Archana Venkataraman

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Education

Massachusetts Institute of Technology, Cambridge, MA

Ph.D., Electrical Engineering — Sept 2007 – Aug 2012
Thesis Title: Generative Models of Brain Connectivity for Population Studies
Thesis Supervisor: Prof. Polina Golland

M. Eng., Electrical Engineering — Sept 2006 – Sept 2007
Thesis Title: Signal Approximation using the Bilinear Transform
Thesis Supervisor: Prof. Alan V. Oppenheim

S.B., Electrical Engineering — Sept 2003 – June 2006
Concentration: Communications, Controls and Signal Processing

Research and Professional Experience

John C. Malone Assistant Professor, Johns Hopkins, Baltimore MD — Aug 2016 – Present
Department of Electrical and Computer Engineering
- *Multimodal Integration of Imaging, Genetics and Behavioral Data*
- *Noninvasive Seizure Localization for Focal Epilepsy*
- *Characterizing Whole Brain Neural Plasticity*
- *Emotional Manipulation of Human Speech*

Research Assistant Professor, Johns Hopkins, Baltimore MD — April 2016 – Aug 2016
Department of Electrical and Computer Engineering
- *Neural Modeling for Clinical Neuroscience Applications*

Yale Image Processing & Analysis Group, New Haven CT — Jan 2014 – April 2016
Faculty Supervisor: Prof. James S. Duncan
- *Characterizing Functional Networks in Autism*
- *Multimodal EEG/fMRI Image Analysis*

MIT Medical Vision Group, Cambridge MA — Jan 2008 – Dec 2013
Faculty Supervisor: Prof. Polina Golland
- *Identifying Foci of a Neurological Disorder*
- *Generative Models for Combined Analysis of fMRI and DWI Data*
- *Robust Feature Selection in fMRI for Patient Classification*

MIT Digital Signal Processing Group, Cambridge MA — Jan 2006 – Sept 2007
Faculty Supervisor: Prof. Alan V. Oppenheim
- *Signal Approximation using the Bilinear Transform*

MIT Lincoln Laboratory, Lexington MA — June 2006 – Aug 2006
Advanced Sensor Techniques Group
Supervisor: Dr. Andrew McKellips
- *Adaptive IIR Nulling Solution for a Sparse Non-Commutative Environment*

MIT Microsystems Technology Laboratory, Cambridge MA — Sept 2004 – Jan 2006
Faculty Supervisor: Prof. Anantha P. Chandrakasan
- *A Low-Power Integrated Switched-Capacitor DC-DC Power Converter*
- *A Low-Power Sensing Front End (w/Naveen Verma)*

Xerox Corporation, Rochester NY June 2004 – Aug 2004
XCEL Summer Internship Program
- *Developed software additions for an online hardware management tool*

MIT Nanostructures Laboratory, Cambridge MA Sept 2003 – June 2004
Faculty Supervisor: Prof. Henry I. Smith
- *Fabrication of a 2D Photonic Crystal (w/Minghao Qi)*

Teaching Experience

Instructor, Signal, Systems & Inference (520.313, JHU) Spring 2018
- *Developed an advanced undergraduate course in ECE*
- *Selected Topics: DTFT, z-transforms, probability spaces, random variables, derived distributions, random processes, power spectral density, signal estimation, hypothesis testing, signal detection, state-space models*

Instructor, Random Signals Analysis (520.651, JHU) Fall 2016, 2017
- *Revised and restructured a core graduate course in ECE*
- *Selected Topics: probability spaces, random variables, derived distributions, decision theory, parameter estimation, graphical models, EM algorithm, approximate inference techniques, Markov models, random sequences, WSS sequences, Kalman filtering*

Teaching Assistant, Information & Inference (6.437, MIT) Spring 2011
- *Graduate-level course satisfying TQE (technical qualifying evaluation) requirement*
- *TA Responsibilities: teaching weekly recitation, writing and grading exams, compiling and distributing HW assignments, office hours*

Instructor, Eta Kappu Nu (MIT) Intersession 2006
- *Co-developed an introductory signals and systems course for underclassmen*
- *Taught four classes, each one lasting for three hours*

Book Chapters and Volumes

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, In Press for 2018.

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.

Journal Articles

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, ePub 2017.

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.

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.

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.

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.

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.

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.

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.

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.

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.

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 Publications

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.* Submitted to In MICCAI: International Conference on Medical Image Computing and Computer Assisted Intervention, 2018.

J. Craley, E. Johnson, **A. Venkataraman**. *A Novel Method for Epileptic Seizure Detection Using Coupled Hidden Markov Models.* Submitted to In MICCAI: International Conference on Medical Image Computing and Computer Assisted Intervention, 2018.

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: MICCAI Workshop on Connectomics in NeuroImaging, LNCS 10511, pp. 60-69 2017.

