# MAHEDI HASAN

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## OBJECTIVE

Currently, I am a doctoral candidate in statistics at Washington State University (WSU). I work at the intersection of statistics and machine learning for theoretical development and practical implementations. My current research focuses on improving the generalization performance of deep learning models, implementing Graph Neural Networks (GNN), inference problems for change point detection in dynamic networks, and optimization for "fairness" in machine learning algorithms. I am also interested in the broad spectrum of "statistical learning" for theoretical development and addressing applied problems.

## RESEARCH INTEREST

**Statistical Methods:** High-Dimensional Statistics, Experimental Design, Mixed Models & Longitudinal Data Analysis, Multivariate Methods, Time Series Models, Change Point Detection, Spatial Statistics.

**Machine Learning & AI:** Deep Learning, Generative AI, Graph Neural Networks, Interpretable ML, Computer Vision.

**Other Interested Areas:** Bioinformatics, Optimization, Network Modeling & SNA

## EDUCATION

- **P.hD. in Statistical Science** **2019 - 2025**
  Dept. of Mathematics and Statistics, Washington State University (WSU)
  CGPA: 3.76 (4.00)
  Research Focus: Statistical Inference, Deep Learning, GNN, Social Network Analysis, Change Point Detection in Dynamic Networks.
  Advisor: Dr. Daryl DeFord, WSU.

- **MS in Computer Science** **2021 - 2023**
  School of Electrical Engineering and Computer Science (EECS), Washington State University (WSU)
  CGPA: 3.97 (4.00)
  Specialization: Machine Learning and AI
  Notable Courses: Data Science, Machine Learning, Deep Learning, Computer Vision, Graph Theory, Algorithms.
  Research Project: Debiased Facial Expression Recognition via Consistency Regularization.
  Mentor: Dr. Yan Yan, EECS, WSU

- **Graduate Certificate in Bioinformatics** **2023- 2024**
  School of Biological Sciences, WSU.
  Concentration: Sequencing algorithms, omics data analysis, biological network analysis.

- **Master of Philosophy (MPhil.) in Statistics** **2017 - 2019**
  Center for Higher Studies, Bangladesh University of Professionals (BUP)
  CGPA: 3.95 (4.00)
  **Thesis:** Impact of Climate Change on Agricultural Production in Bangladesh
  Research Focus: Geo-spatial analysis, spatio-temporal modeling, short and long run effects of climate change.
  Mentor: Dr. Syed Shahadat Hossain, ISRT, University of Dhaka, Bangladesh.

- **MS in Statistics** **2011 - 2012**
  Department of Statistics, Shahjalal University of Science and Technology (SUST), Sylhet, BD.
  CGPA: 3.95 (4.00) (Placed First and Awarded Distinction)
  **Thesis:** Regional Variation of Climate Change in Bangladesh: Estimation of Missing Values, Extremity & Trend
  Research Focus: Forecasting, Multivariate Time series (VAR, VEC), Wavelet Analysis.
  Mentor: Dr. Md Zakir Hossain, SUST, BD.

- **Bachelor in Statistics** **2006 - 2010**
  Department of Statistics, Shahjalal University of Science and Technology (SUST), Sylhet, BD.
  CGPA: 3.83 (4.00) (Placed First and Awarded Distinction)

## EXPERIENCE

- **Dept. of Mathematics and Statistics, Washington State University[🌐]** *Aug 2029 - Current*
  *Graduate Teaching Assistant, and Graduate Student Instructor* Pullman, WA
  - As part of my role, I worked as a teaching assistant for **Calculus I (Math 171), Calculus II (Math 172), and Calculus III (Math 173)**. Additionally, as a graduate student instructor, I taught **Introduction to Statistical Methods (Stat 212), Discrete Mathematics (Math 216), Statistical Methods for Research (Stat 412), and Introduction to Multivariate Statistics (Stat 419)**. I independently designed course materials, including the syllabus, lectures, and assessments. I was honored with the **"Teaching Excellence Award - 2022"** as a graduate student instructor WSU.

- **Los Alamos National Laboratory (LANL)[🌐]** *June 2024 - Aug 2024*
  *Summer Intern as Graduate Research Associate* Los Alamos, New Mexico
  - I simulated seismic waveforms using **HPC** and ran deep learning models at scale, developing **CNN and LSTM** architectures to classify earthquakes and explosions. To enhance model **robustness**, I implemented **data augmentation, regularization techniques, and feature learning**. Additionally, I built **adversarial learning** architectures to improve model **generalizability** and focused on model **interpretability** to better understand and explain the decision-making processes.

