KAI CHEN

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EDUCATION

SHANGHAI JIAO TONG UNIVERSITY   *Ph.D of Applied Mathematics*   09/2020-Present
❖ **Relevant Courses**: *Scientific Computing, High performance Computing in ODEs and PDEs, Inverse Problems;*
SHANGHAI JIAO TONG UNIVERSITY   *Master of Science of Physics*   09/2018-06/2020
❖ **GPA**: 3.57/4.0;
❖ **Relevant Courses**: *Advanced Statistical Physics, Biological Physics, Advanced Electrodynamics and Analytical Mechanics;*
SHANGHAI JIAO TONG UNIVERSITY   *Bachelor of Science of Physics*   09/2013-06/2017
❖ **Rank**: 4/71;   **GPA**: 3.78/4.0;
❖ **Scholarships**: National Scholarship; *Liuyuan* Scholarship of Shanghai Jiao Tong University;
❖ **Relevant Courses**: *Statistical Physics, Computational Physics, Biological Physics, Electrodynamics, Calculus, Linear Algebra, Partial Differential Equation, Complex Variables;*
❖ **Awards**: Champion in *Shanghai Undergraduate Physicists' Tournament*; Champion in *Shanghai Mathematical Contest in Modeling*; Second Prize in *National Mathematical Contest in Modeling*; Successful Participant in *COMAP's Mathematical Contest in Modeling*; Outstanding Graduates of Shanghai Jiao Tong University;

PRESENTATIONS

Oral Presentations:
❖ *Quantitative relations among causality measures with applications to nonlinear pulse-output network reconstruction,* CSIAM2022, online, Nov. 2022.
❖ *Modeling Attentional Modulated Spike Count Correlation in Macaque V1*, CCCN2021, online, Jun. 2021.
Posters:
❖ *Quantitative relations among causality measures with applications to nonlinear pulse-output network reconstruction,* CCCN2022, online, Jun. 2022.
❖ *Modeling Attentional Modulated Spike Count Correlation in Macaque V1*, CCCN2021, online, Jun. 2021.

RESEARCH EXPERIENCE

Project: Effective Inference of Functional Connectivity from ECoG Data Using TDMI   **SHANGHAI**
Shanghai Jiao Tong University   *Supervisor: Prof. Li, Songting; Zhou, Douglas*   01/2021-Present
❖ Developed time-delayed mutual information(TDMI) analysis framework for analyzing neurophysiological data(ECoG).
❖ Showed that strong TDMI inferred signal highly consistent with anatomical connectivity(structure connectivity) with high positive prediction correct rate(PPV) for ECoG data.
❖ Demonstrated the merit of our TDMI inference framework by compared our inference performance based on conventional Granger causality(GC) and conditional GC.
❖ Developed banded inference framework for ECoG data.

Project: Modeling Attentional Modulated Spike Count Correlation(R_{sc}) in Macaque V1   **SHANGHAI**
Shanghai Jiao Tong University   *Supervisor: Prof. Li Songting; Zhou, Douglas*   12/2019-Present
❖ Built neural rate model to simulate the effective dynamics in the delayed color-change detection tasks of macaques.
❖ Fitted the non-monotonic modulations for R_{sc} w.r.t. task difficulty in our model to the electrophysiology data.
❖ Obtained a set of optimized parameters for the structure of model system with the help of *mean field theory* analysis.
❖ Revealed the role of specific top-down inputs towards inhibitory neurons in the attentional modulation.
❖ Built *spiking neuronal network*(SNN) model to verify prediction got from neural rate model.

Project: Causal Inference of Neuronal Data Based on Time-delayed Mutual Information   **SHANGHAI**
Shanghai Jiao Tong University   *Supervisor: Prof. Zhou, Douglas*   07/2017-12/2018
❖ Developed time-delayed mutual information (TDMI) analysis between Gaussian random variables.
❖ Revealed the quantitative relation between inferred causality and coupling strength between Gaussian units.
❖ Designed a pipeline for TDMI estimation between spike train and local field potentials (LFPs) and confirmed its feasibility on causal inference between two types of neuronal signals.
❖ Determined the relation between interacting strength and the value of mutual information for weakly coupled neurons.
❖ Revealed the difference behavior of excitatory and inhibitory neurons in TDMI analysis.
❖ Determined the feasible network dynamical regime for TDMI analysis.

Project: Study of Network Dynamics Based on Integrate-and-Fire Neuron Model   **SHANGHAI**
Shanghai Jiao Tong University   *Supervisor: Prof. Zhou, Douglas; Cai, David*   02/2016-06/2017
❖ Developed programs for point neuronal network simulation, implementing conductance-based LIF model with 4th order global convergence (based on *Runge-Kutta* algorithm).
❖ Simulated dynamics of 'small-world' networks with up to a thousand neurons. Investigated their oscillations using rasters and power spectrums as functions of different Poisson input conditions.

Project: Coherent Diffraction Imaging (CDI) of Micro-Scale Samples   **SHANGHAI**
Shanghai Jiao Tong University   *Supervisor: Prof. Xiang, Dao*   09/2014 - 06/2015
❖ Developed *CDI* retrieval algorithm, and tested it with numerical samples;
❖ Designed and Constructed optical layout of 532nm laser-based CDI. Designed samples and recorded diffraction patterns.
❖ Optimized the performance of the system, and retrieved the structure of samples with ~2um spatial resolution;

Project: Femtosecond Pump-probe Spectroscopy (FPPS) of Protein Photosynthesis   **DAVIS, CA, US**
University of California, Davis   *Supervisor: Dr. Cramer, Stephen*   08/2016 - 09/2016
❖ Adjusted optical layout of non-colinear optical parametric amplifiers (NOPAs).
❖ Built optical systems of FPPS. Ran FPPS study on putidaredoxin. Modified FPPS system by adapting lock-in amplifier.
❖ Reconstructed reaction modes based on global analysis simulations with sequential photosynthesis models.

SKILLS AND SPECIALISTS

Programming: Python, C/C++, LaTeX, Shell, MATLAB/Octave
Hobbies: Chinese Calligraphy; Chinese Flute; Powerlifting;