

# Mohsen Bahrami

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## EDUCATION

### Virginia Tech – Wake Forest University, Winston-Salem, NC

Ph.D. in Biomedical Engineering, *Fall 2019*

Thesis: Brain Networks: Multivariate Tools to Analyze Structure, Function, and Dynamics

Advisors: Paul J. Laurienti, MD, PhD. & Sean L. Simpson, PhD.

### University of Tehran, Tehran, Iran

M.S. in Biomedical Engineering, *Fall 2014*

Thesis: Analysis and Comparison of fMRI Resting-State Functional Connectivity in Patients with Alzheimer's Disease and Healthy Controls

Advisor: Gholam-Ali Hossein-Zadeh, PhD.

### Razi University, Kermanshah, Iran

B.S. in Electrical Engineering, *Fall 2010*

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## EMPLOYMENT

### Research Associate

*January 1, 2020 – present*

*Laboratory for Complex Brain Networks (LCBN)*

*Department of Radiology*

*Wake Forest School of Medicine*

*Winston-Salem, NC 27127, USA*

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## RESEARCH INTERESTS

- Neuroimaging data analysis
  - Signal processing and biomedical image processing
  - Deep learning and machine learning methods
  - Complex brain networks and brain connectivity
  - Multivariate models in brain network studies
  - Computational and theoretical neuroscience
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## BIBLIOGRAPHY

### Peer-Reviewed Journal Articles

1. Burdette JH, Laurienti PJ, Miron LL, **Bahrami M**, Simpson SL, Nicklas BJ, Fanning J, Rejeski JW (2020). "Functional Brain Networks: Unique Patterns with Hedonic Appetite and Confidence to Resist Eating Older Adults with Obesity." *Obesity*, 28 (12): p.2379-2388.

2. **Bahrami M**, Lyday RG, Casanova R, Burdette JH, Simpson SL, Laurienti PJ (2019). “Using Low Dimensional Manifolds to Map Relationships Between Dynamic Brain Networks.” *Frontiers in Human Neuroscience*, 13: p.430.
3. **Bahrami M**, Laurienti PJ, Simpson SL (2019). “Analysis of Brain Subnetworks within the Context of their Whole-Brain Networks.” *Hum Brain Mapp*. 40(17):5123-5141.doi:10.1002/hbm.24762.
4. **Bahrami M**, Laurienti PJ, Simpson SL (2019). “A MATLAB Toolbox for Multivariate Analyses of Brain Networks.” *Hum Brain Mapp*. 40(1):175-186. doi: 10.1002/hbm.24363.
5. Simpson SL, **Bahrami M**, Laurienti PJ (2019). “A Mixed Modeling Framework for Analyzing Multitask Whole Brain Network Data.” *Network Neuroscience*. 3(2):307-324. doi: 10.1162/netn\_a\_00065.
6. **Bahrami M**, Laurienti PJ, Quandt SA, Talton J, Pope CN, Summers P, Burdette JH, Chen HY, Liu J, Howard TD, Arcury TA, Simpson SL (2017).“The Impacts of Pesticide and Nicotine Exposures on Functional Brain Networks in Latino Immigrant Workers.” *Neurotoxicology*.62:138-150.
7. Peterson H, Mayhugh R, **Bahrami M**, Rejeski JW, Simpson SL, Heilman K, Porges SW, Laurienti PJ (2020). “Influence of Heart Rate Variability on Abstinence-related Changes in Brain State in Everyday Drinkers.” *Frontiers in Neuroscience*. Under Interactive Review.

### Manuscripts in Preparation

1. **Bahrami M**, Simpson SL, Burdette JH, Lyday RG, Quandt SQ, Chen H, Arcury TA, Laurienti PJ (2020). “Default Mode Network Disruption Associated with History of Pesticide Exposure in Latinx Children from Farmworker Families.” Submitted.
2. **Bahrami M**, Laurienti PJ, Simpson SL (2020). “A Review on Multivariate Methods for Analyzing Brain Networks.”Submitted.
3. **Bahrami M**, Laurienti PJ, Simpson SL (2020), “A Mixed-Modeling Framework for Whole-Brain Dynamic Network Analysis.” Submitted.