- **Center for Interdisciplinary Statistical Education and Research (CISER), WSU [🌐]** *Jan 2023 - July 2023*
  *Research Assistant* Pullman, WA
  - I managed over 30 research projects across various fields and data types, and led a data analysis workshop using **R** for graduate and professional students at WSU. I applied a range of statistical techniques, including regression, mixed models, and multivariate methods, while conducting data analysis using multiple software platforms such as Python, R, STATA, and SPSS.

- **Analytics and PsychoPharmacology Laboratory (APPL), WSU [🌐]** *Aug 2023 - May 2024*
  *Research Assistant* Spokane, WA (Remote)
  - Managed **clinical trials data** for trans-disciplinary research on drug and alcohol abuse, providing statistical support in data management, analysis, and applying domain-specific methodologies like **twin analysis, SEM, and GEE**. Multiple publications are in progress.

- **NCW Tech Alliance, Washington [🌐]** *May 2022*
  *Lead Trainer* Wenatchee, Washington
  - Led a **data science workshop** with participants from various industries and academia, providing hands-on training in creating interactive **dashboards using RShiny** and conducting **sentiment analysis** with Twitter data to generate word clouds.

- **Faculty of Business Studies, Bangladesh University of Professionals (BUP) [🌐]** *April 2018 - July 2019*
  *Assistant Professor in Statistics* Dhaka, Bangladesh
  - I **taught** both undergraduate and graduate courses, including **Research Methodology, Econometrics, Business Mathematics, and Business Statistics**, while supervising thesis and projects at both levels. I **introduced a new course**, "Software Tools for Economic Data Analysis," and served as the **graduate program coordinator**, along with handling various other administrative responsibilities.

- **Faculty of Business Studies, Bangladesh University of Professionals (BUP) [🌐]** *Jan 2015 - April 2018*
  *Lecturer in Statistics* Dhaka, Bangladesh
  - I focused on teaching and research while contributing to the improvement of the undergraduate curriculum.

- **Directorate of Primary Education, Govt. of Bangladesh [🌐]** *May 2014 - June 14*
  *Lead trainer, STATA training program, funded by: Asian Development Bank (ADB)* Dhaka, Bangladesh
  - Conducted a month-long training on data management and analysis using STATA.

## Published Works

**[1]** Kimberly L. M., Kathryn E. S., Elizabeth A. J., Andrew J. S., Anya L. S. , Kathryn G., Riley T., **Hasan, M. M.** & Marc G. B. (2024) **Evidence for environmental influences on impulsivity and aggression** . in *Urban Forestry & Urban Greening, 103*.

**[2]** Anjum, A., Ahammed, T., **Hasan, M. M.**, Chowdhury, M. A. B., & Uddin, M. J. (2023). **Mothers functional difficulty is affecting the child functioning: Findings from a nationally representative MICS 2019 cross-sectional survey in Bangladesh**. In *Health Science Reports 6(1)*.

**[3]** Shahriar, S., Qian, L., Rahman, A., **Hasan, M.**, Kea, S., & Abdullahi, N. M. (2020). **Youth skill development loans (YSDL) and good governance in Bangladesh: a logit model analysis**. *Emerging Markets Finance and Trade*, 56(11), 2529-2542. https://doi.org/10.1080/1540496X.2019.1594769

**[4]** Nury, A. H., Hasan, K., Alam, M. J. B., & **Hasan, M. M** (2017). **Analysis of Time Series Variations of Temperature and its Forecast in Northeastern Bangladesh**. *International Journal of Global Warming*, 13(2), 157-182. https://doi.org/10.1504/IJGW.2017.086283

**[5]** **Hasan, M. M.** , Islam, M. T., Sultana, N. , &(2017). **Effect of Climate Change on Rice Production in Bangladesh: A Comparative Study between Time Series and Stochastic Models**. *BUP Journal*, 4 (2).

**[6]** Sultana, N., Islam, M. T., & **Hasan, M. M.** (2017). **An Inter-Services Comparative Study on the Diversification of the Factors of Employee Retention in Bangladesh: Application of Structural Equation Modeling**. *Australian Academy of Business and Economics Review*, 3 (3), 166-176.

