P. Ventola. *Pivotal Response Treatment Prompts a Functional Rewiring of the Brain Among Individuals with Autism Spectrum Disorder*. *NeuroReport*, 27(14):1081-1085, 2016.
- [J7] D. Yang, K.A. Pelphrey, D.G. Sukhodolsky, M.J. Crowley, E. Dayan, N. Dvornek, **A. Venkataraman**, J.S. Duncan, L.H. Staib and P. Ventola. *Brain Responses to Biological Motion Predict Treatment Outcome in Young Children with Autism*. *Translational Psychiatry*, 6(11):e948 2016.
- [J8] **A. Venkataraman**, D. Yang, K.A. Pelphrey and J.S. Duncan. *Bayesian Community Detection in the Space of Group-Level Functional Differences*. *IEEE Transactions Medical Imaging*, 35(8):1866-1882, 2016.
- [J9] **A. Venkataraman**, J.S. Duncan, D. Yang and K.A. Pelphrey. *An Unbiased Bayesian Approach to Functional Connectomics Implicates Social-Communication Networks in Autism*. *NeuroImage Clin*, 8:356-366, 2015.
- [J10] **A. Venkataraman**, M. Kubicki and P. Golland. *From Brain Connectivity Models to Region Labels: Identifying Foci of a Neurological Disorder*. *IEEE Transactions on Medical Imaging*, 32(11):2078-2098, 2013.
- [J11] **A. Venkataraman**, T.J. Whitford, C-F. Westin, P. Golland and M. Kubicki. *Whole Brain Resting State Functional Connectivity Abnormalities in Schizophrenia*. *Schizophrenia Research*, 139(1-3):7-12, 2012.
- [J12] **A. Venkataraman**, Y. Rathi, M. Kubicki, C-F. Westin and P. Golland. *Joint Modeling of Anatomical and Functional Connectivity for Population Studies*. *IEEE Trans on Medical Imaging*, 31(2):164-182, 2012.
- [J13] K.R.A. Van Dijk, T. Hedden, **A. Venkataraman**, K.C. Evans, S.W. Lazar and R.L. Buckner. *Intrinsic Functional Connectivity As a Tool For Human Connectomics: Theory, Properties, and Optimization*. *Journal of Neurophysiology*, 103(1):297-321, 2010.

## PEER-REVIEWED CONFERENCE PROCEEDINGS

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- [C1] N.S. D'Souza, N. Wymbs, M.B. Nebel, S. Mostofsky and **A. Venkataraman**. *Integrating Neural Networks and Dictionary Learning for Multidimensional Clinical Characterizations from Functional Connectomics Data*. Under Review for MICCAI: Medical Imaging Computing and Computer Assisted Intervention, 2019.
- [C2] N. Nandakumar, K. Manzoor, J. Pillai, S. Gujar, H. Sair, **A. Venkataraman**. *A Novel Graph Neural Network to Localize Eloquent Cortex in Brain Tumor Patients from Resting-State fMRI Connectivity*. Under Review for MICCAI: Medical Imaging Computing and Computer Assisted Intervention, 2019.
- [C3] R. Shankar, J. Sager and **A. Venkataraman**. *A Multi-Speaker Emotion Morphing Model Using Highway Networks and Maximum Likelihood Objective*. To Appear in Interspeech: Conference of the International Speech Communication Association, 2019. **Selected for an Oral Presentation**
- [C4] J. Sager, J. Reinhold, R. Shankar and **A. Venkataraman**. *VESUS: A Crowd-Annotated Database to Study Emotion Production and Perception in Spoken English*. To Appear in Interspeech: Conference of the International Speech Communication Association, 2019. **Selected for an Oral Presentation**
- [C5] R. Shankar, H.-W. Hsieh, N. Charon and **A. Venkataraman**. *Automated Emotion Morphing in Speech Based on Diffeomorphic Curve Registration and Highway Networks*. To Appear in Interspeech: Conf of the International Speech Communication Association, 2019.
- [C6] R. Shankar and **A. Venkataraman**. *Weakly Supervised Syllable Segmentation by Vowel-Consonant Peak Classification*. To Appear in Interspeech: Conf of the International Speech Communication Association, 2019.

