Gu, Shi

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Research Interests: computational neuroscience, brain inspired intelligence, neuromorphic computing, brain computer interface

EDUCATION:

University of Pennsylvania (UPenn), School of Arts and Science — Philadelphia, PA, USA
Advisors: Dr. Danielle S. Bassett — Fall 2011 – Spring 2016
Ph.D. in Applied Mathematics and Computational Science
Dissertation: Control Theory Analysis on Brain Networks

Tsinghua University - Academic Talent Program — Beijing, China
B.S. in Mathematics and Physics — Fall 2007 – Spring 2011

EXPERIENCE:

Professor in Computer Science and Engineering of UESTC. — Chengdu, China
Director of Brain and Intelligence Laboratory — June 2017– now

Postdoc in Psychiatric and Developmental Imaging Laboratory. — Philadelphia, PA
May 2016 – May 2017

HONORS:

NeurIPS 2021 Outstanding Reviewer Award	Oct 2021
Forbes China 30 under 30 for 2017	July 2017
China's 1000 Young Talent Program	May 2017
Benjamin Franklin Fellowship, University of Pennsylvania,	June 2011
Union Gold Medal winner (ranked 1st) of S-T Yau College Students Mathematics Contest	Oct 2010

PUBLICATIONS (h-Index of 21, > 2600 citations):

Leading and corresponding author papers:

1. **Shi Gu**, Fabio Pasqualetti, Matthew Cieslak, Scott T. Grafton, Danielle S. Bassett. Controllability of Structural Brain Networks. Nature Communications. Nat Commun. 2015, 6:8414.

2. **Shi Gu**, Theodore Satterthwaite, John Medaglia, Muzhi Yang, Raquel Gur, Ruben Gur, Danielle S. Bassett. Emergence of System Roles in Normative Neurodevelopment. PNAS. 112(44): 13681-13686

3. **Shi Gu**, Richard F. Betzel, Matthew Cieslak, Scott T. Grafton, Fabio Pasqualetti, Danielle Bassett. Optimal Trajectories of Brain State Transitions. NeuroImage (2017).

4. **Shi Gu**, Muzhi Yang, John D. Medaglia, Ruben C. Gur, Raquel E. Gur, Theodore D. Satterthwaite, and Danielle S. Bassett. "Functional hypergraph uncovers novel covariant structures over neurodevelopment." *Human brain mapping* 38, no. 8 (2017): 3823-3835.

5. **Shi, Gu**, Matthew Cieslak, Benjamin Baird, Sarah F. Muldoon, Scott T. Grafton, Fabio Pasqualetti, and Danielle S. Bassett. "The energy landscape of neurophysiological activity implicit in brain network structure." *Scientific reports* 8, no. 1 (2018): 1-15.

6. **Shi, Gu**, Cedric Huchuan Xia, Rastko Ciric, Tyler M. Moore, Ruben C. Gur, Raquel E. Gur, Theodore D. Satterthwaite, and Danielle S. Bassett. "Unifying the Notions of Modularity and Core–Periphery Structure in Functional Brain Networks during Youth." *Cerebral Cortex* 30, no. 3 (2020): 1087-1102.

7. Yang, Huzheng, Xiaoxiao Li, Yifan Wu, Siyi Li, Su Lu, James S. Duncan, James C. Gee, and **Shi Gu***. "Interpretable Multimodality Embedding of Cerebral Cortex Using Attention Graph Network for Identifying Bipolar Disorder." In *International Conference on Medical Image Computing and Computer-Assisted Intervention,* pp. 799-807. Springer, Cham, 2019.

8. Zhang, Tianwei, Lequan Yu, Na Hu, Su Lv, and **Shi Gu***. "Robust Medical Image Segmentation from Non-expert Annotations with Tri-network." In *International Conference on Medical Image Computing and Computer-Assisted Intervention*, pp. 249-258. Springer, Cham, 2020.

