

Jessica Zhou

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EDUCATION

University of California, San Diego

Ph.D., Bioinformatics and Systems Biology

La Jolla, CA

Sep. 2017–Jul. 2023

University of Southern California

B.S., Biomedical Engineering

Los Angeles, CA

Aug. 2013–May 2017

EXPERIENCE

- **Cold Spring Harbor Laboratory** Cold Spring Harbor, NY
Postdoctoral fellow Oct. 2023 -
 - Pioneered a knowledge distillation (KD) framework for uncertainty quantification in convolutional neural networks, achieving superior calibration in low data regimes.
 - Optimized explainable AI (XAI) techniques (i.e., SHAP) to evaluate model interpretability, revealing significant improvements following knowledge distillation.
 - Work accepted for oral presentation at MLCB with manuscript in preparation.
 - Developed a chatbot using Retrieval-Augmented Generation (RAG) with ChatGPT to query the CSHL library's transcript database of research conference talks
- **UC San Diego & Salk Institute for Biological Studies** La Jolla, CA
Ph.D. Candidate Sep. 2017 - Jul. 2023
 - Engineered advanced GLMs to quantify DNA sequence element activity from high-dimensional single-cell CRISPR perturbation data.
 - Applied unsupervised learning algorithms (K-means clustering, t-SNE, UMAP) to identify and characterize distinct cellular populations in large-scale single-cell sequencing datasets.
 - Deployed foundation models to generate counterfactual explanations.
 - Led an interdisciplinary team spanning experimental biologists, behavioral geneticists, and neuroscientists.
- **Hasso-Plattner Institute & Berlin Institute for Medical Systems Biology** Berlin, Germany
Fulbright Scholar Sep. 2019 - Mar. 2020
 - Visiting researcher funded by Fulbright Research Award working with Drs. Roland Schwarz and Christoph Lippert.
- **University of Southern California** Los Angeles, CA
Undergraduate Researcher Feb. 2015 - Jun. 2017
 - Performed integrative statistical analysis of multi-omics datasets to study cancer metabolism
- **Harvard Medical School** Boston, MA
Research Intern Jun. 2016 - Aug. 2016
 - Accepted into prestigious Harvard-MIT Health Sciences and Technology (HST) Summer Bioinformatics Program
 - Developed algorithm for identifying enrichment of transcription factor binding motifs in ChIP-seq data

SKILLS

- Programming languages: Python, R, MATLAB, SQL, bash
- Tools: TensorFlow, PyTorch, Lightning, scikit-learn, scipy, numpy, pandas, git, HuggingFace
- Machine learning & statistics: neural networks, deep learning, uncertainty quantification, explainable AI (XAI), knowledge distillation, supervised & unsupervised learning, representation learning, statistical modeling, NLP, LLMs, RA, MC methods, generalized linear models, maximum likelihood estimation, hypothesis testing
- Data analysis and visualization: ggplot, matplotlib, seaborn, pandas, dplyr
- High performance computing (HPC): Microsoft Azure, AWS, SGE, slurm

PUBLICATIONS

1. J. L. Zhou, K. Guruvayurappan, S. Toneyan, H. V. Chen, A. R. Chen, P. Koo & G. McVicker. Analysis of single-cell CRISPR perturbations indicates that enhancers predominantly act multiplicatively. English. *Cell Genomics* **0**. Publisher: Elsevier. ISSN: 2666-979X (Oct. 2024).
2. J. L. Zhou, K. Rizzo, Z. Tang & P. K. Koo. *Uncertainty-aware genomic deep learning with knowledge distillation* en. Pages: 2024.11.13.623485 Section: New Results. Nov. 2024.
3. J. L. Zhou, G. de Guglielmo, A. J. Ho, M. Kallupi, N. Pokhrel, H.-R. Li, A. S. Chitre, D. Munro, P. Mohammadi, L. L. G. Carrette, O. George, A. A. Palmer, G. McVicker & F. Telese. Single-nucleus genomics in outbred rats with divergent cocaine addiction-like behaviors reveals changes in gene amygdala GABAergic inhibition. en. *Nat Neurosci*. Publisher: Nature Publishing Group, 1–12. ISSN: 1546-1726 (Oct. 2023).
4. A. Flores, J. Schell, A. S. Krall, D. Jelinek, M. Miranda, M. Grigorian, D. Braas, A. C. White, J. L. Zhou, N. A. Graham, T. Graeber, P. Seth, D. Evseenko, H. A. Collier, J. Rutter, H. R. Christofk & W. E. Lowry. Lactate dehydrogenase activity drives hair follicle stem cell activation. en. *Nat Cell Biol* **19**. Number: 9 Publisher: Nature Publishing Group, 1017–1026. ISSN: 1476-4679 (Sept. 2017).