- [C7] J. Craley, C. Jouny, E. Johnson and **A. Venkataraman**. *Automated Noninvasive Seizure Detection and Localization Using Switching Markov Models and Convolutional Neural Networks*. To Appear in MICCAI: International Conference on Medical Image Computing and Computer Assisted Intervention, 2019. **Selected for Early Acceptance (Top 20% of Submissions)**
- [C8] S. Ghosal, Q. Chen, A.L. Goldman, W. Ulrich, K.F. Berman, D.R. Weinberger, V.S. Mattay and **A. Venkataraman**. *Bridging Imaging, Genetics, and Diagnosis in a Coupled Low-Dimensional Framework*. To Appear in MICCAI: International Conference on Medical Image Computing and Computer Assisted Intervention, 2019. **Selected for Early Acceptance (Top 20% of Submissions)**
- [C9] J. Craley, E. Johnson, **A. Venkataraman**. *Integrating Convolutional Neural Networks and Probabilistic Graphical Modeling for Epileptic Seizure Detection in Multichannel EEG*. In Proc. IPMI: Information Processing in Medical Imaging, LNCS 11492:291303, 2019. **(Acceptance Rate  $\approx$  30%) – Oral Presentation**
- [C10] N.S. D'Souza, N. Wymbs, M.B. Nebel, S. Mostofsky and **A. Venkataraman**. *A Coupled Manifold Optimization Framework to Jointly Model the Functional Connectomics and Behavioral Data Spaces*. In Proc. IPMI: Information Processing in Medical Imaging, LNCS 11492:605616, 2019. **(Acceptance Rate  $\approx$  30%)**
- [C11] S. Ghosal, Q. Chen, A.L. Goldman, W. Ulrich, D.R. Weinberger, V.S. Mattay and **A. Venkataraman**. *A Generative-Predictive Framework to Capture Altered Brain Activity in fMRI and its Association with Genetic Risk: Application to Schizophrenia*. SPIE Medical Imaging, vol. 10949, 2019.
- [C12] N. Nandakumar, N.S. DSouza, J. Craley, K. Manzoor, J. Pillai, S. Gujar, H. Sair, **A. Venkataraman**. *Defining Patient Specific Functional Parcellations in Lesional Cohorts via Markov Random Fields*. In Proc. CNI: MICCAI Workshop on Connectomics in Neuroimaging, LNCS 11083:88-98, 2018. **Selected for an Oral Presentation (< 25% of Accepted Papers)**
- [C13] N.S. D'Souza, N. Wymbs, M.B. Nebel, S. Mostofsky and **A. Venkataraman**. *A Generative-Discriminative Basis Learning Framework to Predict Clinical Severity from Resting State Functional MRI Data*. In Proc. MICCAI: International Conference on Medical Image Computing and Computer Assisted Intervention, LNCS 11072:163-171, 2018. **(Acceptance Rate  $\approx$  30%) – Early Acceptance (Top 15% of Submissions)**
- [C14] J. Craley, E. Johnson, **A. Venkataraman**. *A Novel Method for Epileptic Seizure Detection Using Coupled Hidden Markov Models*. In Proc. MICCAI: International Conference on Medical Image Computing and Computer Assisted Intervention, LNCS 11072:482-489, 2018. **(Acceptance Rate  $\approx$  30%)**  
**Selected for Early Acceptance (Top 15% of Submissions)**
- [C15] **A. Venkataraman**, N. Wymbs, M.B. Nebel and S. Mostofsky. *A Unified Bayesian Approach to Extract Network-Based Functional Differences from a Heterogeneous Patient Cohort*. In Proc CNI: MICCAI Workshop on Connectomics in NeuroImaging, LNCS 10511, pp. 60-69 2017. **Selected for an Oral Presentation (< 20% of Accepted Papers)**
- [C16] N.C. Dvornek, D. Yang, **A. Venkataraman**, P. Ventola, L.H. Staib, K.A. Pelphrey and J.S. Duncan. *Prediction of Autism Treatment Response from Baseline fMRI using Random Forests and Tree Bagging*. In Proc. MICCAI Workshop on Multimodal Learning for Clinical Decision Support, pp. 1-8, 2016. **Oral Presentation**
- [C17] **A. Venkataraman**, D. Yang, K.A. Pelphrey and J.S. Duncan. *Community Detection in the Space of Functional Abnormalities Reveals both Heightened and Reduced Brain Synchrony in Autism*. In Proc. BAMBI: MICCAI Workshop on Bayesian and Graphical Models for Biomedical Imaging, pp. 1-12, 2015. **Oral Presentation**
- [C18] A. Sweet\*, **A. Venkataraman\***, S.M. Stuffelbeam, H. Liu, N. Tanaka and P. Golland. *Detecting Epileptic Regions Based on Global Brain Connectivity Patterns*. In Proc. MICCAI: International Conference on Medical Image Computing and Computer Assisted Intervention, LNCS 8149:98-105, 2013. **(Acceptance Rate  $\approx$  30%) – Selected for an Oral Presentation (< 10% of Accepted Papers)**  
*\*equal contribution by first two authors*
- [C19] **A. Venkataraman**, M. Kubicki and P. Golland. *From Brain Connectivity Models to Identifying Foci of a Neurological Disorder*. In Proc. MICCAI: International Conference on Medical Image Computing and Computer Assisted Intervention, LNCS 7510:697-704, 2012. **(Acceptance Rate  $\approx$  30%)**  
**Selected for Oral Presentation (< 10% of Accepted Papers)**