9. Cui, Hengji, Dong Wei, Kai Ma, **Shi Gu***, and Yefeng Zheng. "A Unified Framework for Generalized Low-Shot Medical Image Segmentation with Scarce Data." *IEEE Transactions on Medical Imaging* (2020).

10. Deng, Shikuang and **Shi Gu***. "Optimal Conversion of Conventional Artificial Neural Networks to Spiking Neural Networks." *International Conference on Learning Representations* (2021).

11. Yuhang Li, Ruihao Gong, Xu Tan, Yang Yang, Peng Hu, Qi Zhang, Fengwei Yu, Wei Wang, **Shi Gu***. "BRECQ: Pushing the Limit of Post-Training Quantization by Block Reconstruction." *International Conference on Learning Representations* (2021).

12. Yuhang Li, Shikuang Deng, Ruihao Gong, Xin Dong, **Shi Gu***. "Towards Accurate Spiking Neural Networks Conversion by Adaptive Threshold and Layer-wise Calibration." *International Conference on Machine Learning* (2021).

13. Yuhang Li, Feng Zhu, Ruihao Gong, Mingzhu Shen, Xin Dong, Fengwei Yu, Shaoqing Lu, **Shi Gu***. "MixMix: All You Need for Data-Free Compression Are Feature and Data Mixing. " *International Conference on Computer Vision* (2021).

14. Yuhang Li, Yufei Guo, Shanghang Zhang, Shikuang Deng, Yongqing Hai, **Shi Gu***. "Differentiable Spike: Rethinking Gradient-Descent for Training Spiking Neural Networks." *Neural Information Processing Systems* (2021).

15. **Shi Gu**, Panagiotis Fotiadis, Linden Parkes, Cedric H Xia, Ruben C Gur, Raquel E Gur, David R Roalf, Theodore D Satterthwaite, Dani S Bassett. “Network controllability mediates the relationship between rigid structure and flexible dynamics.” *Network Neuroscience (2022).*

16. Shikuang Deng, Yuhang Li, Shanghang Zhang, **Shi Gu***. “Temporal Efficient Training of Spiking Neural Network via Gradient Re-weighting” *International Conference on Learning Representations* (2022).

17. Shikuang Deng, Jingwei Li, B.T. Thomas Yeo, **Shi Gu***. “Control theory illustrates the energy efficiency in the dynamic reconfiguration of functional connectivity.” *Communications Biology*, *5*(295), 2022.

18. Biqiu Tang, Wenjing Zhang, Shikuang Deng, Jiang Liu, Na Hu, Qiyong Gong, **Shi Gu***, Su Lui*. “Age-associated network controllability changes in first episode drug-naïve schizophrenia.” *BMC psychiatry,* 22(1), 1-9.

19. Na Hu, Tianwei Zhang, Yifan Wu, Biqiu Tang, Minlong Li, Bin Song, Qiyong Gong, Min Wu, **Shi Gu***, and Su Lui*. "Detecting brain lesions in suspected acute ischemic stroke with CT-based synthetic MRI using generative adversarial networks." *Annals of Translational Medicine* 10, no. 2 (2022).

20. Biqiu Tang, Wenjing Zhang, Jiang Liu, Shikuang Deng, Na Hu, Youjin Zhao, Nian Liu, Jiaxin Zeng, Hengyi Cao, John A. Sweeney, Qiyong Gong, **Shi Gu***, Su Lui. "Altered controllability of white matter networks and related brain function changes in first-episode drug-naïve schizophrenia." *(Accepted by Cerebral Cortex)*

21. Yuhang Li, Shikuang Deng, Xin Dong, **Shi Gu***. "Converting Artificial Neural Networks to Spiking Neural Networks via Parameter Calibration." *arXiv preprint arXiv:2205.10121 (under review by TPAMI)*

22. Shwai He, Yuhang Li, Chenbo Jiang, **Shi Gu***. "When Sparsity Meets Dynamic Convolution". arXiv preprint arXiv:2204.02227

