Daniel Chang

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Minneapolis, MN

Department of Computer Science
University of Minnesota Twin Cities

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Education		
	University of Minnesota Twin Cities, Minneapolis, MN	Sept 2022 - Expected May 2024

University of Minnesota Twin Cities, Minneapolis, MN — Sept 2022 - Expected May 2024
Master of Science in Computer Science
Thesis Advisor: Chad Myers, PhD
Research focus: machine learning for cancer genetic dependency prediction
GPA: 4.0/4.0

University of Minnesota Twin Cities, Minneapolis, MN — Sept 2020 - May 2023
Bachelor of Science in Computer Science
Thesis Advisor: Jaeyun Sung, PhD
Research focus: machine learning for gut microbiome based health monitoring
summa cum laude + with high distinction
GPA: 4.0/4.0

Publications

https://scholar.google.com/citations?user=nwQ70xkAAAAJ

* - co-first author; # - co-corresponding author

Submitted, under review, or in revision

Daniel Chang, Xiang Zhang, and Chad Myers. "Ridge Regression Baseline Model Outperforms Deep Learning Method for Cancer Genetic Dependency Prediction". submitted. [bioRxiv][code]

Daniel Chang*, Vinod K. Gupta*, Benjamin Hur, Sergio Cobo-López, Kevin Y. Cunningham, Levi M. Teigen, Erin L. Longbrake, Insuk Lee, Yong-Su Jin, Nam Soo Han, John M. Davis III, and Jaeyun Sung. "Gut Microbiome Wellness Index 2 for Enhanced Health Status Prediction from Gut Microbiome Taxonomic Profiles". in revision at *Nature Communications*. [bioRxiv][code]

Published or in press

Dong Hyeon Lee*, Hyunbin Seong*, **Daniel Chang**, Vinod K. Gupta, Jiseung Kim, Seongwon Cheon, Geonhee Kim, Jaeyun Sung#, and Nam Soo Han#. "Evaluating the Prebiotic Effect of Oligosaccharides on Gut Microbiome Wellness Using in vitro Fecal Fermentation". *npj Science of Food* (2023). [html][pdf]

Daniel Chang, Vinod K. Gupta, Benjamin Hur, Kevin Y. Cunningham, and Jaeyun Sung. "GMWI-webtool: A User-friendly Browser Application for Assessing Health through Metagenomic Gut Microbiome Profiling". *Bioinformatics* (2023). [html][pdf][code]

Vinod K. Gupta, Utpal Bakshi, **Daniel Chang**, Aileen R. Lee, John M. Davis III, Sriram Chandrasekaran, Yong-Su Jin, Michael F. Freeman, and Jaeyun Sung. "TaxiBGC: a Taxonomy-guided Approach for Profiling Experimentally Characterized Microbial Biosynthetic Gene Clusters in Metagenomes". *mSystems* (2022). [html][pdf][code]

Patents

Jaeyun Sung, **Daniel Chang**, Vinod K. Gupta. "Gut Microbiome-based Indicator of Health". patent application submitted.

Honors & Awards

Minnesota Supercomputing Institute Research Exhibition Poster Award - $1,000	2023
University of Minnesota Emerson Scholarship - $3,000	2022
Delta Sigma Phi Men of Courage Award - $400	2021
Dean's List (6 semesters)	2020-2023
University of Minnesota Presidental Scholarship - $40,000	2020-2024

Presentations

Daniel Chang, Suzie Hoops, Dan Knights. "Metagenomic MAGIC: Dissecting the Structure and

Function of the Developing Gut Microbiome". *Minnesota Supercomputing Institute Research Exhibition.* Minneapolis, MN. Apr 25, 2023. [pdf]

Daniel Chang, Vinod K. Gupta, Jaeyun Sung. "Gut Microbiome Wellness Index 2 for Enhanced Health Status Prediction from Gut Microbiome Taxonomic Profiles". *Mayo Clinic Individualizing Medicine Conference.* Rochester, MN. Nov 2, 2022.

Daniel Chang, Vinod K. Gupta, Jaeyun Sung. "Gut Microbiome Wellness Index 2 for Enhanced Health Status Prediction from Gut Microbiome Taxonomic Profiles". *Cold Spring Harbor Microbiome Meeting.* Laurel Hollow, NY. Oct 27, 2022.