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. Multimodal Learning for Clinical Decision Support, pp. 1-8, 2016.

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. Bayesian and Graphical Models for Biomedical Imaging, pp. 1-12, 2015.

A. Sweet*, **A. Venkataraman***, S.M. Stufflebeam, 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.
Selected for Oral Presentation (10% of Accepted Publications)
**equal contribution by first two authors*

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.
Selected for Oral Presentation (10% of Accepted Publications)

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.
Selected for Oral Presentation (10% of Accepted Publications)

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.

A. Venkataraman, K.R.A Van Dijk, R.L. Buckner and P. Golland. *Exploring Functional Connectivity in fMRI via Clustering.* In Proc. ICASSP: IEEE Conference on Acoustics, Speech and Signal Processing, 441-444, 2009.

P. Golland, D. Lashkari and **A. Venkataraman**. *Spatial Patterns and Functional Profiles for Discovering Structure in fMRI Data.* Invited paper In Proc. Asilomar Conf on Signals, Systems and Computers, 1402-1409, 2008.

A. Venkataraman and A.V. Oppenheim, *Signal Approximation using the Bilinear Transform*, In Proc. ICASSP: IEEE International Conference on Acoustics, Speech and Signal Processing, 3729-3732, 2008.

Conference Abstracts

N.S. D'Souza, M.B. Nebel, N. Wymbs, S. Mostofsky, **A. Venkataraman**. *A Generative-Discriminative Basis Learning Framework to Predict Autism Spectrum Disorder Severity.* In Proc. ISBI: International Symposium on Biomedical Imaging, 2018.

N. Nandakumar, N.S. D'Souza, H. Sair, **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.

J. Craley, E. Johnson, **A. Venkataraman**. *Robust Seizure Detection Using Coupled Hidden Markov Models.* In Proc. ISBI: International Symposium on Biomedical Imaging, 2018.

A. Venkataraman, J.S. Duncan, D. Yang and K.A. Pelphrey. *Abnormal Functional Communities in Autism.* IMFAR: Intl Meeting For Autism Research, 2016. **Selected for Oral Presentation ($< 5\%$ of Abstracts)**

D. Rangaprakash, G. Deshpande, **A. Venkataraman**, J.S. Katz, T.S. Denney and M.N. Dretsch. *Identifying Foci of Brain Disorders from Effective Connectivity Networks*, ISMRM, 2016. **Received Honorable Mention**

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.

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.

A. Venkataraman, M. Kubicki and P. Golland. *From Brain Connectivity Models to Identifying Foci of a Neurological Disorder.* 3^{rd} Biennial Conference on Resting State Brain Connectivity, Sept 2012.

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.

Awards and Honors

John C. Malone Assistant Professorship	**April 2017**
Council of Early Career Investigators in Imaging (CECI^2) 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
Asssociation 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

Current Research Support

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 aim to 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.
Funding Amount: $7,000 in Direct Costs for 1 year

JHMI Synergy Award Joint PI: Johnson/Venkataraman 07/01/17 – 06/31/18
Epileptic Seizure Localization via Bayesian Structure Learning
This goal of this project is to develop a mathematical model to track the origin and progression of a focal epileptic seizure in the brain. We use a Bayesian structure learning framework and draw from the wealth of data collected at the JHMI Epilepsy Monitoring Unit.
Funding Amount: $100,000 in Direct Costs for 1 year

Pending Research Support

NIH R21 PI: Venkataraman 07/01/18 – 06/30/20
Exploiting the Heterogeneity of Autism Spectrum Disorder for Multimodal Image Fusion
This project combines static and dynamic imaging information with behavioral measures to capture the underlying neural mechanisms of autism spectrum disorder.
Agency: National Institute of Mental Health
Funding Amount: $275,000 in Direct Costs over 2 years

NSF RI Small PI: Venkataraman 07/01/18 – 06/31/20
A Data-Driven Approach to Understand and Manipulate the Emotional Percept. of Human Speech
This project samples, annotates and characterizes the high-dimensional space of prosodic manipulations to alter the emotional saliency of a natural speech utterance. Broader impacts include a naturalistic therapy for autism, capturing attention in early childhood education and improving human-computer interactions.
Agency: National Science Foundation
Total Funding Amount: $489,689 over 2 years

NSF CRCNS PI: Venkataraman 07/01/18 – 06/31/21
Discovering Network Structure in the Space of Group-Level Functional Differences
This project develops 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
Total Funding Amount: $874,049 over 3 years

***Ten Internal and External Funding Applications Submitted 2016–2018**

Technical Presentations

Invited Talks

2017 IEEE Joint Chapter Meeting Rochester, University of Rochester (BME), UVA Charlottesville, RIT
An Adaptable Framework to Extract Abnormal Brain Networks