### Peer-Reviewed Extended Abstracts in Conference Proceedings (Published)

1. **Bahrami M**, Hossein-Zadeh GA (2015). “Assortativity Changes in Alzheimer’s Disease: A Resting State fMRI Study.” *IEEE 23<sup>rd</sup> Iranian Conference on Electrical Engineering (ICEE)*. Tehran, Iran. Publisher: IEEE. Pages:141-144. doi: 10.1109/IranianCEE.2015.7146198.
2. **Bahrami M**, Hossein-Zadeh GA (2014). “Functional Parcellation Affect Network Measures in Graph Analysis of Resting-State fMRI.” *21<sup>st</sup> Iranian Conference on Biomedical Engineering (ICBME)*. Tehran, Iran. Publisher: IEEE. Pages:263-268. doi: 10.1109/ICBME.2014.7043933.
3. Yousefi H, **Bahrami M**, Fatehi M, Zoroofi RA (2014). “3D Statistical Shape Models of Radius Bone for Segmentation in Multi Resolution MRI Data Sets.” *21<sup>st</sup> Iranian Conference on Biomedical Engineering (ICBME)*. Tehran, Iran. Publisher: IEEE. Pages:246-251. doi: 10.1109/ICBME.2014.7043930.

## Abstracts/Scientific Exhibits/Presentations at National and International Conferences

1. **(Invited Presentation) Bahrami M**, Simpson SL, Arcury TA, Laurienti PJ. “A Mixed-Effects Modeling Approach to Study the Impacts of Pesticides on Farmworkers’ Brain Networks Using RSfMRI Data.” Joint Statistical Meetings. Chicago, IL. Summer 2016.
2. **Bahrami M**, Laurienti PJ, Simpson SL. “Analyzing Local Subnetworks: Context is Everything.” NetSci. Burlington, VT. Summer 2019.
3. Peterson H, Mayhugh R, Rejeski JW, **Bahrami M**, Simpson SL, Heilman K, Porges SW, Laurienti PJ. “Relationship between Cardiac Vagal Tone and Functional Brain Connectivity in Moderate to Heavy Alcohol Consumers.” Netsci. Burlington, VT. Summer 2019.
4. **Bahrami M**, Laurienti PJ, Simpson SL. “A Matlab Toolbox for Multivariate Analysis of Brain Networks.” BMES Annual Meeting. Atlanta GA. Fall 2018.
5. **Bahrami M**, Laurienti PJ, Simpson SL. “A Matlab Toolbox for Multivariate Analysis of Brain Networks.” Statistical Methods in Imaging. Philadelphia PA. Summer 2018.
6. **Bahrami M**, Laurienti PJ, Arcury TA, Simpson SL. “Brain Networks in Latino Farmworkers with Chronic Exposures to Pesticides.” BMES Annual Meeting. Phoenix AZ. Fall 2017.
7. **Bahrami M**, Laurienti PJ, Arcury TA, Simpson SL. “The Impacts of Pesticide and Nicotine on Functional Brain Networks in Latino Farmworkers.” North Carolina cognition Group Conference. Greensboro NC. Spring 2017.
8. **Bahrami M**, Laurienti PJ, Sandberg JC, Daniel SS, Arcury TA, Simpson SL. “The Impact of Pesticide on Latino Farmworkers’ Functional Brain Networks.” NIEHS Environmental Health Science FEST. Research Triangle Park NC, Fall 2016.
9. **Bahrami M**, Borjkhani M, Hossein-Zadeh GA, Bahrami F. “Lyapunove Exponent as a Feature to Distinguish Patients with Alzheimer’s Disease and Healthy Controls Using Resting-State fMRI BOLD Signals.” 1<sup>st</sup> Iranian Conference on Human Brain Mapping. Tehran, Iran. Fall 2014.
10. **Bahrami M**, Hossein-Zadeh GA. “A Comparison Between Statistical characteristics of a CopulaBased Measure and Cross-Correlation in Resting-State fMRI Connectivity Analysis.” 1<sup>st</sup> Iranian Conference on Human Brain Mapping. Tehran, Iran, Fall 2014.
11. **Bahrami M**, Hossein-Zadeh GA. “On the Robustness of Copula-Based Measures of Connectivity Analysis for Resting-State fMRI Data Analysis.” 5<sup>th</sup> Iranian Conference on Bioinformatics (ICB 2014). Tehran, Iran. Spring 2014.