23. Yingni Chen, Shikuang Deng, Yuhang Li, Xin Dong, **Shi Gu***. " Synergistic Neuromorphic Federated Learning with ANN-SNN Conversion For Privacy Protection". (*under review by ICLR 2021*)

24. Hao Lin, Shikuang Deng, Yuhang Li, **Shi Gu***. "Efficient Surrogate Gradients for Training Spiking Neural Networks". (*under review by ICLR 2021*)

Collaborative papers:

1. Richard F Betzel, **Shi Gu**, John D Medaglia, Fabio Pasqualetti, Danielle S. Basset. Optimally controlling the human connectome: the role of network topology. *Scientific Reports* 6 (2016).

2. Sarah Feldt Muldoon, Fabio Pasqualetti, **Shi Gu**, Matthew Cieslak, Scott T. Grafton, Jean M. Vettel, Danielle S. Bassett. Stimulation-based control of dynamic brain networks. *PLoS Comput Biol, 12(9),* p.e 1005076.

3. Wiles, Laura, **Shi Gu**, Fabio Pasqualetti, Brandon Parvesse, David Gabrieli, Danielle S. Bassett, and David F. Meaney. "Autaptic connections shift network excitability and bursting." *Scientific Reports* 7 (2017).

4. Ashourvan, Arian, **Shi Gu**, Marcelo G. Mattar, Jean M. Vettel, and Danielle S. Bassett. "The Energy Landscape Underpinning Module Dynamics in the Human Brain Connectome." *NeuroImage* (2017)..

5. Medaglia, John D., Shi Gu, Fabio Pasqualetti, Rebecca L. Ashare, Caryn Lerman, Joseph Kable, and Danielle S. Bassett. "Cognitive control in the controllable connectome." *arXiv preprint arXiv*:1606.09185 (2016).

6. Murphy, Andrew C., Shi Gu, Ankit N. Khambhati, Nicholas F. Wymbs, Scott T. Grafton, Theodore D. Satterthwaite, and Danielle S. Bassett. "Explicitly linking regional activation and function connectivity: community structure of weighted networks with continuous annotation." *arXiv preprint arXiv:*1611.07962 (2016).

7. Heidi K Norton, Harvey Huang, Daniel J Emerson, Jesi Kim, **Shi Gu**, Danielle S Bassett, Jennifer E Phillips-Cremins. Detecting hierarchical 3-D genome domain reconfiguration with network modularity. *Nature methods*, *15*(2), p.119

8. Tang, Evelyn, Chad Giusti, Graham L. Baum, **Shi Gu**, Eli Pollock, Ari E. Kahn, David R. Roalf et al. "Developmental increases in white matter network controllability support a growing diversity of brain dynamics." *Nature Communications*8, no. 1 (2017): 1252.

9. Cedric Huchuan Xia, Zongming Ma, Rastko Ciric, **Shi Gu**, Richard F Betzel, Antonia N Kaczkurkin, Monica E Calkins, Philip A Cook, Angel Garcia de la Garza, Simon N Vandekar, Zaixu Cui, Tyler M Moore, David R Roalf, Kosha Ruparel, Daniel H Wolf, Christos Davatzikos, Ruben C Gur, Raquel E Gur, Russell T Shinohara, Danielle S Bassett, Theodore D Satterthwaite., 2018. Linked dimensions of psychopathology and connectivity in functional brain networks. *Nature communications*, *9*(1), p.3003.

10. Zhen Yang, **Shi Gu**, Nicolas Honnorat, Kristin A Linn, Russell T Shinohara, Irem Aselcioglu, Steven Bruce, Desmond J Oathes, Christos Davatzikos, Theodore D Satterthwaite, Danielle S Bassett, Yvette I Sheline. *Molecular psychiatry*, p.1.