**[7]** Ahmed, M. U., Muzib, M. M., **Hasan, M. M.** (2016). **Inflation, Inflation Uncertainty and Relative Price Variability in Bangladesh**. *Eurasian Economic Review*, 6 (3), 389–427.

## Work in Progress (in-progress research titles are tentative)

**[1]** **Improving Generalizability of Deep Learning Models for Discriminating Earthquakes and Explosions**. [**Current Status:** Work-in-Progress]

**[2]** **Interpretable Deep Learning Model for Discriminating Earthquakes and Explosions**. [**Current Status:** Work-in-Progress]

**[3]** **Change Point Detection for Dimensionality in Random Dot Product Graphs**. **Current Status:** Work-in-Progress.

**[4]** **Studying Social Network Dynamics: Addressing Aggregation Challenges and Modeling Language Risk in School Friendship Networks. Current Status:** Work-in-progress.

**[5]** Smith, C. L., Avery, A., Ryan, R., Duncan, G. E., Colletto, S., **Hasan, M. M.**, Hall, L., McPherson, S. M. **Genetic and environmental influences on the relationships between smoking and cannabis co-use and their association with chronic pain: A twin study**. [**Current Status:** Ready-to-Submit]

## Conference Psesentations

**[1]** **Hasan, M. M.** & DeFord, D. (2024). Studying Social Network Dynamics: Addressing Aggregation Challenges and Modeling Language Risk. *Joint Statistical Meeting*. Portland, Oregon, USA.

**[2]** **Hasan, M. M.**, Kim. W., Carlton-Wargo, J. & Rice, D. (2024). Investigating American Optimism: Evidence from 2022 General Social Survey (GSS) Data. *Joint Statistical Meeting*. Portland, Oregon, USA.

**[3]** **Hasan, M. M.** & DeFord, D. (2024). Social Network Dynamics: Addressing Aggregation Challenges in School Friendship Networks. *SIAM Annual Meeting*. Spokane, WA, USA.

**[4]** **Hasan, M. M.** (2017). Climate Change and Its Impact on Agricultural Production in Bangladesh: Geo-statistical Analysis of Spatial and Temporal Variation. *9th Biennial Conference of Indian Society for Ecological Economics (INSEE)*. Keralla, India.

**[5]** **Hasan, M. M.** & Hossain, M. Z. (2017). Climate Change in Terms of Extreme Weather Events in Bangladesh: Impacts on the Economic Developme. *16th Biennial Conference of Bangladesh Statistical Associatio*. Dhaka, Bangladesh.

**[6]** **Hasan, M. M.** & Hossain, M. Z. (2016). Engendering Extremity in the Climate of Bangladesh: An Observation through Maximum and Minimum Temperature. *National Conference on Sustainable Developmen*. SUST, Sylhet, Bangladesh.

**[7]** **Hasan, M. M.** & Sultana, N. (2016). An Inter-Services Comparative Study on Job Satisfaction in Bangladesh: Application of Discriminant Function Analysis and Structural Equation Modeling. *International Conference on Business Analytics and Big Data*. Indian Institute of Management (IIM), Ahmadabad, India.

**[8]** **Hasan, M. M.** & Sultana, N. (2016). An Inter-Services Comparative Study on the Diversification of the Factors of Employee Retention in Bangladesh: Application of Structural Equation Modeling. *International Conference organized by AMDISA*. Uttara University, Dhaka, Bangladesh.

**[9]** **Hasan, M. M.** & Hossain, M. Z. (2014). Regional Variation of Climate Change through Drought and Trend Analysis using Temperature and Rainfall Data. *Bi-annual Conference of Bangladesh Statistical Association (BSA*. Dhaka, Bangladesh.

**[10]** **Hasan, M. M.** & Hossain, M. Z. (2014). Rainfall Variation in Bangladesh: A Wavelet Transformation Analysis. *Bi-annual Conference of Bangladesh Statistical Association (BSA*. Dhaka, Bangladesh.

## FUNDED RESEARCH PROJECTS

- **Understanding Women's COVID-19 Vaccine Decisions in the USA** *2021 - 2021*
  *Position: Data Analyst, Collaborative Project by Washington State University and the University of Idaho.*
  ◦ Managed data for a nationally representative survey and performed statistical analysis, including multi-dimensional plots and logit modeling

- **Time Series Analysis of the Economic Factors of Development in Bangladesh** *2017 - 2018*
  *Position: Project Lead, Funded By: Center for Higher Studies and Research, BUP*
  ◦ Led the development of the research proposal, study design, survey creation and execution, data analysis, and report preparation.

