

Abel Gurung

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Education

Purdue University West Lafayette, IN
PhD in Computer Science

University of Southern Mississippi Hattiesburg, MS
Major: *Mathematics*
Minor: *Computer Science and Biological Sciences*

Internship

Chan Zuckerberg Biohub, San Francisco San Francisco, CA
Theory and Data Science Intern May 2023 – November 2023

- Studied the developmental trajectories of single cells using Single-cell RNA sequencing (scRNA-seq) and RNA velocity
- Developed a novel method to find the transition path of developmental trajectories with defined initial and final states
- Created a method to compute macrostate transition probabilities based on microstate transitions

Baylor College of Medicine Houston, TX
Biomedical Research Assistant June 2022 - August 2022

- Studied how the Integrator complex regulates gene expression
- Compared the efficacy of CRISPR-based cytosine base editors (CBEs) to introduce stop codons within genes encoding Integrator subunits and analyzed effects on expression of Integrator regulated genes.
- Performed DNA extraction from E. coli, transfection of HEK293FT cells, total RNA extraction, cDNA preparation, qPCR, western blot, and KLD cloning

Research Experience

University of Southern Mississippi Hattiesburg, MS

Machine Learning Research Assistant

Project: Flash Tuning April 2024 – Present

- Developed an alternative approach for finetuning LLMS using lower rank matrices

Project: Modelling the Open Probability of Ion Channels on Cell/Organelle's Membrane August 2022 – April 2024

- Built a deep neural network that models the probability of ion channels opening as accurately as traditional ODE models with less information
- Improve the model's performance by fine-tuning the neural network architecture and hyperparameters

Bioinformatics Research Assistant

Project: Post-translational gene regulation through small regulatory RNAs February 2022 – June 2022

- Collected single-nucleus RNA (snRNA) genomic data of crop pests to study the role of RNA interference (RNAi)
- Developed an algorithm to identify adapter sequences in unfiltered small nucleus RNA datasets
- Preprocessed genome data for further analysis and interpretation

Project: Global Gene Regulation of Virulence Staphylococcus Aureus September 2021 - February 2022

- Studied the effects of antimicrobial agents in different media for Staphylococcus Aureus
- Performed RT-PCR, gel-electrophoresis, and preparation of growth media

Work Experience

Telenutrition Center Hattiesburg, MS

Full-Stack Engineer November 2021- December 2023

- Maintain and upgrade health application used by researchers to collect data from participants
- Built features to make interaction between researchers and participants more accessible
- Utilized Vue.js for front-end development and Ruby on Rails for back-end services, integrating USDA API to enhance the application with comprehensive nutritional information.

Publications

Abel Gurung and Qingguang Guan. Hybrid PDE-Deep Neural Network Model for Calcium Dynamics in Neurons. arXiv preprint [arXiv:2407.15364](https://arxiv.org/abs/2407.15364), 2024

Sarah Ancheta^{1*}, Leah Dorman¹, Guillaume Le Treut¹, **Abel Gurung**¹, Loïc A. Royer¹, Alejandro Granados^{1,2*}, Merlin Lange^{1*}. Challenges and Progress in RNA Velocity: Comparative Analysis Across Multiple Biological Contexts. bioRxiv preprint <https://doi.org/10.1101/2024.06.25.600667>, 2024

Presentation

Gurung, Abel; “Modelling the Open Probability of Ion Channels using Deep Neural Network” (2024) Oral presentation presented at Mathematical Association of America (**MAA**) LA-MS

Gurung, Abel; “Investigating Cell Fate Trajectories Using Kinetic Monte Carlo” (2023) Oral presentation presented at Chan Zuckerberg Biohub Internship Symposium

Gurung, Abel; “Modelling the Open Probability of Ion Channels using Deep Neural Network” (2023) Oral presentation presented at University of Southern Mississippi and University of Southern Alabama

Gurung, Abel; “Testing the efficacy of cytosine base editors for making targeted mutations in the Integrator complex” (2022) Oral presentation presented at Baylor College of Medicine Smart Program

Honors & Awards

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| • University of Southern Mississippi Undergraduate Research Symposium – 1st Place | April 2024 |
| • University of Southern Mississippi Business Pitch Competition | April 2024 |
| - Received \$1000 for CleanLabel | |
| • Mathematical Association of America (MAA) LA-MS – 3rd Place – Student Paper Competition | March 2024 |
| • Eagle SPUR Research Grant | November 2023 |
| - Received \$1000 research grant for Modeling Ion Channels using Machine Learning | |
| • USM + VOXO Hackathon - Tech for Social Impact – 1st Place | November 2023 |
| - Created an application to better inform consumers about the food they consume | |
| - Received \$2500 CleanLabel | |
| • Wright W. Cross Fellowship | |
| - Competitive Scholarship awarded to students doing research in Mathematics | August 2023 |
| • University of Southern Mississippi Undergraduate Research Symposium – 1st Place | April 2023 |
| - Title: “Modelling the Open Probability of Ion Channels on Cell/Organelle’s Membrane” | |
| • 3rd Annual VJ Canizaro, MD Health Summit Research Abstract – 1st Place | March 2023 |
| - Title: “Modelling the Open Probability of Ion Channels on Cell/Organelle’s Membrane” | |
| • Wright W. Cross Fellowship | |
| - Competitive Scholarship awarded to students doing research in Mathematics | August 2022 |
| • Academic Excellence Scholarship – Merit based scholarship that covers full-tuition | August 2021 |

Open-Source Contributions

[PlateParser](#) – Parse semi-structured microplate data

[PlateChain](#) – LLM for parsing semi-structured microplate data

[CellRank](#) – Dynamics from multi-view single-cell data

Projects

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|---|----------------------------|
| CleanLabel | November 2023 - April 2024 |
| • App to better inform consumers about the food they consume | |
| • Awarded \$2500 from "Tech for Social Impact" Hackathon and \$1500 from USM Business Pitch Competition | |
| • Developed a working prototype in 3 days | |
| • Built using Fastify/Node.js and Swift | |

Fine-tuned GPT-2

June 2020 - December 2020

- Fine-tuned GPT-2 model to mimic literature authors

Skills & Interest

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| • Python | • Stochastic Modeling | • Machine Learning |
| • C++ | • TensorFlow | • Pytorch |
| • JavaScript | • Vue | • Keras |
| • SQL | • React | • Ruby on Rails |