11. Bernhardt, Boris C., Fatemeh Fadaie, Min Liu, Benoit Caldairou, **Shi Gu,** Elizabeth Jefferies, Jonathan Smallwood, Danielle S. Bassett, Andrea Bernasconi, and Neda Bernasconi. "Temporal lobe epilepsy: Hippocampal pathology modulates connectome topology and controllability." *Neurology* 92, no. 19 (2019): e2209-e2220.

12. Yang, Zhen, Qawi K. Telesford, Alexandre R. Franco, Ryan Lim, **Shi Gu**, Ting Xu, Lei Ai et al. "Measurement Reliability for Individual Differences in Multilayer Network Dynamics: Cautions and Considerations." *NeuroImage* (2020): 117489.

13. Cui, Zaixu, Jennifer Stiso, Graham L. Baum, Jason Z. Kim, David R. Roalf, Richard F. Betzel, **Shi Gu** et al. "Optimization of energy state transition trajectory supports the development of executive function during youth." *Elife* 9 (2020): e53060.

14. Ashourvan, Arian, Preya Shah, Adam Pines, **Shi Gu**, Christopher W. Lynn, Danielle S. Bassett, Kathryn A. Davis, and Brian Litt. "Pairwise maximum entropy model explains the role of white matter structure in shaping emergent co-activation states." *Communications Biology* 4, no. 1 (2021): 1-15.

15. Zhang, Longfei, Ke Li, and **Shi Gu**. "Empirical study of correlations in the fitness landscapes of combinatorial optimization problems." *Proceedings of the Genetic and Evolutionary Computation Conference Companion. 2021.*

16. Qian Li, Li Yao, Jiang Liu , Deng Shikuang, Bin Li, Lekai Luo, Youjin Zhao, Wanfang You, Yuxia Wang, Yaxuan Wang, Qian Zhang, Fenghua Long, John A. Sweeney, **Shi Gu**, Fei Li, Qiyong Gong. "Controllability of functional brain networks and its clinical significance in first-episode schizophrenia". *Accepted by Schizophrenia Bulletin. 2022*

FUNDINGS:

1. NSFC General program (PI): controllability modeling and analysis on functional brain networks, RMB 0.62 million
2. Young Talent Program package (PI): RMB 3 million
3. School startup package (PI): RMB 3 million
4. Shenzhen General program (PI): Brain-inspired Training Methods of Spiking Neural Network, RMB 0.60 million
5. Key Lab of Longhua District (PI), Shenzhen, RMB 1.5 million
6. Key program of NSFC (coPI): Online Learning for Spiking Neural Networks, RMB 0.99 million

TEACHING:

1. Introduction to Electronic Information Science and Technology, Spring 2018
2. Introduction to Artificial Intelligence, Fall 2018, Fall 2019, Fall 2020
3. Advanced topics in Computer Science, Fall 2021, Fall 2022
4. Academic Writing for Ph.D. Students, Fall 2021, Fall 2022
5. Artificial Intelligence, Fall 2022

ACTIVITIES:

1. IPMI 2019 International Summer School, May 2019, Chengdu, Co-organizer.
2. SfN Global Event: AI meets Neuroscience, Jan 2021, Online, Co-chair.
3. Board Member: Recruitment of Tenure-track Assistant Professor in Computer Science, UESTC, 2020-
4. Frontiers in Neuroimaging, Associate Editor

INVITED TALKS:

1. TEDxChengdu 2017: Understand our brain, Chengdu, Nov, 2017
2. NetSci 2018 Satellite Symposium: Controlling complex networks, Paris, June 11, 2018
3. OHBM 2018 Symposium: A spotlight on network hub, Singapore, June 11, 2018
4. SfN 2018 Minisymposium: Controllability Analysis on Functional Brain Networks, Nov 6, 2018
5. SfN 2019 Minisymposium: Cross-modality optimization of Brain's Modular Structure, Oct 22, 2019
6. Invited Talk in Fudan University: Neurodevelopment from the network perspective, May 2020
7. Invited Talk in Tsinghua University: Control Theoretic Analysis on Brain Networks, May 2021
8. Invited Talk in Peking University: Conversion Theory for Spiking Neural Networks, May 2021
9. Invited Lecture in Peking University: Introduction to Network Neuroscience, May 2021
10. Invited Talk for *Guest Lecture in China: Research,* April 6, 2022
11. Invited Talk in Zhejiang University: Modularization for Brain and Brain-inspired Neural Networks, Aug 2022
13. Invited Talk in Beijing Academy of Artificial Intelligence: Modularization for Brain and Brain-inspired Neural Networks, Sep 2022