## Non-Conference Presentations

1. **Bahrami M**, Lyday RG, Casanova R, Burdette JH, Simpson SL, Laurienti PJ. “Trajectories of Dynamic Functional Brain Networks.” SBES Symposium. Virginia Tech, Blacksburg, VA. Spring 2019.
2. **Bahrami M**, Laurienti PJ, Simpson SL. “A Multivariate Model for Statistical Assessments of Biological Networks.” Center for Molecular Signaling (CMS) Seminar. Wake Forest School of Medicine, Winston – Salem, NC. Spring 2018.

3. **Bahrami M**, Laurienti PJ, Simpson SL. “A Matlab Toolbox for Multivariate Analysis of Brain Networks.” *Carolina Network Research Group (NRG) Meeting*. UNC, Chapel Hill, NC. Spring 2018.
4. **Bahrami M**, Laurienti PJ, Simpson PL. “A Matlab Toolbox for Multivariate Analysis of Brain Networks.” *SBES Annual Symposium*. Wake Forest School of Medicine, Winston – Salem, NC. Spring 2018.
5. **Bahrami M**, Laurienti PJ, Arcury TA, Simpson PL. “The Impacts of Pesticide and Nicotine on Functional Brain Networks in Latino Farmworkers.” *SBES Annual Symposium*. Virginia Tech, Blacksburg, VA. Spring 2017.
6. **Bahrami M**, Laurienti PJ, Arcury TA, Simpson PL. “The Impacts of Pesticide and Nicotine on Functional Brain Networks in Latino Farmworkers.” *Research Day*. Wake Forest School of Medicine, Winston - Salem, NC. Spring 2017.
7. **Bahrami M**, Laurienti PJ, Arcury TA, Simpson PL. “A Mixed-Effects Modeling Approach to study the Impacts of Pesticide on Farmworkers’ Brain Networks Using R-fMRI Data.” *SBES Annual Symposium*. Wake Forest School of Medicine, Winston - Salem, NC. Spring 2016.

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## Review of Journal Articles

- NeuroImage
- Human Brain Mapping
- Network Neuroscience
- Statistical Analysis and Data Mining
- Frontiers in Physics
- Brain Connectivity
- TNSRE

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## AWARDS AND HONORS

- Top downloaded paper, 2018-2019, in Human Brain Mapping.
- Clinical Neuroscience project award for the best grant proposal, Fall 2016.
- Admitted into the MS program of the most prestigious university of Iran, University of Tehran, 2011.
- 1<sup>st</sup> rank, achieving the highest GPA among Biomedical Engineering graduate (MS) students.

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## PROFESSIONAL MEMBERSHIP AND SERVICES

- Biomedical Engineering Society (BMES) Organization, Fall 2015 – Present.
  - American Statistical Association, Spring 2016 – Spring 2017.
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## COMPUTER SKILLS

### Programming

- MATLAB, *Advanced*
- Python, *Intermediate*
- SAS, *Intermediate*
- R, *Advanced*
- C, *Basic*
- SLURM, *Intermediate*
- Unix and Shell, *Advanced*

### Neuroimaging Software

- FSL, *Advanced*
- SPM, *Advanced*
- FreeSurfer, *Intermediate*
- CAMINO, *Basic*
- MRICRON, *Intermediate*
- DPABI, *Intermediate*

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## TEACHING ASSISTANT

- Functional Medical Imaging Systems, Graduate Course, Spring 2014.
- Pattern Recognition, Graduate Course, Fall 2014.
- Pattern Recognition, Graduate Course, Fall 2013.

