ABU ZOBAYER

Ph.D. Student in Applied Mathematics | Doctoral Teaching Assistant
Department of Mathematics, Texas State University | San Marcos, Texas, USA
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RESEARCH INTERESTS

Mathematical biology and population dynamics; mathematical epidemiology and epidemic modeling; evolutionary game theory; agent-based modeling; epidemics on networks and network science; data-driven modeling; behavioral and social-system modeling; statistical data analysis; adversarial robustness and robust machine learning.

EDUCATION

Ph.D. in Applied Mathematics, *Texas State University*, San Marcos, TX, USA — Aug 2025-Present
- Current research: adversarial robustness using the Benamou-Brenier dynamical formulation of optimal transport. Mathematical biology, Agent based modeling (ABM), Evolutionary game theory (EGT).

Master of Science (M.Sc.) in Mathematics, *Bangladesh University of Engineering and Technology (BUET)*, Dhaka, Bangladesh — Jul 2023
- Thesis: "A Cyclic Behavioral Modeling Aspect to Understand the Effect of Vaccination and Treatment on Epidemic Transmission Dynamics."

Master of Science (M.Sc.) in Applied Mathematics, *Noakhali Science and Technology University (NSTU)*, Noakhali, Bangladesh — Jun 2022

Bachelor of Science (B.Sc.) in Applied Mathematics, *Noakhali Science and Technology University (NSTU)*, Noakhali, Bangladesh — Jan 2021
- Thesis: "Matrix Use in Computer Graphics."

ACADEMIC AND RESEARCH APPOINTMENTS

Doctoral Teaching Assistant, *Department of Mathematics, Texas State University*, San Marcos, TX, USA.	August 2026 - present
Doctoral Research Assistant, *Department of Mathematics, Texas State University*, San Marcos, TX, USA. • Advisor: Dr. Jeremiah Birrell. • Developing and evaluating flow-based defenses for adversarial robust machine learning using dynamic OT. Math in Biology, Numerical analysis, ABM.	Jan -Aug 2026
Doctoral Instructional Assistant, *Department of Mathematics, Texas State University*, San Marcos, TX • Supported Calculus II sections through grading, student assistance, office hours, and instructional activities.	Aug-Dec 2025
Lecturer, *Department of Mathematics, Feni University*, Feni, Bangladesh • Taught undergraduate mathematics courses and supported departmental academic activities.	Sep 2023-Jul 2025
Research Assistant, *Higher Training & Research Programme, BUET*, Dhaka, Bangladesh • Conducted research in the Computational Mathematics and Complex Systems (CoMaCs) Lab under Dr. K. M. Ariful Kabir.	Sep 2023-Aug 2024
Graduate Research Assistant, *Research and Innovation for Science and Engineering (RISE), BUET*, Dhaka, Bangladesh • Worked on mathematical and data-driven models of epidemic transmission and health behavior.	May 2022-May 2023
Graduate Teaching Assistant, *Department of Mathematics, BUET*, Dhaka, Bangladesh	Jul 2021-May 2022

PUBLICATIONS

6. **Abu Zobayer**, Ganghyun Yoon,Junwoo Jo,Sunmi Lee,Young Ju Lee " A Conformity-Induced Intervention Paradox: Delayed Epidemic Resurgence in Coupled Disease–Behavior Dynamics" Journal of Applied Mathematics and Computation- AMC [Submitted]

5. Shuvo, M. F. R., **Zobayer, A**., & Kabir, K. M. A. Assessing the impact of mask-wearing behavior to reduce contact on COVID-19 transmission in Bangladesh. [Submitted]

4. Shuvo, M. F. R., **Zobayer, A.,** & Kabir, K. M. A. Assessing the impact of health, economy, and environment on post-COVID syndrome: A study on the Bangladesh perspective. *Journal of Medicine, Surgery, and Public Health*. [Accepted]

3. **Zobayer, A**., & Kabir, K. M. A. Impact of awareness-driven controlling response and network heterogeneity on Nipah virus transmission dynamics. *Applied Mathematics and Computation*. [Accepted]

