Qi Xin

Email: qix@andrew.cmu.edu | Personal homepage | Phone: 412-209-5740

Education

Ph.D. in Statistics and Neural Computation, Carnegie Mellon University Jan 2020 – (exp) Dec 2024

B.S. in Physics, University of Science and Technology of China (USTC) 2014 – 2018

Qualification

- 5+ Years research experience in statistics, computational neuroscience, and machine learning.
- 5+ Years of programming experience, familiar with Python (PyTorch, Jupyter Notebook), MATLAB, R, LaTeX.

Research Experience

My research lies in time series analysis with special focus on point processes and their applications in neuroscience.

Detecting interactions between multiple groups of point processes in brain data Mar 2022 – Present

Advisor: Prof. Robert E. Kass

- Designed a robust and efficient generative model to detect interactions between groups of point processes.
- Achieved higher statistical power while reducing quadratic complexity to linear complexity, by pooling point processes and introducing non-linear self-modulating effects.
- The inferred graph of communication between mouse visual areas reveals new cross-area interactions undiscovered.

Neural activity reconstruction from multi-electrode local field potential recording Jan 2021 – Oct 2021

Advisor: Prof. Robert E. Kass

- Created a current source reconstruction method based on regularized regression, which outperforms current methods with higher accuracy and fewer artifacts.
- Developed an optimization algorithm which efficiently handles highly correlated predictors with multiple regularization terms including L1 penalty.

Modeling the locomotion decision-making network of C. elegans Apr 2017 – Jun 2019

Advisor: Prof. Quan Wen

- Built a biological neural network model that explains and reproduces the behavioral statistics of C. elegans (roundworm) escape response. The model correctly predicted results of other experiments, including optogenetic and calcium imaging.
- Trained a recurrent spiking network to perform escape response with evolutionary algorithm, which matches the proposed model undesignedly.

Theoretical study on point process generalized linear models Dec 2019 – Dec 2020

Advisor: Prof. Robert Kass

- Proved orthogonality of the history effect to stimulus effect in point process generalized linear models of spiking neurons.
- Developed an algorithm that estimates coupling effects twenty times more efficiently than traditional approaches.

Fixing the inherent instability problem in empirical spiking neuron model Jul 2017 – Sep 2017

Advisor: Prof. Robert Kass

- Explored causes and proposed solutions for the instability problem: fitted point process regression models pass the goodness-of-fit test but generate simulated spike trains with explosive firing rates.
- Created an outlier detection method and a lack-of-data diagnosis to avoid instability.

Selected Course Project

Image caption generation with Transformer-Transformer architecture Fall 2021

Course: 10-701 Introduction to Machine Learning

We implemented a Transformer-Transformer architecture image captioning model, with pretrained Vision Transformer (ViT) as the encoder and GPT-2 as the decoder. After fine-tuning, our model outperforms the CNN-LSTM baseline. We further improved the performance by data augmentation. See our final report here.

Publication

1) Yuan Wang*, Xiaoqian Zhang*, **Qi Xin***, et al, and Quan Wen. **Flexible motor sequence generation during stereotyped escape responses.** *eLife* (2020). **(* Equal contribution)** (link)
2) Yu Chen*, **Qi Xin***, Valerie Ventura and R. E. Kass. **Stability of point process spiking neuron models.** *Journal of Computational Neuroscience* (2018). **(*Equal contribution)** (link)
3) **Qi Xin**, Spencer Koerner and R. E. Kass. **Spike train variability from quasi-Poisson neuron models.** *in preparation*
4) **Qi Xin**, and R. E. Kass. **Current source density reconstruction with penalized regression.** *in preparation*