- [C20] **A. Venkataraman**, Y. Rathi, M. Kubicki, C-F. Westin and P. Golland. *Joint Generative Model for fMRI/DWI and its Application to Population Studies*. In Proc. MICCAI: International Conference on Medical Image Computing and Computer Assisted Intervention, LNCS 6361:191-199, 2010. **(Acceptance Rate  $\approx$  30%) Selected for Oral Presentation (< 10% of Accepted Papers)**
- [C21] **A. Venkataraman**, M. Kubicki, C-F. Westin and P. Golland. *Robust Feature Selection in Resting-State fMRI Connectivity Based on Population Studies*. In Proc. MMBIA: IEEE Computer Society Workshop on Mathematical Methods in Biomedical Image Analysis: 63-70, 2010.
- [C22] **A. Venkataraman**, K.R.A Van Dijk, R.L. Buckner and P. Golland. *Exploring Functional Connectivity in fMRI via Clustering*. In Proc. ICASSP: IEEE Conf on Acoustics, Speech and Signal Proc, 441-444, 2009.
- [C23] P. Golland, D. Lashkari and **A. Venkataraman**. *Spatial Patterns and Functional Profiles for Discovering Structure in fMRI Data*. In Proc. Asilomar Conf on Signals, Systems and Computers, 1402-1409, 2008.
- [C24] **A. Venkataraman** and A.V. Oppenheim, *Signal Approximation using the Bilinear Transform*, In Proc. ICASSP: IEEE Conference on Acoustics, Speech and Signal Processing, 3729-3732, 2008.

## CONFERENCE ABSTRACTS

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- [A1] N.S. D'Souza, M.B. Nebel, N. Wymbs, S. Mostofsky, and **A. Venkataraman**. *A Joint Network Optimization Framework to Predict Clinical Severity from Resting-State Functional MRI Data*. Second International Conference on Medical Imaging and Case Reports, 2019. **Invited Abstract and Presentation**
- [A2] N.S. D'Souza, M.B. Nebel, N. Wymbs, S. Mostofsky, and **A. Venkataraman**. *A Joint Network Optimization Framework to Predict Clinical Severity from Resting-State Functional Connectomics*. Flux Congress, 2019.
- [A3] **A. Venkataraman**, N.S. D'Souza, M.B. Nebel, N. Wymbs and S. Mostofsky. *Predicting Behavior from Resting-State fMRI Connectivity*. In Proc. SAND9: Statistical Analysis of Neuronal Data, 2019. **Selected for a Young Investigator Spotlight Presentation**
- [A4] N.S. D'Souza, M.B. Nebel, N. Wymbs, S. Mostofsky, and **A. Venkataraman**. *A Generative-Discriminative Basis Learning Framework to Predict Autism Spectrum Disorder Severity*. In Proc. ISBI: International Symposium on Biomedical Imaging, 2018.
- [A5] N. Nandakumar, N.S. D'Souza, H. Sair, and **A. Venkataraman**. *A Modified K-Means Algorithm for Resting State FMRI Analysis of Brain Tumor Patients, As Validated by Language Localization*. In Proc. ISBI: International Symposium on Biomedical Imaging, 2018.
- [A6] J. Craley, E. Johnson, and **A. Venkataraman**. *Robust Seizure Detection Using Coupled Hidden Markov Models*. In Proc. ISBI: International Symposium on Biomedical Imaging, 2018.
- [A7] **A. Venkataraman**, J.S. Duncan, D. Yang and K.A. Pelphrey. *Abnormal Functional Communities in Autism*. IMFAR: Intl Meeting For Autism Research, 2016. **Oral Presentation (< 5% of Abstracts)**
- [A8] D. Rangaprakash, G. Deshpande, **A. Venkataraman**, J.S. Katz, T.S. Denney and M.N. Dretschi. *Identifying Foci of Brain Disorders from Effective Connectivity Networks*, ISMRM, 2016. **Honorable Mention**
- [A9] **A. Venkataraman**, J.S. Duncan, D. Yang and K.A. Pelphrey. *An Unbiased Bayesian Approach to Functional Connectomics Implicates Social-Communication Networks in Autism*. In Proc. ISBI: International Symposium on Biomedical Imaging, 2015. **Invited Abstract and Presentation**
- [A10] S. Zhao, **A. Venkataraman**, P. Liang and G. Deshpande. *Investigating the Role of Brain Stem in Alzheimers Disease using Directional Brain Networks derived from Resting State fMRI*, Annual Mtg of ISMRM, 2015.
- [A11] **A. Venkataraman**, M. Kubicki and P. Golland. *From Brain Connectivity Models to Identifying Foci of a Neurological Disorder*. 3<sup>rd</sup> Biennial Conference on Resting State Brain Connectivity, Sept 2012.
- [A12] **A. Venkataraman**, K.R.A Van Dijk, R.L. Buckner and P. Golland. *Exploring Functional Connectivity in fMRI via Clustering*, Annual Meeting of the Organization of Human Brain Mapping, June 2009.