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## PROJECTS

### Software

#### **WFU\_MMNET: Wake Forest University - Multivariate Modeling of brain Networks Toolbox**

*A variety of neuroimaging data such as fMRI, EEG, MEG, and DTI can be analyzed with this toolbox. The toolbox has been developed in MATLAB, but uses SAS, R, or Python (depending on software availability) to perform the statistical modeling. The uploaded software along with its user manual and provided case study has been downloaded around 600 times so far since being released on the NITRC repository in 2019:*

[https://www.nitrc.org/projects/wfu\\_mmnet/](https://www.nitrc.org/projects/wfu_mmnet/)

### Studies

#### **Multivariate Modeling of brain Subnetworks Within the Context of Their Whole-Brain Networks**

*To the best of our knowledge, this study provides a first baseline modeling framework to study local brain subnetworks within the context of their whole-brain networks while controlling for many potential sources of confounding effects. (Funding: K25 EB012236, RO1EB024559, NCATS UL1TR001420, and RO1ES008739).*

#### **Low-Dimensional Manifolds for Mapping Relationships between Brain Network Changes**

*The big complex data used for analyses of brain network changes makes meaningful visualization and interpretation of such changes an exceptional challenge. In this work, we represent such changes as dynamic trajectories in 2D or 3D space. We show that these dynamic trajectories contain meaningful information, as they are able to successfully*

*discriminate between cognitive tasks and study populations. (Funding: P50 AA026117, RO1 ES00873922S1, and RO1 EB024559).*

### **Brain Connectivity and IQ in HCP participants**

*This study investigates the association of brain network and brain connectivity with Human intelligence quotient (IQ) using the entire data of Human Connectome Project (HCP) as the most high-quality data available. This study will open new avenues into understanding the brain and intelligence. (Funding: RO1EB024559).*

### **PACE 5: The Effect of Pesticide Exposures on Cognitive and Brain Development in Latino Children**

*This work investigates abnormalities of brain networks in children of immigrant workers with chronic exposures to pesticide and nicotine. In our previous study we have shown that chronic exposures to pesticide and nicotine alter the brain network of such immigrants such that it could produce complications for high-level cognitive tasks in their later life. Here we hypothesize that such exposures affect the brain of their children as well. (Funding: ES00873922S1).*

### **ACBN: How Mindfulness Modulates Craving and Brain Networks in Moderate-To-Heavy Drinkers**

*Using the developed software and methodological extensions for regional subnetwork analyses, a part of this study funded by P50 AA026117 looks into the brain network connections differences between a period of normal drinking and period of alcohol abstinence in moderate to heavy alcohol consumers. (Funding: P50 AA026117).*

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### **OTHER INTERESTS**

- **Music:** Professional musician playing TAR (a Persian long-necked, waisted instrument) in public events as well as occasional singing.
- **Poetry and Novels:** Reading poems and novels on a regular basis and participating at local poetry nights.
- **Sports:** Playing volleyball and soccer and occasionally hiking

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### **REFERENCES**

**Paul J. Laurienti, M.D, Ph.D. Professor.** Department of Radiology, Wake Forest School of Medicine, Winston-Salem, NC 27157-1088, USA.

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**Sean L. Simpson, Ph.D. Associate Professor.** Department of Biostatistical Sciences, Wake Forest School of Medicine, Winston-Salem, NC 27157-1063, USA.

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**Gholam-Ali Hossein-Zadeh, Ph.D. Professor.** Department of Electrical Engineering, College of Engineering, University of Tehran, Tehran, Iran.

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