- **Factors and Strategies for Effective Employee Retention in the Organizations of Bangladesh** *2017 - 2018*
  *Position: Project Lead, Funded By: University Grants Commission (UGC), Bangladesh.*
  ◦ Led the development of the research proposal, study design, survey creation and execution, data analysis, and report preparation.

- **Rana Plaza Disaster and the Aftermaths: Vulnerability Assessment of the Victims Children(s)** *2016 - 2017*
  *Position: Project Lead, Funded By: University Grants Commission (UGC), Bangladesh.*
  ◦ Led the research team in writing a research proposal, designing the study, designing the survey for data collection, data analysis, and report writing.

- **Regional Variation of Climate Change: an Application of Wavelet Transformation** *2013 - 2014*
  *Position: Research Assistant, Funded by: Research Center, SUST, BD*
  ◦ Proposal writing, Data analysis, and report preparation.

- **Capital Formation through Remittances & Investment Climate: A Study in the Sylhet, Bangladesh** *2013 - 2014*
  *Position: Research Assistant, Funded by: Research Center, SUST, BD*
  ◦ Data analysis, and report writing

## CLASS PROJECTS (SELECTED)

- **Classification and Segmentation using Deep Neural Networks** *Fall 2022*
  *Course: Computer Vision, Washington State University*
  ◦ Designed and implemented a deep Convolutional Neural Network (CNN) for brain tumor classification, and a UNet-based encoder-decoder architecture for tumor segmentation from MRI images using Python.

- **Variable Selection and Post-selection Inference under Endogeneity** *Spring 2022*
  *Course:Theory of Statistical Learning, Washington State University*
  ◦ Investigated the impact of endogeneity on variable selection methods, assessing the performance of ridge projection and de-sparsified LASSO under varying sparsity levels and sample sizes. Addressed challenges in high-dimensional statistics using R.

- **UNet-Based Autoencoder for Denoising Electrocardiogram Signals** *Fall 2020*
  *Course: Machine Learning, Washington State University*
  ◦ Implemented an UNet-based autoencoder approach for effectively denoising motion encrypted electrocardiogram (ECG) signals, enhancing the visibility of R-peaks and enabling accurate interbeat interval (IBI) estimation.

- **Comparing the link Prediction algorithms in network** *Fall 2020*
  *Course: Elements of Network Science, Washington State University*
  ◦ Used a public "Citations" network to test and compare three link prediction algorithms: common neighbors, preferential attachment, and total neighbors. The goal was to figure out how likely it was that nodes would connect in the future (authors).

- **Genome-Wide Regression Analysis with Bayesian Methods** *Fall 2020*
  *Course: Bayesian Analysis, Washington State University*
  ◦ This project utilizes Bayesian methods for conducting genome-wide regression analysis, comparing various Bayesian models and integrating both genetic and non-genetic predictors to estimate marker effects on a phenotype in "mice" data with R.

- **Implementing Sequence Alignment Algorithm in Python** *Fall 2023*
  *Course: Bioinformatics, Washington State University*
  ◦ Develop a Python code from scratch to implement the Global Sequence Alignment dynamic programming algorithm for a given DNA and Protein sequences.

- **Markov Chain Modeling for Stock Price Prediction** *Fall 2021*
  *Course: Advanced Algorithms, Washington State University*
  ◦ Employed Markov chain models to predict next-day stock prices based on historical stock charts, particularly focusing on the highest, opening, closing, lowest prices, and volume.

## SKILLS

- **Operating Systems:** Windows, Linux, macOS
- **Programming Languages:** Python, R, MATLAB
- **Database Systems:** SQL
- **ML/DL Libraries:** pandas, NumPy, scikit-learn, PyTorch, TensorFlow, NetworkX, PyG, DGL
- **HPC Environment:** Slurm, CUDA, Parallel Computing Techniques
- **Data Analysis Tools:** R, SAS, STATA, SPSS, Minitab, AMOS, MPlus
- **Document Writing:** LaTeX, Markdown, MS Office Suite
- **Version Control:** Git, GitHub
- **Cloud Platforms:** AWS, Google Cloud, Microsoft Azure

## HONORS AND AWARDS

- **Winner of "2024 Data Challenge Expo" at JSM** *2024*
  *Joint Statistical Meeting (JSM), Portland Oregon. American Statistical Association (ASA)* [🌐]
  ◦ Secured third place in the nationwide General Social Survey (GSS) data competition.