## DISSERTATIONS

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- [D1] **A. Venkataraman.** *Generative Models of Brain Connectivity for Population Studies.* Doctor of Philosophy Thesis. Massachusetts Institute of Technology, Cambridge MA, 2012.
- [D2] **A. Venkataraman.** *Signal Approximation Using the Bilinear Transform.* Masters of Engineering Thesis. Massachusetts Institute of Technology, Cambridge MA, 2007.

## CURRENT & COMPLETED RESEARCH SUPPORT

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**JHU Discovery Award** PI: Venkataraman 07/01/19 – 06/31/20  
**Noninvasive Seizure Localization in Epilepsy Patients via Multimodal Magnetic Resonance Imaging**  
*We will collect multimodal MRI from patients admitted to the JHMI Epilepsy Monitoring Unit. Using this data, we will develop new machine learning algorithms based on probabilistic graphical models to localize the seizure onset. This is a highly competitive internal award with only a 10 – 15% funding rate.*  
Co-PIs: Emily Johnson, Christophe Jouny, Haris Sair  
**Total Funding Amount: \$100,000 for 1 year**

**NSF CAREER 1845430** PI: Venkataraman 02/15/19 – 01/31/24  
**Small Data in a Big World: Balancing Interpretability and Generalizability for Data Integration in Clinical Neuroscience**  
*This project develops a coupled network optimization framework that simultaneously extracts interpretable features from functional neuroimaging data and makes patient-specific predictions.*  
Agency: National Science Foundation, CISE Directorate  
**Total Funding Amount: \$500,006 over 5 years**

**NSF CRCNS 1822575** PI: Venkataraman 10/01/18 – 09/30/21  
**Discovering Network Structure in the Space of Group-Level Functional Differences**  
*We will develop a robust mathematical framework to detect altered neural subsystems that track with a particular neurological disorder. We focus on three clinical testbeds: autism, ADHD and schizophrenia.*  
Agency: National Science Foundation, CISE Directorate  
**Total Funding Amount: \$874,048 over 3 years**

**JHMI Synergy Award** Joint PI: Johnson/Venkataraman 07/01/17 – 06/31/18  
**Epileptic Seizure Localization via Bayesian Structure Learning**  
*We will develop a Bayesian structure learning framework to track the origin and progression of a focal epileptic seizure in the brain. We will validate our method on EEG data collected at the JHMI Epilepsy Monitoring Unit. This is a highly competitive internal award with only a 10 – 15% funding rate.*  
**Total Funding Amount: \$100,000 for 1 year**

**Neuroradiology MRI Scanning Award** Joint PI: Sair/Venkataraman/Johnson 07/01/17 – 06/31/18  
**Building a Database of Neurotypical Controls for Multiple Clinical Studies**  
*We will collect rsfMRI data from a normative population using the research Siemens 3T scanner at JHMI. This dataset will serve as a resource for the Johns Hopkins community.*  
**Total Funding Amount: \$7,000 for 1 year**