PRESENTATIONS

- *Learning to predict model uncertainty in genomic deep learning through knowledge distillation*. Poster presentation at Intelligent Systems for Molecular Biology. July 12-16, 2024.
- *Predicting model uncertainty in genomic deep learning with knowledge distillation*. Poster presentation at Biology of Genomes. May 7-11, 2024.
- *Genome-wide analysis of CRISPR perturbations indicates that enhancers act multiplicatively, but provides no evidence for epistatic-like enhancer interactions*. Selected talk at the International Conference for Intelligent Systems for Molecular Biology. July 23-27, 2023.
- *Single-cell sequencing links reduced glucose metabolism to cocaine addiction-like behavior in rats*. Poster presentation at the American Society of Human Genetics Annual Meeting. Oct. 25-29, 2022. Recipient of Reviewer's Choice Award.
- *Cocaine addiction is associated with long-term changes in gene regulation, metabolic pathways, and GABAergic inhibition within the amygdala*. Selected talk at the Complex Traits Community conference. September 29-30, 2022.

- *snRNA-seq reveals that reduced glucose metabolism is linked in cocaine addiction in HS rats.* Selected talk at the NIDA P50 Center for GWAS in Outbred Rats Retreat. Nov. 4, 2022.
- *Cell type-specific multiomic analysis of substance use disorders in outbred rats.* Selected talk at the Probabilistic Modeling in Genomics conference. May 14-16, 2021.
- *A novel statistical method for identifying combinatorial regulatory elements from multiplexed single-cell CRISPR regulatory screens.* Poster presentation at the Probabilistic Modeling in Genomics conference. October 6-9, 2019.
- *Enhanced breast cancer risk prediction from imputed gene expression.* Poster presentation at the American Society of Human Genetics Annual Meeting. October 17, 2018.

AWARDS

NIH Ruth L. Kirschstein Predoctoral Individual National Research Service Award (F31)
 UCSD Interdisciplinary Research Award
 Fulbright Study/Research Award
 National Science Foundation Graduate Research Fellowship Program Honorable Mention
 University of California Trustee Scholar
 University of Southern California Provost's Research Fellowship
 Women in Science and Engineering Research Fellowship
 Rose Hills Foundation Research Fellowship

TEACHING & OUTREACH

- **American Society of Human Genetics** USA
Public Education and Awareness Committee Member Jan. 2020 - Dec. 2022
 - Brainstorm subjects for public-facing online Discover Genetics fact sheets and advise on content
 - Run and judge annual ASHG DNA Day Essay Contest for high schoolers
 - Participate in AskScience Reddit panels
- **Fleet Science Center** San Diego, CA
Volunteer 2017-2023
 - Volunteer with Two Scientists Walk Into a Bar program, where pairs of local scientists visit local breweries and invite the public to ask questions about science
 - Volunteer with BE WiSE program, which engages local young women (grades 7-12) in STEM
- **UC San Diego** La Jolla, CA
Bioinformatics Bootcamp Instructor Sep. 2018 - Sep. 2019
 - Designed and taught lectures on statistical concepts (e.g. p-values, statistical distributions, OLS, MLE) paired with interactive Jupyter notebooks to incoming first year students in the Bioinformatics PhD program
 - Planned and organized welcome week events for the Bioinformatics PhD program
- **University of Southern California** Los Angeles, CA
MATH 226 Supplemental Instructor Aug. 2015 - May 2017
 - Designed and taught weekly lectures (3x/week) to supplement undergraduate vector calculus course