- **President's Award for Leadership at WSU** *2023*
  *Washington State University* [🌐]
  ◦ For exemplary leadership and community engagement at WSU.

- **Teaching Excellence Award as Graduate Student Instructor** *2022*
  *Graduate and Professional Students Association, Washington State Unviersity*
  ◦ Acknowledged for outstanding teaching performance as a graduate student instructor at WSU.

- **Three Minutes Thesis Contest Winner** *2022*
  *Dept. of Mathematics and Statistics, Washington State University*
  ◦ Secured second place in the department-level competition and advanced to the college-level competition.

- **Sidney G. Hacker Mathematics Scholarship** *2022*
  *Dept. of Mathematics and Statistics, Washington State University*
  ◦ For exceptional community engagement and service, Washington State University.

- **Academic Distinction Award** *2010 & 2012*
  *Shahjalal University of Science and Technology, Sylhet, Bangladesh.*
  ◦ For achieving the top position with the highest CGPA in both undergraduate and Master's programs.

- **Best Research Paper Award** *2018*
  *International Conference Organized by AMDISA, Uttara University, Dhaka, Bangladesh*
  ◦ Selected as the best paper among over 70 papers presented in the conference.

## Leadership and Volunteer Experience

- **Senator-at-Large** *Oct 2022 - Current*
  *Graduate and Professional Students Association (GPSA), Washington State University.* [🌐]
  ◦ Advocating for the needs and concerns of graduate and professional students to ensure their voices are heard in the university policy-making and decision processes.
  ◦ Represented the department and college at university-level meetings.
  ◦ Served on several internal committees for student welfare and professional development initiatives.

- **President** *Jan 2022 - Aug 2023*
  *American Statistical Association (ASA)-Graduate Student Chapter, Washington State University.* [🌐]
  ◦ Organized a range of professional and social events, including workshops, colloquia, data camps, and community-building activities, to foster student engagement and skill development at both the departmental and university level.
  ◦ Introduced and led a free workshop on R programming for graduate students at WSU.

- **Vice-President** *May 2021 - Dec 2021*
  *American Statistical Association (ASA)-Graduate Student Chapter, Washington State University.* [🌐]
  ◦ Performed similar duties while actively assisting and collaborating with other members.

- **Facilitator** *2022 - Current*
  *Data Literacy Camps* [🌐]
  ◦ Assisted in organizing multiple data literacy camps with local school kids across Washington State.

- **Advisor** *Jan 2019 - July 2019*
  *BUP Research Society* [🌐]
  ◦ Contributed in the establishment as a new club at the university and in designing its organizational structure.

## Professional Memberships

- **American Statistical Association (ASA)**
- **American Mathematical Society (AMS)**
- **Bangladesh Statistical Society (BSA)**
- **Indian Society for Ecological Economics(INSEE)**

## Certifications (Attended)

- Summer School on Machine Learning. **University of California, San Diego, USA** *June- July 2023*
- R for Ecological Economics. **TERI School of Advanced Studies, New Delhi, India** *March 2018*
- Introduction to GIS Programming and Algorithm. **BUET-JIDPUS, Dhaka, Bangladesh** *Dec 2017*
- Spatial Analysis using R. **Institute of Remote Sensing- Jahangirnagar University, Bangladesh.** *Dec 2017*
- Structural Equation Modeling (SEM) using AMOS. **Uttara University, Dhaka, Bangladesh.** *Jan 2016*
- Advanced Time Series Analysis using R. **Dept. of Statistics, SUST, Bangladesh.** *June 2013*
- Statistical Inference in Bioinformatics. **Dept. of Statistics, SUST, Bangladesh.** *May 2013*
- Machine Learning using MATLAB. **Dept. of Statistics, SUST, Bangladesh.** *July 2013*
- Advanced Data Analysis using SPSS. **Dept. of Statistics, SUST, Bangladesh.** *March 2012*

## Additional Information

**Languages:** Bengali (Mother Tongue), English (Proficient), Hindi (Intermediate)
**Interests:** Reading, playing soccer, cricket, Badminton, and love traveling.