## PENDING RESEARCH SUPPORT

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**NIH R21** PI: Venkataraman 01/01/20 – 12/31/21  
**Automated Multimodal Language Localization for Presurgical Planning in Brain Tumor Patients**  
*We will develop automated algorithms to map the language areas of the brain using resting-state fMRI and diffusion MRI. Our methodology leverages a graph neural network architecture to capture representative patterns in the data. We will also conduct pre- and postoperative cognitive assessments to identify patient risk factors.*  
Agency: National Cancer Institute  
**Total Funding Amount: \$435,988 over 2 years**

**NIH R01** Joint PI: Volk/Mostofsky 01/01/20 – 12/31/24  
**Resolving High-Dimensionality: The Effect of Disordered Sleep on Brain Function**  
*The goal of this study is to examine how disturbed sleep affects communication and function, mental health outcomes, and brain development into adolescence among school-age children with developmental disorders.*  
Agency: National Institute of Mental Health  
Total Funding Amount: \$4,080,000 over 5 years  
Project Role: Co-Investigator

**NIH R01** PI: Venkataraman 09/01/19 – 08/31/24  
**Automated Noninvasive Seizure Onset Localization via Clinically-Informed Machine Learning and Integration of Electrophysiological and Neuroimaging Data**  
*This project will develop noninvasive seizure localization strategies in medically refractory focal epilepsy based on scalp EEG and multimodal MRI. Our methodology is based on probabilistic graphical models.*  
Agency: National Institute of Neurological Disorders and Stroke  
Total Funding Amount: \$2,455,676 over 5 years

**NSF NRT-HDR** PI: Vidal 09/01/19 – 08/31/24  
**Educating and Training 21st Century Scientists and Engineers for the Data Science Revolution**  
*The objective of this program is to train the next generation of scientists on the fundamental principles behind the analysis and interpretation of complex high-dimensional data via hands-on interdisciplinary projects.*  
Agency: National Science Foundation, CISE Directorate  
Total Funding Amount: \$3,000,000 over 5 years  
Role: Co-Principal Investigator

## PUBLIC MENTIONS

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### **MIT Technology Review (June/July 2019): 35 Innovators Under 35**

Article Summary: Archana Venkataraman develops mathematical models designed to unlock the black box of the brain's function and provide the building blocks for treatments. (*Correspondent: Jonathan Rosen*)

### **JHU Engineering Magazine (Summer 2019): Safety First: Building a Resilient Future**

Article Summary: Researchers at Johns Hopkins develop algorithms to use brain imaging and electrical monitoring technology to localize epileptic foci in the brain. (*Correspondent: Andrew Meyers*)

### **JHU Engineering Magazine (Summer 2018): Your Brain on Engineering**

Article Summary: Researchers at Johns Hopkins use machine learning techniques to localize the source of epileptic seizures based on noninvasive EEG recordings. (*Correspondent: Christen Brownlee*)

### **MIT News (2012): Mapping Neurological Disease**

Article Summary: A new algorithm developed at MIT can analyze information from medical images to identify diseased areas of the brain and connections with other regions. (*Correspondent: Helen Knight*)

## TECHNICAL PRESENTATIONS

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### **Invited Seminars**

#### 2019 **Generative Models to Decode the Brain**

- Machine Learning in Medicine Seminar Series, Cornell University, USA
- Medical Imaging Seminar Series, University of North Carolina Chapel Hill, USA
- Neuroscience and Behavior Distinguished Seminar Series, University of Massachusetts Amherst, USA

#### 2018 **Mathematical Models for Functional Neuroimaging**

- Bodian Distinguished Lecturer, Mind Brain Institute, Johns Hopkins University, USA

#### **Generative Models to Decode Brain Pathology**

- Department of Applied Mathematics and Statistics, Johns Hopkins University, USA