SUPERVISED STUDENTS:

Current:

1.	Shikuang Deng (Ph.D. candidate in Computer Science)	Fall 2018 to present
2.	Tianwei Zhang (Ph.D. candidate in Computer Science)	Fall 2018 to present
3.	Yanyun Gao (Ph.D. student in Computer Science)	Fall 2021 to present
4.	Wei Li (M.S. student in Computer Science)	Fall 2021 to present
5.	Lin Li (M.S. student in Computer Science)	Fall 2021 to present
6.	Yang Liu (M.S. student in Computer Science)	Fall 2021 to present
7.	Yihang Li (M.S. student in Computer Science)	Fall 2020 to present
8.	Wei Zhang (M.S. student in Computer Science)	Fall 2020 to present
9.	Lidong Guo (M.S. student in Computer Science)	Fall 2020 to present
10.	Wenqiang Guo (M.S. student in Computer Science)	Fall 2020 to present
11.	Jun Jiang (M.S. student in Computer Science)	Fall 2020 to present
12.	Shuai Shao (M.S. student in Computer Science)	Fall 2020 to present
13.	Hao Lin (M.S. student in Computer Science)	Fall 2020 to present
14.	Kun Chen (M.S. student in Computer Science)	Fall 2020 to present
15.	Zipei Zhang (M.S. student in Computer Science)	Fall 2020 to present

Past:

1. Huili Sun (currently Ph.D. student at Yale University)
2. Huzheng Yang (currently Ph.D. student at University of Pennsylvania)
3. Yuhang Li (currently PhD. student at University Yale University)
4. Wenqi Gu (currently Ph.D. student at Tsinghua University)
5. Yu Feng (currently Ph.D. student at Shanghai Jiaotong University)
6. Mengmeng Zhu (M.S. in Computer Science) Fall 2019 - Spring 2022
7. Zelong Su (M.S. in Computer Science) Fall 2019 - Spring 2022
8. Hengji Cui (M.S. in Computer Science) Fall 2018 - Spring 2021
9. Jiang Liu (M.S. in Computer Science) Fall 2018 - Spring 2021
10. Zhangzhe Cao (M.S. in Computer Science) Fall 2018 - Spring 2021
11. Wei Guo (M.S. in Computer Science) Fall 2018 - Spring 2021
12. Bin Li (M.S. in Computer Science) Fall 2018 - Spring 2021
13. Maoxiang Xiong (M.S. in Computer Science) Fall 2017 - Spring 2020
14. Chuang Li (M.S. in Computer Science) Fall 2017 - Spring 2020
15. Zelin Zhu (M.S. in Computer Science) Fall 2017 - Spring 2020

REFERENCES:

1. **Dani Smith Bassett**, dsb@seas.upenn.edu
J. Peter Skirkanich Professor, University of Pennsylvania & Santa Fe Institute

2. **James C. Gee**, gee@upenn.edu
Professor of Radiologic Science in Radiology, University of Pennsylvania

3. **BT Thomas Yeo**, yeoyeo02@gmail.com
Associate Professor of Electronical & Computer Engineering, National University of Singapore

4. **Theodore D. Satterthwaite**, sattertt@pennmedicine.upenn.edu
Associate Professor of Department of Psychiatry, University of Pennsylvania

5. **Murray Grossman**, mgrossma@pennmedicine.upenn.edu
Emeritus Professor of Neurology, University of Pennsylvania