Zeqian Li

https://zeqianli.me | zeqianli.chicago@gmail.com | 217-377-7442

EDUCATION

Graduate Research Assistant, University of Chicago (Chicago, IL)   *Expected July 2023*

Ph.D in Physics, University of Illinois at Urbana-Champaign (Champaign, IL)   *Expected July 2023*
- Center for Physics of Living Cells Fellow (*2018 - 2020*)

B.S in Green Energy Science, Hong Kong Baptist University (Hong Kong)   *Sep 2014 – July 2018*
- Hong Kong Special Administrative Region Government Scholarship (*2015 - 2018*)
- Scholastic Award (*2018*)

RESEARCH AND PROFESSIONAL EXPERIENCE

Seppe Kuehn lab (University of Chicago / UIUC), Research Assistant (IL)   *July 2019 - Present*
- Designed and optimized experiments to assay carbon utilization for more than 100 bacterial strains
- Used machine learning to achieve state-of-the-art prediction of microbial carbon utilization, combining experimental data and large-scale web-scrapped datasets with over 4000 bacterial genomes
- Built custom bioinformatic pipelines (Snakemake) on high-performance computing clusters to analyze over 10TBs of multi-omics NGS data spanning more than 1000 samples
- Extracted DNA and conducted whole-genome shotgun sequencing on soil-isolated microbes
- Created accurate mathematical models for two systems (microbial respiration/photosynthesis and buffering capacity of complex biological media) and validated the models in experiments
- Constructed microcontroller-based (Raspberry Pi) experimental devices and troubleshot Python-based software to interface sensors, PID controllers, and other electronic components

Upward Farms, Microbial Research Associate (Brooklyn, NY)   *May 2022 - Aug 2022*
- Led an innovative experiment to improve hydroponic crop yields by manipulating plant microbiome. Used statistical modeling and 16S sequencing to identify potential plant growth-promoting bacteria
- Built and unit-tested two production-level software prototypes in AWS: a Snakemake pipeline to streamline NGS sequencing data analysis and a web-based R&D experiment management portal
- Performed Nanopore long-read sequencing with the R&D team to profile hydroponic metagenome
- Contributed to other R&D experiments in crop phenotyping and sample collection
- Collaborated closely with the R&D team using Git and project management tools

Hong Kong Baptist University, Research Assistant (Hong Kong)   *July 2015 - June 2018*
- Designed novel machine learning models based on biological neural networks and principles in non-equilibrium statistical physics to conduct computation of input signals
- Implemented novel optimization algorithms in C++ and Python to model *C. elegans* neurons
- Collaborated in three data-driven projects with interdisciplinary teams spanning four research labs

SKILLS

Data analysis: Machine learning, applied statistics, data collection and cleaning, web scrapping, data visualization, remote computing, reinforcement learning, deep learning

Bioinformatics: Snakemake, NGS data (16S, metagenome, transcriptome, single-cell amplified genome), long-read data, databases (KEGG, NCBI, UniProt, Pfam, BioCyc, ENA)

Experimental microbiology: Next-generation sequencing, Oxford Nanopore long-read sequencing, DNA extraction, common wet lab assays, microcontrollers (Arduino, Raspberry Pi), electronics

Computational biology and physics: Computational neuroscience, signal analysis, image analysis, dynamical systems, numerical simulation, statistical physics

Software: Python (Numpy, Pandas, Scikit-Learn, Seaborn, Matplotlib, Jupyter), MongoDB, R, Git, unit-testing, Linux, Bash, dashboard (Dash/Plotly), Java, JavaScript, LaTeX, project management

Other Experience

The Abdus Salam International Centre for Theoretical Physics   *Mar 2018*
Spring College on the Physics of Complex Systems (Trieste, Italy)

○ Completed graduate-level courses in reinforcement learning, statistical physics, and biophysics

Hong Kong Baptist University, Teaching Assistant (Hong Kong)   *July 2015 - June 2018*

○ Taught discussion sessions of Introduction to Physics for two semesters

Publications

Zeqian Li, Ahmed Selim, Seppe Kuehn. "Statistical prediction of microbial metabolic traits from genomes." *In preparation* (2023).

Kyle Crocker, Milena Chakraverti-Wuerthwein, **Zeqian Li**, Madhav Mani, Karna Gowda, Seppe Kuehn. "Genomics patterns in the global soil microbiome emerge from microbial interactions." *In preparation* (2023)

Chandana Gopalakrishnappa, **Zeqian Li**, Seppe Kuehn. "Environmental modulators of algae-bacteria interactions at scale." *bioRxiv* (2023): 2023-03

Luis Miguel de Jesús Astacio[*], Kaumudi H. Prabhakara[*], **Zeqian Li**, Harry Mickalide, Seppe Kuehn. "Closed microbial communities self-organize to persistently cycle carbon." *Proceedings of the National Academy of Sciences* 118, no. 45 (2021): e2013564118.

Selected conference presentations

Speaker: Microbiome Research Symposium, The University of Chicago, "Machine learning predicts microbial metabolic traits from genomes." (2023)

Speaker: The Yellowstone Hot Spring Microbial Mats Symposium, Carnegie Institution for Science, "Co-expression constrains genome organization in an extensively recombined microbial population." (2022)

Speaker: The American Physical Society March Meeting, "Unique functional structure of the Yellowstone hot spring microbial mats revealed by multi-omics studies." (2022)