- 2018 **Automated Detection and Localization of Epileptic Seizures**
- NCCU Grand Rounds, Johns Hopkins Medical Institute, USA
- 2017 **An Adaptable Framework to Extract Abnormal Brain Networks**
- Distinguished Lecturer, Institute for Computational Medicine, Johns Hopkins University, USA
  - IEEE Joint Chapters Meeting (Keynote), Rochester NY, USA
  - Department of Biomedical Engineering, University of Rochester, USA
  - Department of Electrical Engineering, Rochester Institute of Technology, USA
  - Department of Electrical and Computer Engineering, University of Virginia Charlottesville, USA
- 2016 **An Adaptable Framework to Extract Abnormal Brain Networks**
- Magnetic Resonance Research Center, Yale University, USA
  - Department of Electrical and Computer Engineering, University of Texas San Antonio, USA
  - Department of Biomedical Engineering, Vanderbilt University, USA
  - Department of Electrical Engineering, University of Rochester, USA
  - Department of Electrical Engineering and Systems Science, Washington University, USA
- 2015 **An Unbiased Bayesian Approach to Functional Connectomics Implicates Social-Communication Networks in Autism**
- International Symposium on Biomedical Imaging, Brooklyn NY, USA
- An Adaptable Framework to Extract Abnormal Brain Networks**
- Department of Electrical and Computer Engineering, Johns Hopkins University, USA
- 2014 **Characterizing Abnormal Brain Networks**
- Image Processing Conference at SPIE Medical Imaging, San Diego CA, USA
- 2013 **Characterizing Abnormal Brain Networks**
- Institute of Medical Engineering and Science, Massachusetts Institute of Technology, USA
  - Department of Electrical and Computer Engineering, Johns Hopkins University, USA
  - Department of Electrical and Computer Engineering, University of Texas Austin, USA
  - Department of Diagnostic Radiology, Yale University, USA
- 2012 **From Brain Connectivity Models to Identifying Foci of a Neurological Disorder**
- Laboratory for Mathematical Imaging, Brigham and Womens Hospital, USA
  - Rising Stars Workshop, Massachusetts Institute of Technology, USA
- Generative Models of Brain Connectivity for Population Studies**
- MIT Lincoln Laboratory, Lexington MA, USA
  - MGH Martinos Center for Biomedical Imaging, USA
- 2011 **Joint Modeling of Anatomical and Functional Connectivity for Population Studies**
- Parietal Team, Neurospin, Gif-sur-Yvette, France

### Conference and Workshop Oral Presentations

- 2019 **Integrating Convolutional Neural Networks and Probabilistic Graphical Modeling for Epileptic Seizure Detection in Multichannel EEG**
- IPMI: International Conference on Information Processing in Medical Imaging, Hong Kong  
*Speaker: Jeff Craley, PhD Student*



- 2019 **Predicting Behavior from Resting-State fMRI Connectivity**  
SAND9: Statistical Analysis of Neuronal Data, Pittsburgh, PA
- 2018 **Defining Patient Specific Functional Parcellations in Lesional Cohorts via MRFs**  
CNI: MICCAI Workshop on Connectomics in Neuroimaging, Granada, Spain  
*Speaker: Naresh Nandakumar, PhD Student*
- 2017 **Extracting Network-Based Functional Differences from a Heterogeneous Patient Cohort**  
CNI: MICCAI Workshop on Connectomics in Neuroimaging
- 2016 **Abnormal Functional Communities in Autism**  
IMFAR: International Meeting for Autism Research
- 2015 **Community Detection in the Space of Functional Abnormalities Reveals Abnormal Brain Synchrony in Autism**  
BAMBI: MICCAI Workshop on Bayesian and Graphical Models for Biomedical Imaging
- 2013 **Detecting Epileptic Regions Based on Global Brain Connectivity Patterns**  
MICCAI: International Conference on Medical Image Computing and Computer Assisted Intervention
- 2012 **From Brain Connectivity Models to Identifying Foci of a Neurological Disorder**  
MICCAI: International Conference on Medical Image Computing and Computer Assisted Intervention
- 2010 **Joint Generative Model for fMRI/DWI and its Application to Population Studies**  
MICCAI: International Conference on Medical Image Computing and Computer Assisted Intervention

#### Invited Poster Presentations

- 2019 **A Generative-Predictive Framework to Capture Altered Brain Activity in fMRI and its Association with Genetic Risk: Application to Schizophrenia**  
WSE/DOM Research Retreat, Johns Hopkins University  
*Presenter: Sayan Ghosal, PhD Student*
- Defining Patient Specific Functional Parcellations in Lesional Cohorts via MRFs**  
WSE/DOM Research Retreat, Johns Hopkins University  
*Presenter: Naresh Nandakumar, PhD Student*
- A Generative-Discriminative Basis Learning Framework to Predict Clinical Severity from Resting State Functional MRI Data**  
WSE/DOM Research Retreat, Johns Hopkins University  
*Presenter: Niharika Shimona D'Souza, PhD Student*
- A Novel Method for Epileptic Seizure Detection Using Coupled Hidden Markov Models**  
WSE/DOM Research Retreat, Johns Hopkins University  
*Presenter: Jeff Craley, PhD Student*
- 2015 **Bayesian Community Detection in the Space of Group-Level Functional Differences**  
Yale Bioimaging Sciences Retreat Symposium
- 2012 **From Brain Connectivity Models to Identifying Foci of a Neurological Disorder**  
Third Biennial Conference on Resting State Brain Connectivity
- 2009 **Exploring Functional Connectivity in fMRI via Clustering**  
Annual Meeting of the Organization of Human Brain Mapping
- 2005 **An Integrated Low-Power Switched-Capacitor DC-DC Power Converter**  
Interconnect Focus Center Design Review, Atlanta, GA



