Curriculum Vitae of

Md Mutasim Billah, Ph.D.

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Academic Appointment

- **Visiting Assistant Professor** Fall 2025–Present
  - Department of Mathematics, Statistics, and Computer Science (MSCS)
  - **Macalester College**, St. Paul, Minnesota

Education

- **Ph.D.** in Statistics Fall 2023–Summer 2025
  - **Michigan Technological University**, Houghton, Michigan
  - **Dissertation**: "Methods in Statistics, Machine Learning, and Deep Learning for Combining Multi-Omics Dataset"
  - **Advisor**: Dr. Kui Zhang, Professor, Dept. of Mathematical Sciences
- **M.Sc.** in Statistics Fall 2019–Fall 2023
  - **Michigan Technological University**, Houghton, Michigan
- **Graduate Studies** in Applied Statistics Fall 2018–Summer 2019
  - **University of Northern Colorado**, Greeley, Colorado
- **M.Sc.** in Statistics, Biostatistics & Informatics Fall 2012–Summer 2013
  - **University of Dhaka**, Dhaka, Bangladesh
- **B.Sc.** in Statistics, Biostatistics & Informatics Fall 2006–Summer 2012
  - **University of Dhaka**, Dhaka, Bangladesh

Research Agenda

- **Research Interests**
  - **Core Methodology:** Developing methods in statistics, machine learning (ML), and deep learning (DL) tailored to genomic data; Next-generation frameworks for multi-omics integration; Methodological advances in missing data imputation and uncertainty modeling for high-dimensional, incomplete biological data; Causal inference and modeling of biological heterogeneity
  - **Application Domain:** Dissection of gene regulatory architecture across diverse tissues (pleiotropy, cis/trans-effects); High-resolution fine-mapping of causal variants to elucidate disease etiology; Translation of multi-omics discoveries into predictive biomarkers and public-health interventions; Genomic medicine and health-equity research in ancestrally diverse and historically underserved populations
  - **Computational Science:** Scalable and reproducible computational genomics for cohort-scale studies (GWAS, GTEx, dbGaP); Development of end-to-end analysis pipelines for secure, controlled-access omics data; High-performance computing implementations that couple deep learning with statistical genomics for large-scale discovery
- **Active and Future Research Plan**
  - Extending previously developed multi-tissue TWAS frameworks (e.g., CTL, G-Boost-CTL) to leverage GWAS summary-level data
  - Benchmarking advanced ML and DL Models for cross-tissue gene expression imputation
  - Developing unsupervised clustering and latent-factor approaches to characterize pleiotropic effects in GWAS
  - Investigating the distinct roles and interactions of local and distant genetic variants in controlling gene expression across different tissues within the TWAS framework
  - Applying advanced ML and DL architectures for multi-omics data integration
  - Developing sparsity-inducing, power-adaptive procedures to identify and remove non-informative tissues in multi-tissue TWAS

Honors and Awards

- **Finishing Fellowship** from Michigan Technological University in Summer 2025
- **Recognition award** for exceptional average of 7 dimensions in teaching in fall 2020
  - Provost's office for academic affairs, Michigan Technological University
  - Only 73 instructors (86 sections out of more than 1,000 evaluated) university-wide were rated this highly by students
- **Recognition Award** for outstanding teaching in spring 2020
  - Provost's office for academic affairs, Michigan Technological University
- **Graduate Course Excellence Awards**, Mathematical Sciences, Michigan Technological University
  - Awarded for top performance in Ph.D.-level coursework, including Advanced Topics in Statistics (Probability I (Fall 21), Probability II (Spring 22), Mathematical Statistics I (Fall 19, Fall 20), Mathematical Statistics II (Spring 20, Spring 21), Linear Algebra (Fall 19), and Categorical Data Analysis (Spring 20).