2. **Zobayer, A**., Riyad, M. M. H., Mia, M. J., et al. (2025). Evaluating socioeconomic influences on Nipah virus vaccination decisions in Bangladesh through machine learning. *Journal of Health, Population and Nutrition*, 44, 328. DOI

1. **Zobayer, A.,** Ullah, M. S., & Kabir, K. M. A. (2023). A cyclic behavioral modeling aspect to understand the effects of vaccination and treatment on epidemic transmission dynamics. *Scientific Reports*, 13, 8356. DOI

SELECTED RESEARCH PROJECTS

Flow-Based Adversarial Robustness via Dynamic Optimal Transport, *Texas State University* 2026-Present

- Studies neural-flow perturbation models, standard adversarial training, and strong PGD-based robustness evaluation.
- Implements reproducible experiments in Python/PyTorch on tabular and image datasets, including UCI Breast Cancer, MNIST, and CIFAR-10.

Behavioral and Network Models of Infectious Disease, *BUET / CoMaCs Lab* 2022-2025

- Developed mathematical models linking vaccination, treatment, adherence, awareness, social behavior, and epidemic transmission.
- Applied differential equations, evolutionary game theory, network modeling, and machine-learning-based analysis.

TEACHING EXPERIENCE

- Calculus II, Texas State University - Doctoral Instructional Assistant, Fall 2025.
- Undergraduate mathematics courses, Feni University - Lecturer, 2023-2025.
- Undergraduate mathematics instruction and academic support, BUET - Graduate Teaching Assistant, 2021-2022.

AWARDS AND SCHOLARSHIPS

The Graduate College Scholarship - Science & Engineering, *Texas State University* 2026
Ross and Sarah Wayment Endowed Scholarship, *Texas State University* 2025
Graduate Research Excellence Award, *Texas State University* 2025
TXST Grad Merit Fellowship, T*exas State University* Spring - 2026
TXST Grad Merit Fellowship, T*exas State University* Fall - 2025

CONFERENCE AND POSTER PRESENTATIONS

Enhancing Adversarial Robustness of Machine Learning Models with Neural Flows, Apr 9, 2026
Graduate Student Research Conference, Texas State University, San Marcos, TX
• Poster presentation; co-authors: Jeremiah Birrell and Reza Ebrahimi.

Enhancing the Adversarial Robustness of Machine Learning Models: Application of a Dynamical Formulation of Optimal Transport, *Texas State STEM Conference*, San Marcos, TX Mar 27, 2026
• Poster presentation; co-authors: Jeremiah Birrell and Reza Ebrahimi.

Predicting Breast Cancer Recurrence Using Logistic Regression, *Texas State University*, San Marcos, TX Apr 17, 2026

Optimal Control Applied to Vaccination and Treatment Strategies for the Human Papillomavirus (HPV) Epidemic Model, *Faculty of Science, BUET*, Dhaka, Bangladesh Jan 2023

Analysis of Lockdown Strategy on Epidemic Dynamics to Understand Multi-Wave Disease Incidence, *Department of Mathematics, Jahangirnagar University*, Savar, Bangladesh Nov 2022

LEADERSHIP AND SERVICE

Graduate Student Ambassador, *The Graduate College, Texas State University*, San Marcos, TX 2026-Present
• Supports graduate recruitment, outreach, prospective-student engagement, and university events.
Team Leader, Lead a small team, Bobcats LEAD Spring Retreat, Austin (March 7–8, 2026) March 2026

Field Surveyor, *Research Project, BUET*, Bangladesh Nov 2023

SEMINARS AND PROFESSIONAL DEVELOPMENT

Research and Innovation: Industry Needs and Perspectives, *RISE, BUET*, Dhaka, Bangladesh May 2024

World Friends Korea (WFK) ICT Volunteer Program - Machine Learning and AI, *National Information Society Agency (NIA)*, Bangladesh Oct 2023

TECHNICAL SKILLS

Programming and Data: Python (PyTorch, NumPy, pandas), MATLAB, Mathematica, R, C++.
Research and Productivity: LaTeX/Overleaf, Google Colab, Microsoft Office, data visualization, statistical modeling, machine learning, numerical simulation.