2016 Johns Hopkins, UT San Antonio, Vanderbilt, University of Rochester (ECE), WashU St. Louis
An Adaptable Framework to Extract Abnormal Brain Networks

2015 International Symposium on Biomedical Imaging, Brooklyn NY
An Unbiased Bayesian Approach to Func Connectomics Implicates Soc-Comm Networks in Autism

2014 Image Processing Conference at SPIE Medical Imaging, San Diego CA
Characterizing Abnormal Brain Networks

2013 Johns Hopkins University, MIT IMES, UT Austin, MIT Lincoln Laboratory
Characterizing Abnormal Brain Networks

2012 Laboratory for Mathematical Imaging, Harvard & Rising Stars Workshop, MIT
From Brain Connectivity Models to Identifying Foci of a Neurological Disorder
MIT Lincoln Laboratory, Martinos Center for Biomedical Imaging, Yale University
Generative Models of Brain Connectivity for Population Studies

2011 Neurospin, Gif-sur-Yvette, France
Joint Modeling of Anatomical and Functional Connectivity for Population Studies

Conference and Workshop Oral Presentations

2017 CNI: MICCAI Workshop on Connectomics in Neuroimaging
Extracting Network-Based Functional Differences from a Heterogeneous Patient Cohort

2016 IMFAR: International Meeting for Autism Research
Abnormal Functional Communities in Autism

2015 Bayesian and grAphical Models for Biomedical Imaging
Comm Detection in the Space of Func Abnormalities Reveals Abnormal Brain Synchrony in Autism

2013 International Conference on Medical Image Computing and Computer Assisted Intervention
Detecting Epileptic Regions Based on Global Brain Connectivity Patterns

2012 International Conference on Medical Image Computing and Computer Assisted Intervention
From Brain Connectivity Models to Identifying Foci of a Neurological Disorder

2010 International Conference on Medical Image Computing and Computer Assisted Intervention
Joint Generative Model for fMRI/DWI and it Application to Population Studies

2009 Masterworks Symposium, MIT – **Won Best Thesis Presentation Award**
Signal Approximation Using the Bilinear Transform

Poster Presentations

2015 Yale Bioimaging Sciences Retreat Symposium
Bayesian Comm Detection in the Space of Group-Level Functional Differences

2012 3^{rd} Biennial Conference on Resting State Brain Connectivity
From Brain Connectivity Models to Identifying Foci of a Neurological Disorder

2010 IEEE Computer Society Workshop on Mathematical Methods in Biomedical Image Analysis
Robust Feature Selection in Resting-State fMRI Connectivity Based on Population Studies

2009 Annual Meeting of the Organization of Human Brain Mapping
IEEE International Conference on Acoustics, Speech and Signal Processing
Exploring Functional Connectivity in fMRI via Clustering

2008 IEEE International Conference on Acoustics, Speech and Signal Processing
Signal Approximation Using the Bilinear Transform

2005 Interconnect Focus Center Design Review, Atlanta, GA
An Integrated Low-Power Switched-Capacitor DC-DC Power Converter

Professional Service Activities

Editor for "Computational Diffusion MRI & Brain Connectivity" (Springer *Mathematics & Visualization*, 2013)

Organizer for "Mathematical Models for Brain Connectivity" (MICCAI Workshop, 2013)

Reviewer for the IEEE Transactions on Medical Imaging, NeuroImage, PLoS One, the International Conference on Medical Image Computing and Computer Assisted Intervention, the IEEE Conference on Computer Vision and Pattern Recognition, the European Conference on Computer Vision and Neuroinformatics

University Service

Department Head Search Committee, Dept of Chemical and Biomolecular Engineering, JHU (2017 - 2018)
Faculty Search Committee, JHU Electrical & Computer Engineering (2017 - 2018)
Faculty Search Committee, Malone Center for Engineering in Healthcare, JHU (2016 - 2017)
Strategic Planning Committee, Malone Center for Engineering in Healthcare, JHU (2016 - Present)
Graduate Student Admissions, JHU Electrical & Computer Engineering, JHU (2016 - Present)
Curriculum Planning Committee, Whiting School of Engineering, JHU (2016 - Present)

Professional Society Memberships

Siebel Scholar (2007 – Present)
IEEE Member (2006 – Present)
MICCAI Society Member (2008 – 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

Ashdown Residential Scholar Coordinator (MIT)	June 2009 – June 2010
President, Ashdown House Executive Committee (MIT)	June 2008 – June 2009
Living Things Officer, Ashdown House (MIT)	Jan 2006 – June 2008
Boston Open Committee, International Badminton Tournament (Cambridge, MA)	Sept 2004 – June 2008
Honor Society Chair Positions (MIT)	Feb 2006 – Apr 2007
Treasurer and Co-Captain, MIT Badminton Club	June 2005 – June 2006