Teaching Experience

- **Instructor of Records**

Visiting Assistant Professor Fall 2025–Present

Department of MSCS, Macalester College

- Teaching courses at both the foundational and advanced levels of the undergraduate statistics and data science curriculum.
- Designed and continually updating course website using Quarto, integrated with GitHub for version control and RStudio for reproducible workflows, ensuring students have seamless access to current materials and activities
- Designing and continually refining course materials in collaboration with other instructors so learning outcomes align with program objectives; integrate statistical software to strengthen students' analytic fluency
- Mentoring undergraduate researchers from project conception through analysis and conference-style presentations; preparing students to present their work at research symposia

Graduate Teaching Instructor Spring 2020–Spring 2025

Dept. of Mathematical Sciences, Michigan Technological University

Engineering Statistics (taught across multiple modalities: in-person, hybrid, synchronous online, and asynchronous online)

- Maintained average students' evaluation scores of **4.21+/5.00** in **14 of 15 semesters** (~**93%** of courses). Notably, **4.21** is the overall average student evaluation score of MTU faculties over the past seven years
- Designed and continually updated all course materials, adding two applied projects that teach statistical software so students gain both theoretical insight and hands-on analytic skills
- Produced a full suite of instructional assets—short lecture videos, annotated slide decks, and concise handouts—to support flexible, asynchronous learning
- Designed, administered, and graded every homework set, quiz, project, and examination, ensuring alignment with departmental rubrics
- Supervised undergraduates as they transformed class project ideas into posters for the annual Undergraduate Research & Scholarship Symposium, and advised former students on research-methodology questions for the Graduate Research Colloquium and integrating statistical reasoning into honors theses

Graduate Teaching Instructor Fall 2018–Summer 2019

Dept. of Applied Statistics and Research Methods, University of Northern Colorado

Introduction to statistics (face-to-face, a required general-education course)

- Collaborated with instructors of record to overhaul syllabi, examples, and assignments during a department-wide textbook transition
- Administered and graded homework, quizzes, projects, and examinations; maintained detailed analytics to track student progress
- Mentored undergraduates preparing posters for Research Evening and the McNair Scholars Program, guiding study design and data analysis
- Offered career mentorship to former students exploring opportunities in research and applied statistics

- **Teaching and Learning Support**

Graduate Teaching Assistant Fall 2022–Spring 2023

Dr. Kui Zhang, Dept. of Mathematical Sciences, Michigan Technological University

- Supported instruction in advanced undergraduate and graduate statistics courses
- Held office hours and provided comprehensive assistance—from theoretical proof explanations to hands-on statistical-software implementation
- Graded all homework and quizzes, supplying detailed, formative feedback to enhance student mastery

Graduate Teaching Assistant Fall 2019

Beth Reed, Dept. of Mathematical Sciences, Michigan Technological University

- Co-instructed selected lectures in Statistical Methods (a university-core course) and provided ongoing classroom support
- Conducted office hours, guiding students from theoretical concepts to practical applications relevant to their research
- Held office hours, providing supports from theoretical to application to the students so that they can see relevancy of statistical methods in their area of research
- Graded homework, quizzes, and exams, furnishing individualized feedback to promote deeper understanding

- **Instructor of records/Co-Instructor/Teaching Assistant course experience**

Course	**Semester**	**Topics and Duties**
Introduction to Statistical Modeling	Fall 2025$^{\bullet}$ (2 sections) Spring 2026$^{\bullet\bullet}$ (2 sections)	Students learn exploratory data analysis and visualization; Simple and multiple linear regression with comprehensive model building—addressing confounding, interaction effects, variable selection, diagnostics, and transformations; Simple and multiple logistic regression with interpretation of odds ratios and evaluation of classification performance; Core inference for modeling (confidence intervals, hypothesis testing, F-tests); Semester-long research projects
Statistical Machine Learning	Spring 2026$^{\bullet\bullet}$	Topics will include model-evaluation strategies (overfitting diagnostics, cross-validation); regression model-selection techniques (LASSO and nonparametric alternatives); flexible models (K-NN with bias–variance considerations, LOESS, GAM); classification methods (logistic regression, K-NN, decision trees) and their performance metrics; ensemble learning (bagging, random forests); unsupervised learning (hierarchical and k-means clustering); and dimensionality-reduction tools such as principal component analysis (PCA) and principal component regression; Semester-long research projects
Engineering Statistics	Spring 2025$^{\bullet}$ Summer 2024† Spring 2024† Fall 2023† Summer 2023† Spring 2023† Summer 2022† Spring 2022† Fall 2021† Summer 2021† Spring 2021† Fall 2020†† Summer 2020†† Spring 2020$^{\bullet}$	Independently instructed this foundational course, covering: exploratory data analysis and visualization; Probability theory and Bayes' theorem; Discrete and continuous distributions; Central Limit Theorem; Statistical inference including confidence intervals and hypothesis testing for means, proportions, and variances (t-tests, F-tests, Chi-square tests); Statistical process control and control charts; Linear regression modeling (simple, multiple, diagnostics, ANOVA); Principles of experimental design Evaluations are available upon request