## Rotation PhD Students

1. Pouria Tohidi April 2016 – Mar 2018  
Department: Electrical and Computer Engineering  
Project: Epileptic Seizure Detection
2. Jacob Reinhold Aug 2017 – Jan 2018  
Department: Electrical and Computer Engineering  
Project: Manipulating Emotional Content in Speech

## Masters Students

1. Rohan Nandkarni Jan 2018 – June 2019  
Department: Biomedical Engineering  
Thesis: Examination of the Association Between Arterial Blood Pressure Below the Lower Limit of Autoregulation and Acute Kidney Injury After Cardiac Surgery  
*Co-advised with Charles Brown in the Department of Anesthesiology*  
**Current Position:** Researcher in the Imaging for Surgery, Therapy and Radiology Lab

## Undergraduate Students

1. Narayani Wagle Jan 2019 – Present  
Department: Computer Science and Biomedical Engineering  
Project: Analyzing the Structure and Function of the Enteric Nervous System
2. Yuta Kobayashi Jan 2019 – Present  
Department: Biomedical Engineering  
Project: Analyzing the Structure and Function of the Enteric Nervous System
3. Jacob Sager June 2017 – June 2019  
Department: Electrical and Computer Engineering  
Project: Emotion Recognition from Human Speech  
**Awards:** William B. Huggins Fellowship Recipient (2018)  
**Current Position:** Software Engineer at FiscalNote
4. Duha Awad June 2018 – Aug 2018  
Department: NSF Research Experiences for Undergraduates Program  
Project: Epileptic Seizure Detection  
**Current Position:** Graduate Student at University of Maryland College Park

## UNIVERSITY SERVICE

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### Department of Electrical and Computer Engineering

ECE Curriculum Committee	2018 – Present
Distinguished Lecturer Committee	2016 – Present
Graduate Student Admissions	2017 – Present
Faculty Search Committee	2017 – 2018
Graduate Student Visit Day	2016 – 2017

### Whiting School of Engineering

AI-X Initiative Vision Committee	2019 – Present
MINDS Faculty Search Committee	2018 – Present
WSE/DOM Research Retreat Committee	2018 – Present
Malone Center Strategic Planning Committee	2016 – Present
WSE Curriculum Committee	2016 – 2018
ChemBE Dept Head Search Committee	2017 – 2018

**Doctoral Thesis Committee Membership**

- |   |                   |
|---|-------------------|
| 1. Jeff Glaister<br>Department: Electrical and Computer Engineering<br>Thesis Advisor: Jerry Prince, ECE  | Expected Aug 2019 |
| 2. Evan Schwab<br>Department: Electrical and Computer Engineering<br>Thesis Title: Joint Spatial-Angular Sparse Coding, Compressed Sensing, and Dictionary Learning for dMRI<br>Thesis Advisors: Rene Vidal, BME and Nicholas Charon, AMS | Nov 2017          |

**Masters Thesis Committee Membership**

- |   |           |
|---|-----------|
| 1. Rohan Nandkarni<br>Department: Biomedical Engineering<br>Thesis Title: Examination of the Association Between Arterial Blood Pressure Below the Lower Limit of Autoregulation and Acute Kidney Injury After Cardiac Surgery<br>Thesis Advisor: Charles Brown, Anesthesiology and Archana Venkataraman, ECE | June 2019 |
| 2. Carolina Pacheco<br>Department: Biomedical Engineering<br>Thesis Title: Recurrent Neural Nets for Classification of Human Embryonic Stem Cell-Derived Cardiomyocytes<br>Thesis Advisor: Rene Vidal, BME  | Aug 2018  |

