

Kyle Regan

Ph.D. Candidate — Bioinformatics Data Science

University of Delaware

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Ph.D. Candidate with expertise in bioinformatics, computer science, and electrical engineering, with a research focus on data science and deep learning. My research explores generative AI for portable mass spectrometry, pioneering real-time pathogen detection in air and breath particles. Driving innovations for identifying airborne threats with field-tested applications in high-stakes environments such as hospitals, airports, and subways. Skilled in Python and PyTorch, implementing Transformers, VQ-VAEs, and GANs for processing complex data. Proven leader in mentoring students, teaching data science, and fostering collaborative teamwork.

Education

Ph.D. in Bioinformatics Data Science, *University of Delaware*

Sept 2023 – Present

NIH/NIGMS T32 CBB Predoctoral Training Fellow (2023)

Zeteo Tech–University of Delaware Research Grant (2024,2025)

GPA: 3.90

Honors B.E. in Electrical Engineering, *University of Delaware*

Sept 2019 – May 2023

Minor in Computer Science · Eta Kappa Nu Award · GPA: 3.83

Experience

Graduate Research Assistant

Sept 2023 – Ongoing

University of Delaware, Newark, DE, USA

- Engineered a novel efficient tokenizer based on next-wavelet prediction for autoregressive modeling of one-dimensional time-series data.
- Built transformer-based models guided by biological priors, boosting F1 scores from 82.4% → 98.2% and accuracy from 86.2% → 98.3% over standard transformers in microbial classification.
- Developed an ML/AI approach for LASSO optimization to identify pathogens in single-shot mass spectral data, significantly improving the separation between background and threat particles in airports and subways.
- Drove industry–academic partnerships between the University of Delaware and corporate collaborators, securing a two-year grant to translate mass spectrometry research into applied solutions.

Machine Learning Intern

Summer 2024, Summer 2025

Zeteo Tech Inc. Sykesville, MD, USA

- Implemented self-supervised generative AI models to detect respiratory diseases from human breath aerosols, enabling non-invasive diagnostics.
- Leveraged self-supervised learning to extract richer feature representations, improving classification accuracy over purely supervised methods for aerosol mass spectrometry data.
- Integrated sparse signal processing with large language models to enhance both efficiency and accuracy in supervised pathogen classification pipelines.
- Collaborated with an interdisciplinary team to deploy a real-time environmental monitoring system, accelerating pathogen identification for public health applications.

Undergraduate Engineering Intern

Feb 2021 – Sept 2023

Zeteo Tech Inc. Sykesville, MD, USA

- Built a preprocessing pipeline for baseline detection and peak alignment, addressing low-resolution signal challenges in miniaturized, portable mass spectrometers.
- Introduced the feasibility of using invertible mass spectrograms with Discrete Cosine Transform to utilize state-of-the-art vision models for proteomics.
- Implemented a modified Pix2Pix conditional Generative Adversarial Network (cGAN) for enhancing low-resolution spectrograms to high-resolution laboratory-grade fidelity.
- Delivered weekly updates to team leaders, presented a final team-wide summer presentation, and contributed to a grant proposal submission.

Skills

- **Tools and Languages** Python, PyTorch, Git, Weights & Biases, C, L^AT_EX
- **Intangibles** collaborations, presentations, interdisciplinary environments, grant writing

Publications & Patents

- [1] **Regan, K.M.**; McLoughlin, M.; Bryden, W.A.; Arce, G.R. **Unmasking Airborne Threats: Guided-Transformers for Portable Aerosol Mass Spectrometry**. Submitted to *Computers in Biology and Medicine*, 2025.
- [2] Chen, D.; Bryden, W.A.; McLoughlin, M.; Ecelberger, S.A.; Cornish, T.J.; Moore, L.P.; **Regan, K.M.** **digitalMALDI: A Single-Particle-Based Mass Spectrometric Detection System for Biomolecules**. *Journal of Mass Spectrometry*, 2025, 60(2): e5110. doi:10.1002/jms.5110. PMID: 39821951.
- [3] McLoughlin, M.; Kliegman, R.; Cornish, T.; Berkout, V.; Ecelberger, S.; Arce, G.; **Regan, K.** **Methods and Systems for Detecting Aerosol Particles**. U.S. Patent Application No. US 2024/0282568 A1, filed May 2, 2024; published August 22, 2024.

Symposium Presentations

- [1] **Regan, M. K.**; *McLoughlin, M.*; *Arce, G. R.* **Wavelet-Flow Tokenization for Efficient Mass Spectral Generation via Next-Scale Prediction**
Bioinformatics Data Science Symposium, Newark, DE, October 2025.
- [2] **Regan, M. K.**; *McLoughlin, M.*; *Arce, G. R.* **Deep Learning Architecture for Rapid Pathogen Identification using Portable Aerosol Mass Spectrometry**
Data Science and DARWIN Symposium, Newark, DE, February 2025.

Leadership & Volunteering

Team Leader — Deep Learning Course

Spring 2024, 2025 – Ongoing

Department of Electrical and Computer Engineering

- Supervised a team of undergraduates on a semester-long project, emphasizing best practices in data management, model design, and implementation in PyTorch.
- Mentored students on creating effective presentation slides, communicating research clearly, and appropriately sharing results.

Bioinformatics Student Association Mentor

Spring 2025 – Ongoing

Center for Bioinformatics and Computational Biology

- Provide mentorship to first-year Bioinformatics graduate students, fostering academic success and community engagement within the program.

Graduate Student Government Senator

Sept 2025 – Ongoing

Center for Bioinformatics and Computational Biology

- Representative for the Bioinformatics Data Science graduate program in the graduate student government.
- Served on the Graduate Research Advancements Committee to support a collaborative and enriching research environment for graduate students.

Computer Science Instructor

January 2023

Department of Computer and Information Sciences

- Introduced computer science to elementary schools in Hawaii, teaching K–4 students core computational concepts. Designed interactive educational games in Java and TypeScript to foster engagement and learning.

Hobbies

- running, weight lifting, biking, drumming, music