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Course	Semester	Topics and Duties
Applied Generalized Linear Models	Spring 2023*	Assisted as TA: held office hours, moderated online discussions panel, graded assignments, and provided consultation on course topics and projects in Statistical modeling foundations; Linear regression and model diagnostics; Maximum likelihood estimation; Generalized linear models (GLMs) including structure, estimation, inference, and diagnostics; Models for proportions (binomial GLMs), counts (Poisson and negative binomial GLMs), and positive continuous data (gamma and inverse Gaussian GLMs); Tweedie models; Nominal and ordinal logistic regression
Design & Analysis of Experiments	Fall 2022*	Assisted as TA: held office hours, moderated online discussions panel, graded assignments, and provided consultation on course projects and topics in Principles of experimental design; ANOVA for one-way, factorial, and randomized complete block designs; post-hoc analysis, including contrasts and multiple comparison procedures; model diagnostics, assumption checking, and data transformations; and ANCOVA, including power and sample size determination
Statistical Methods	Fall 2019**	Assisted as TA: co-taught coursework; held office hours, graded assignments and provided consultation on course topics in descriptive statistics and data visualization; fundamental probability theory; discrete and continuous distributions, including the binomial and normal; confidence-interval construction and hypothesis testing for one- and two-sample means; simple linear regression modeling and prediction; and one- and two-way ANOVA
Introduction to Statistical Analysis	Fall 2018• Spring 2019• Summer 2019•	Instructed core statistical concepts including data organization (frequency distributions, histograms), measures of central tendency and variability, probability distributions, estimation, hypothesis testing, regression, and ANOVA. Actively contributed to ongoing course development, collaborated with fellow instructors to enhance course textbook and materials

• Instructor of records (in person)
•• Instructor of records (in person; scheduled)
† Instructor of records (asynchronous online)
†† Instructor of records (synchronous online)
* Teaching assistant (asynchronous online)
** Teaching assistant (in person)

Service and Leadership

- **Member, Transformation Committee, Dept. of MSCS, Macalester College** 2025–2026
  - **Preceptor (GTA) Program Development & Training:**
    - Contributing to preceptor hiring, training, and evaluation with emphasis on creating community.
    - Designing and leading training sessions on Diversity, Equity, and Inclusion (DEI), pedagogy, and departmental policies.
    - Serving as liaison to the Science and Quantitative Center.
  - **Faculty Support & Mentoring:**
    - Ensuring junior faculty are paired with senior mentors and new faculty are assigned mentors who have taught the same course.
    - Organizing reciprocal course visits for all faculty early in the academic year.