**Graduate Board Exams Administered**

- |  |            |
|--|------------|
| 1. Miguel Vivar Lazo<br>Department: Biomedical Engineering                     | June 2019  |
| 2. Yufan He<br>Department: Electrical and Computer Engineering                 | June 2019  |
| 3. Niharika Shimona D'Souza<br>Department: Electrical and Computer Engineering | April 2019 |
| 4. Jeff Craley<br>Department: Electrical and Computer Engineering              | April 2019 |
| 5. Jordi Abante Llenas<br>Department: Electrical and Computer Engineering      | April 2019 |
| 6. Muhan Shao<br>Department: Electrical and Computer Engineering               | Feb 2019   |
| 7. Scott Sterrett<br>Department: Biomedical Engineering                        | Feb 2019   |
| 8. Wenying Wang<br>Department: Biomedical Engineering                          | April 2018 |

**ECE Qualifying Exams Administered**

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>• Hancheng Min (Jan 2019)</li> <li>• Naresh Nandakumar (Aug 2018)</li> <li>• Ravi Shankar (Aug 2018)</li> <li>• Sayan Ghosal (Aug 2018)</li> <li>• Ranjani Srinivasan (Aug 2018)</li> <li>• Jacob Reinhold (Aug 2018)</li> <li>• Yan Jiang (Jan 2018)</li> </ul> | <ul style="list-style-type: none"> <li>• Niharika Shimona D'Souza (Aug 2017)</li> <li>• Yufan He (Aug 2017)</li> <li>• Muhan Shao (Aug 2017)</li> <li>• Mengnan Zhao (Aug 2017)</li> <li>• Nanxin Chen (Jan 2017)</li> <li>• Jaejin Cho (Jan 2017)</li> </ul> |
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## PROFESSIONAL SERVICE ACTIVITIES

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- 2019 NSF Ad-Hoc Reviewer: III Small Informatics Panel (CISE Directorate)  
NSF Panelist: Collaborative Research in Computational Neuroscience (CISE Directorate)  
NSF Panelist: III Medium Informatics Panel (CISE Directorate)  
Organizer, CNI: MICCAI Workshop on Connectomics in Neuroimaging  
Organizer, CISS Invited Session on Mathematical Models to Decode the Brain  
Area Chair for Medical Image Computing and Computer Assisted Intervention (MICCAI)  
Area Chair for Medical Imaging with Deep Learning (MIDL)  
Session Chair, Conference on Information Processing in Medical Imaging (IPMI)
- 2018 NIH Reviewer: Neuroscience and Ophthalmic Imaging Technologies (NOIT) Study Section  
Organizing Committee, Rising Stars in Biomedical Workshop  
Technical Program Committee, MICCAI Workshop on Connectomics in Neuroimaging  
Session Chair, IEEE International Symposium on Biomedical Imaging
- 2017 Technical Program Committee, IEEE Conference on Information Sciences and Systems  
Session Chair, Conference on Information Processing in Medical Imaging
- 2014 Editor for “Computational Diffusion MRI & Brain Connectivity”  
*Springer Mathematics & Visualization Series*
- 2013 Organizer, MMBC: MICCAI Workshop on Mathematical Models for Brain Connectivity

### Reviewer for the Following Journal and Conferences:

- IEEE Transactions on Medical Imaging
- Medical Image Analysis (MedIA)
- NeuroImage
- NeuroImage: Clinical
- PLoS One
- MICCAI: Intl Conference on Medical Image Computing and Computer Assisted Intervention
- NeurIPS: Neural Information Processing Systems
- CVPR: IEEE Conference on Computer Vision and Pattern Recognition
- CISS: IEEE Conference on Information Sciences and Systems

## PROFESSIONAL SOCIETY MEMBERSHIPS

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MICCAI Society Member	2008 – Present
Siebel Scholar	2007 – Present
IEEE Member	2006 – Present
Tau Beta Pi, Engineering Honor Society	2006 – Present
Eta Kappa Nu, EE Honor Society	2006 – Present
National Society of Collegiate Scholars	2006 – Present

## NON-PROFESSIONAL ACTIVITIES AND LEADERSHIP ROLES

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President, Ashdown House Executive Committee (MIT)	2008 – 2009
Boston Open Committee, International Badminton Tournament (Cambridge, MA)	2004 – 2008
Honor Society Chair Positions (MIT)	2006 – 2007
Treasurer and Co-Captain, MIT Badminton Club	2005 – 2006

## HOBBIES AND INTERESTS

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Running · Hiking · Dog Training · Cooking · Badminton · Classical Voice

## REFERENCES

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