Zhuocheng Xiao

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EDUCATION

Program in Applied Mathematics,
The University of Arizona 08/2016 – present
Ph.D., Applied Mathematics, Expected in August 2020
Co-Advised by Dr. Kevin Lin and Dr. Jean-Marc Fellous

School of Life Sciences, Peking University, China 09/2012 – 07/2016
Bachelor of Biological Science, July 2016
Dual Bachelor of Mathematical Science, 2016
Advised by Dr. Louis Tao

RESEARCH EXPERIENCE

Project: **The Dynamics and Reconsolidations of Spatial Representations of Reward in Brain** 01/2018 – present
Advisors: **Prof. Jean-Marc Fellous & Prof. Kevin Lin**
Psychology Department, Mathematics Department, The University of Arizona

- A continuous range of pyramidal cell population from place cells and reward cells is found in our reward experiment, suggesting a representation system for both space and reward. We explore the structure of such representation and analyse the role it plays in hippocampal memory reconmsolidation. We have also developed a novel method to quantitatively measure how are the sequential structure of firing patterns in tasks repeated in sleep.

Project: **Multilevel Monte Carlo Methods for Spiking Networks** 01/2017 – 12/2017
Advisor: **Prof. Kevin Lin**
Mathematics Department, The University of Arizona

- A common task in computer modeling of large networks is to collect dynamical statistics like firing rates and correlations elicited by stimuli. We have developed a numerical theory enabling Multilevel Monte Carlo methods for Integrate-Fire spiking network, with the challenge of discontinuous variables and highly nonlinear dynamics.

Project: **Analysis on Iterative System of Synfire Chain** 10/2014 – 07/2016

Advisors: **Prof. Louis Tao & Prof. Jiwei Zhang**
Center for Bioinformatics, Peking University, Beijing, China
Beijing Computational Science Research Center, Beijing, China

- Developing an iterative dynamical system for Gaussian-simplified and accurate Synfire Chain, using phase-plane analysis and moment closure to find the crucial mechanism of graded current propagation in a large group of feedforward networks.

Project: **A Fokker-Planck Approach to Graded Current Propagation in Pulse-Gated Feedforward Neuronal Networks**

09/2013 – 10/2014

Advisor: **Prof. Louis Tao**
Center for Bioinformatics, Peking University, Beijing, China

- Applying current-based Fokker-Planck approach to continuous simulation of the stochastic process of Synfire Chain to gain graded current propagation and developing an iterative dynamical system for Synfire Chain roughly.

PUBLICATIONS

- **Xiao, Z.**; Lin, K.K.; Fellous, JM. *The Dynamics and Reconsolidations of Spatial Representations of Reward in Brain.* In Preparation.
- **Xiao, Z.**; Lin, K.K.; Fellous, JM. *Conjunctive Reward-Place Coding Properties of Dorsal Distal CA1 Hippocampus Cells.* Submitted.
- Dong, Y.; Wang, J.; **Xiao, Z.**; Hu, H. *Relief as a natural resilience mechanism against depression.* Submitted.
- **Xiao, Z.**; Lin, K.K. *A Multi-Level Monte Carlo Algorithm for Integrate-Fire Neuron Network.* Submitted.
- **Xiao, Z.**; Wang, B.; Sornborger, A.; Tao, L. *Mutual Information and Information Gating in Synfire Chains.* Entropy 2018, 20(2), 102.
- **Xiao, Z.**; Zhang, J.; Sornborger, A.; Tao, L. *Cusps enable line attractors for neural computation.* Phys. Rev. E 2017, 96, 052308.
- Wang, C.; **Xiao, Z.**; Wang, Z.; Sornborger, A.; Tao, L. *A Fokker-Planck approach to graded information propagation in pulse-gated feed-forward neuronal networks.* Preprint. arXiv:1512.00520.

Presentations

Invited Talks

- *Computational Strategies in Analysis of Hippocampal Data* Analysis and Its Applications Seminar, The University of Arizona 03/2018
- *Multi-Level Monte Carlo Methods for Spiking Networks,* Modeling and Computation Seminar, The University of Arizona 02/2019

Posters

- *Continuous Reward-Place Coding Properties of Dorsal Distal CA1 Hippocampus Cells,* Society for Neuroscience 2019 10/2019
- *Multi-Level Monte Carlo Methods for Spiking Networks,* SIAM Conference on Applications of Dynamical Systems (DS19) 05/2019
- *Multi-Level Monte Carlo Methods for Spiking Networks,* and *Cusps Enable Faithful Information Transfer in Feed-Forward Networks,* 27th Annual Computational Neuroscience Meeting (CNS 2018) 07/2018

Teaching Assistant

In the University of Arizona:

- Math 583 *Principles and Methods of Applied Mathematics* 2018 Fa – present
- Math 254 *Ordinary Differential Equations* 2017 Fa – 2018 Fa
- Math 112 *College Algebra* 2016 Fa – 2017 Sp

In Peking University:

- *Mathematical Modeling in the Life Sciences* 2015 Sp
- *Advanced Mathematics* 2015 Sp
- *Journal Club of the Frontier for Life Sciences* 2014 Fa
- *Mathematical Modeling in the Life Sciences* 2014 Sp

AWARDS AND HONORS

Selected Presentation, 3rd Annual Symposium of Undergraduate Research Honor Program in Biology 2015

Best Poster, 2nd Annual Symposium of Undergraduate Research Honor Program in Biology 2014

Admitted into Undergraduate Research Honor Program in Biology of Peking University 2013

Gold Medal (ranking 5th), 10th Chinese Western Mathematical Olympiad 2010

SKILLS AND INTERESTS

Demonstrated Coding Skills for:

• Matlab, C, R

Experience for:

• Python, Julia

Language: English (fluent).