Research Experience	**Undergraduate Research Assistant**	Mayo Clinic, Rochester, MN

Undergraduate Research Assistant — Mayo Clinic, Rochester, MN
Microbiome Systems Medicine Laboratory (PI: Jaeyun Sung, PhD) — March 2021 - Present

- Developed GMWI-webtool, a browser application for computing the lab's previously published Gut Microbiome Wellness Index (GMWI), a gut microbiome based health status predictor. GMWI-webtool was used by the lab to apply GMWI as a quantitative tool for measuring the prebiotic effect of oligosaccharides on the gut microbiome.
- Conducted a pooled analysis of 8,069 stool metagenomes from 54 independent studies across 12 health and disease phenotypes to develop Gut Microbiome Wellness Index 2 (GMWI2). Using Lasso-penalized logistic regression, GMWI2 achieved a cross-validation balanced accuracy of 80% in predicting disease presence from gut microbiome taxonomic profiles (nearly 10% higher than that of its predecessor).
- Developed software for the lab's TaxiBGC pipeline, a computational tool for detecting biosynthetic gene clusters in metagenomes by first identifying the microbes likely to harbor them.
- Proposed a computational framework for investigating the role of Human Endogenous Retroviruses (HERVs) in human disease. Used structural bioinformatics tools to identify HERV gene products that potentially induce autoimmunity via molecular mimicry.

Undergraduate Research Assistant — University of Minnesota, Minneapolis, MN
Knights Laboratory (PI: Dan Knights, PhD) — Spring 2023

- Analyzed the lab's Microbiome, Antibiotics, and Growth Infant Cohort (MAGIC), a longitudinal birth cohort of 386 children. Used computational techniques to dissect the structure and function of the developing gut microbiome.
- Used multivariate ecology methods to observe long term species-level taxonomic composition effects of perinatal antibiotic exposure.
- Inferred microbial growth rates by computing peak-to-trough ratios (PTR) of genome read coverage, identifying microbes with significantly different growth rates between infants with and without perinatal antibiotic exposure, and discovering that microbes rapidly colonize the gut in the first few weeks after birth followed by stagnation.
- Developed a reference genome- and assembly-free computational framework for discovering novel biological entities and ecological relationships in metagenomic data *de novo*.

Master's Thesis — University of Minnesota, Minneapolis, MN
Myers Laboratory (PI: Chad Myers, PhD) — Sept 2023 - Expected May 2024

- Developing predictive models of cancer genetic dependencies using data from the Broad Institute's cancer dependency map project (DepMap).
- Conducted a re-analysis of a previously published deep learning method for predicting cancer genetic dependencies, concluding that the method fails to outperform simple baseline models.
- Exploring the use of network smoothing and utilizing gene expression prediction from mutation profiles as a pre-training task to better represent functional effects of cancer mutation profiles.

Teaching

Teaching Assistant — University of Minnesota, Minneapolis, MN
CSCI 5481: Computational Techniques for Genomics (Prof. Dan Knights) — Fall 2023

- Graduate teaching assistant for a class of 90 students about computational techniques for analyzing biological data generated by genome sequencing, proteomics, and cell-wide measurements of gene expression changes.
- Held weekly office hours to provide conceptual help on programming assignments and readings.

- Wrote Gradescope autograder scripts for automatic code validation to help students debug programming assignments.
- Developed interactive Jupyter notebook exercises covering supplementary topics related to programming homework assignments.

Section Leader Stanford University (virtual)
CS106a: Code in Place Spring 2021
- Section leader for Stanford University's free, non-credit, remote course CS106a ("Code in Place").
- Created engaging programming lessons and discussions for introductory Python for a group of 10 students online.
- Held office hours and provided feedback and grading on programming assignments and exams to improve class.

STEM Outreach **Robotics Instructor** Youth Enrichment League, Rochester, MN
Robotics Evolution Challenge Camp Summer 2021
- Led a summer robotics camp, teaching several groups of 5-10 grade school students the fundamentals of LEGO EV3 robotics, modular programming, problem solving, and teamwork.
- Prepared the students with teamwork and programming skills to compete in the LEGO robotics FLL competition.

Co-founder and officer University of Minnesota, Minneapolis, MN
UMN GopherHack Spring 2021 - Spring 2023
- Co-founded GopherHack, a student organization at the University of Minnesota focused on learning hands-on offensive cybersecurity through capture-the-flag (CTF) competitions.
- Helped develop presentations for learning reverse engineering principles, underlying implementation details of web technologies, and vulnerability exploits.