  - **DEI Initiatives:**
    - Updating DEI website drafts and communicating concrete efforts.
    - Rethinking departmental policies and procedures through a DEI lens.
    - Scheduling student listening sessions and maintaining community guidelines (updating and sharing widely).
    - Initiating pedagogical workshops and faculty working groups based on interest.
    - Working with the Student Advisory Board to integrate student perspectives.
- **Treasurer and Vice-president (Elected), Muslim Student Association** Jan 2021-Dec 2022
  - Graduate Student Government (GSG), Michigan Technological University
  - Organized events, managed finances, submitted budgets to the GSG, and coordinated university collaborations; Led a community of over 200 members, ensuring smooth operations, communication, and member engagement in the president's absence
- **President (Elected), Bangladesh Student Association** Jan 2020-Dec 2020
  - GSG, Michigan Technological University
  - Led cultural and community-building events, coordinated activities for around 50 members, and managed the organization's administrative tasks

Research Experience

- **Doctoral Researcher** Sept 2022–August 2025
  Department of Mathematical Sciences, Michigan Technological University
  - Developed TWAS-CTL, a novel and computationally efficient multi-tissue learning method that enhances statistical power by strategically weighting and integrating gene expression data from multiple learners, outperforming existing benchmarks
  - Introduced G-Boost-CTL, an advanced framework that further improves TWAS-CTL by incorporating a dual-weighting scheme that uses information from the GWAS cohort itself to automatically emphasize tissues carrying the relevant genetic signals, delivering significant gains in statistical power and discovering more biologically plausible disease loci while preserving error control compared to other established methods in multi-tissue TWAS
  - Demonstrated significant gains in discovery power and identifying more causal genes by replacing traditional linear models in the multi-tissue TWAS pipeline with non-linear machine learning and deep learning engines (gradient-boosted trees and deep neural networks) to capture complex, heterogeneous gene regulatory patterns, outshining conventional benchmarks
- **Graduate Research Assistant** Summers 2023, 2024
  Dr. Kui Zhang, Professor, Department of Mathematical Sciences, Michigan Technological University
  - Secured NIH dbGaP approval and coordinated the download of $>$ 2 TB of protected GTEx genotype and RNA-seq data; built automated Bash/R pipelines for de-identification, quality control, and harmonization across 49 tissues
  - Designed and coded scalable R-/Python-based workflows for both established (PrediXcan, UTMOST) and new cross-tissue TWAS methods (TWAS-CTL, G-Boost-CTL)
  - Conducted large-scale power simulations, statistical validation, and data-visualization that underpin two forthcoming manuscripts; presented preliminary findings at the 2024 ASHG annual meeting
- **Statistical Consultant, Research Consulting Lab** August 2018-July 2019
  Department of Applied Statistics and Research Methods, University of Northern Colorado
  - Acted as a lead statistical consultant, overseeing client intake, aligning project needs with consultant expertise, and mentoring new team members while coordinating statistical training workshops
  - Delivered full-spectrum consulting support for qualitative, quantitative, mixed-methods, and evaluation studies—from research design and methodology development to final data analysis and reporting
  - Designed and executed rigorous statistical analysis plans tailored to diverse academic disciplines
  - Collaborated with graduate students, faculty, and staff on data analysis, research presentations, and thesis projects using R, SAS, and SPSS

Publications

- **Manuscripts in Preparation**
  - TWAS-CTL: A robust and efficient framework in multi-tissue transcriptome-wide association studies using cross-tissue learner; **Billah, M.**, Wei, H.†, Sun, F.$^{\bullet}$, Zhang, K.†
  - GBoost-CTL: A novel method in multi-tissue transcriptome-wide association studies in cross-tissue

learner incorporating GWAS information; **Billah, M.**, Wei, H.[†], Sun, F.[•], Zhang, K.[•]
- Application of Deep Learning and Boosted Tree Methods in multi-tissue TWAS framework; **Billah, M.**, Acheampong, S., Kareem, K., Subedi, Megh., Silwal, S., Zhang, K.[†]

[†] Professor, Michigan Technological University [•] Professor, University of Southern California

