KAIWEN SHENG

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EDUCATION

University College London   **London, UK**
MRes in Biosciences: Neuroscience   Expected Sept 2022
Peking University   **Beijing, CN**
BS in Computer Science   Jun 2020

RESEARCH PROJECTS

A computational framework to investigate the functional specificity of cortical neurons   **University College London**
Advised by Prof. Michael Häusser and Dr. Brendan Bicknell   Dec 2021 - Present
- Developed a general learning rule with which detailed models of neurons, comprising 3D reconstructed morphologies and an array of active conductances, can be 'trained' to perform sophisticated computational tasks.
- Trained biophysical models from Allen Cell Types Database to implement nonlinear feature-binding computations, Boolean logic operations, and a regression task designed to test the limits of stimulus selectivity.
- Identified a diverse set of morphological and biophysical features to explain the computational performances of different neuron models.

Inferring Neural Properties from Neural Data across Scales   **Beijing Academy of Artificial Intelligence**
Advised by Dr. Kai Du, Dr. Shanghang Zhang and Dr. Lei Ma   Jan 2020 - Present
- Proposed a general domain adaptive neural inference framework to infer biophysical properties and connectivity.
- Designed self-training and domain adaptation to avoid biased inference results caused by out-of-distribution problem.
- Accurately and efficiently inferred biophysical properties of 550 neurons across 14 brain regions of mice and those of a microcircuit with 3 neurons of *Cancer Borealis*.
- Achieved near-optimal accuracy in inferring monosynaptic connectivity of networks in the CA1 region of mice.

A Human Perception-based Criterion for Cell Membrane Segmentation   **Beijing Academy of Artificial Intelligence**
Advised by Dr. Kai Du and Dr. Tingting Jiang   Aug 2020 - March 2022
- Helped design, organize perceptual experiments, and analyze subjects' result.
- Manually annotated cell membranes of electron microscopy images.

A General-Purpose Tracker for Animal Behavior Analysis   **Beijing Academy of Artificial Intelligence**
Advised by Dr. Kai Du and Dr. Lei Ma   Aug 2019 - March 2022
- Performed accuracy comparison between SNAP-tracker, DeepLabCut and LEAP.
- Analyzed animal behavior based on the tracking results of SNAP-tracker.

PUBLICATIONS

- **Sheng, K.**, Zhang, S., Beau, M., Qu, P., Yang, L., Liu, X., He, L., Ma, L., & Du, K. (2022). Domain Adaptive Neural Inference. *bioRxiv*.
- Shi, R., Wang, W., Li, Z., He, L., **Sheng, K.**, Ma, L., ... & Huang, T. (2022). U-RISC: an annotated ultra-high-resolution electron microscopy dataset challenging existing deep learning algorithms. *Frontiers in Computational Neuroscience*, *21*.
- Su, L.*, Wang, W.*, **Sheng, K.**, Liu, X., Du, K., Tian, Y., & Ma, L. (2022). Siamese Network-Based All-Purpose-Tracker, a Model-Free Deep Learning Tool for Animal Behavioral Tracking. *Frontiers in Behavioral Neuroscience, 48*. (* equally contributed)
- **Sheng, K.**, Qu, P., Yang, L., Liu, X., He, L., Ma, L., & Du, K. (2021). A General LSTM-based Deep Learning Method for Estimating Neuronal Models and Inferring Neural Circuitry. *bioRxiv*.
- Shi, R., Wang, W., Li, Z., He, L., **Sheng, K.**, Ma, L., ... & Huang, T. (2020). Human Perception-based Evaluation Criterion for Ultra-high Resolution Cell Membrane Segmentation. *arXiv preprint arXiv:2010.08209*.
- Zheng, S., Liang, Y., Wang, S., Chen, R., & **Sheng, K.**. (2020, March). FlexTensor: An Automatic Schedule Exploration and Optimization Framework for Tensor Computation on Heterogeneous System. In *Proceedings of the Twenty-Fifth International Conference on Architectural Support for Programming Languages and Operating Systems* (pp. 859-873).

PRESENTATIONS

Posters

- **Sheng, K.**, Bicknell, B.A., Häusser, M. Computational Specialization of Cortical Dendrites.
  UCL Neuroscience Symposium 2022; June 2022; London, United Kingdom.

- Bicknell, B.A., **Sheng, K.**, Häusser, M. Learning to Harness Dendritic Computations.
  Dendrites 2020: Dendritic anatomy, molecules and function; May 2022; Heraklion, Greece.
- **Sheng, K.**, Qu, P., Yang, L., Liu, X., He, L., Ma, L., & Du, K. A General LSTM-based Deep Learning Method for Estimating Neuronal Models and Inferring Neural Circuitry
  Third Chinese Computational and Cognitive Neuroscience Conference; June 2021; Shenzhen, China.

WORKING EXPERIENCE

Leader of Application Research Team | **Beijing Academy of Artificial Intelligence**
Life Simulation Research Center | Jun 2021 - Sept 2021

- Organized research cooperation among researchers and interns.
- Scheduled and summarized weekly discussions on the progress of research projects of the group members.

Software Development Engineer | **Beijing Academy of Artificial Intelligence**
Life Simulation Research Center | Jun 2020 - Sept 2021

- Developed an automatic tool for parameter estimation and optimization for computational neural models.
- Published a preprint paper of the tool on bioRxiv.

TEACHING EXPERIENCE

Compiler Practice | **Peking University**
Teaching Assistant | Feb 2020 - Jun 2020

- Guided students to work through each stage of compiler design, including symbol table construction, type check, intermediate representation generation, register allocation.

Algorithm Design and Analysis Seminar | **Peking University**
Teaching Assistant | Feb 2019 - Jun 2019

- Reviewed and expanded lecture content based on *Introduction to Algorithms*
- Designed exam papers and provided references on reinforcement learning.

ACADEMIC SERVICE

Reviewer of Bioscience Horizons | Nov 2021 - Present

AWARDS

Yanhong Li Scholarship of Peking University | Sept 2019

Excellent Research of Peking University | Sept 2019

Ke Chuanglong Scholarship of Peking University | Sept 2018

Merited Student of Peking University | Sept 2018 & Sept 2017

May Fourth Scholarship of Peking University | Sept 2017