Presentations

- **Juried Poster Presentations**
  - **Billah, M. (Presenter)**, Zhang, K; "GBoost-CTL: A novel method in multi-tissue transcriptome-wide association studies in cross-tissue learner incorporating GWAS information"–American Society of Human Genetics Annual Meeting 2025
  - **Billah, M. (Presenter)**, Zhang, K; "TWAS-CTL: A robust and efficient framework in transcriptome-wide association studies using cross-tissue learner"–American Society of Human Genetics Annual Meeting 2024
- **Non-juried Poster Presentations**
  - **Billah, M. (Presenter)**; "A simple Analogy for Research Plan in Grant Application"–Prototype Poster Session, Associated Colleges of the Midwest (ACM) Grant Workshop 2025
  - **Billah, M. (Presenter)**, Acheampong, S., Kareem, K., Subedi, Megh., Silwal, S., Zhang, K.; "Application of Deep Learning and Boosted Tree Methods in multi-tissue TWAS Framework"–Graduate Research Poster Session, Michigan Technological University, Summer 2025
- **Non-Juried Podium Presentations**
  - **Billah, M. (Presenter)**, Zhang, K; "GBoost-CTL: A novel method in multi-tissue transcriptome-wide association studies in cross-tissue learner incorporating GWAS information"–Research Seminar, Mathematical Science, Spring 2025
  - **Billah, M. (Presenter)**, Zhang, K; "TWAS-CTL: A robust and efficient framework in transcriptome-wide association studies using cross-tissue learner"–Research Seminar, Mathematical Science, Spring 2024

Grants

- **Grants in Preparation**
  - "Application of Deep Learning methods and its imrpoved accuracy in predicting multi-tissue gene expression from genotypes"–R03 NIH Grant
- **Travel Grants**
  - Faculty Travel and Research Grant, Macalester College; Amount: $1250 Fall 2025
  - Department of Mathematical Sciences Travel Grants, MTU; Amount: $1000 Fall 2024
  - Graduate Student Government (GSG) Travel Grants, MTU; Amount: $500 Fall 2024

Professional Developement

- **Workshops**
  - Associated Colleges of the Midwest (ACM) Grant Workshop, Macalester College August 12-15, 2025
    - "How to Read a RFP and Write to Funder Priorities", "Artificial Intelligence in the Grantseeking Process"– Dr. Anna Beno, Dr. Claudia Scholz
- **Conferences**
  - Upper Peninsula's Teaching and Learning Conference, Bay College in Escanaba May 13-14, 2024
    - "AI: Changing the Face of Teaching and Learning"– Dr. Janet Anthony and Dr. Jennifer Fisch Ferguson
  - UP's Teaching and Learning Conference, Lake Superior State University, May 15-16, 2023
    - "The Ultimate Course is Not an Illusion: Creating Courses of Excellence"; "Why Don't My Students Think I'm Groovy: The New "R"s for Engaging Modern Learners"– Dr. Christy Price
  - UP's Teaching and Learning Conference, Northern Michigan University May 24-25, 2022
    - "A Beacon of Possibilities: Charting a Course for Post-Pandemic Teaching"; "Finding your True North: Motivating and Engaging Students to Enhance Learning"– Dr. Todd, D. Zakrajsek

Computational and Analytical Proficiency

- **Course Development & Instructional Tools**
  - Designed interactive course websites using **Quarto**, integrated with **GitHub** for version control and reproducible publishing
  - Experienced in managing courses with **Canvas** and **Moodle**, including site design, communication, scheduling, assessments, and gradebook integration
  - Proficient in **Panopto**, **DocCam**, **iClicker**, **WebAssign**, **SpeedGrader**, and **LockDown Browser**
  - Skilled at integrating multiple tools into a cohesive learning ecosystem to support active learning and flexible course delivery
- **Statistical Programming and Data Analysis**
  - Proficient in **R**, **Python**, **SAS**, **Plink**, **GCTA**, and **SPSS**
- **Technology and Documentation Tools**
  - Experienced with **Windows**, **macOS**; familiar with **Unix/Linux** systems
  - Adept in document preparation with **LaTeX**, **Microsoft 365**, and **Endnote**
  - Skilled in employing **Google Forms and Sheets** for surveys, feedback collection, meeting planning, and collaborative data management

References

- **Dr. Kui Zhang**
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- **Dr. Qiuying Sha**
  - Professor, Mathematical Sciences, MTU
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