Md Mahmudur Rahman

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Research Interests

Statistics, Machine learning, Survival analysis, Federated learning, Fairness in AI, Privacy in AI, Machine Learning Interpretability, Causal Inference, and Healthcare Informatics

Education

- **Ph.D. in Information Systems**
  University of Maryland, Baltimore County, MD, USA.
  Dissertation title: Fair and Interpretable Pseudo Value-Based Deep Learning Models for Federated Survival Analysis
  Advisor: Dr. Sanjay Purushotham
  Expected Graduation: Fall 2024
- **M.Sc. in Information Systems**
  University of Maryland, Baltimore County, MD, USA.
  Graduation: May 2023
  CGPA: 3.87/4.00
- **M.Sc. in Statistics**
  University of Dhaka, Bangladesh.
  January 2016 – March 2017
  GPA: 3.89/4.00
  Thesis title: Effect of Caesarean Section on Neonatal Health in Bangladesh after Controlling Selection Bias: Propensity Score-Based Analysis
- **B.Sc. in Statistics, Biostatistics and Informatics**
  University of Dhaka, Bangladesh.
  January 2011 – November 2015
  CGPA: 3.78/4.00

Honors and Awards

- KDD Student Travel Award, ACM SIGKDD 2023.
- GSA Travel Grant, UMBC, 2023.
- IS Department Travel Grant, Department of Information Systems, UMBC, 2023.
- SIAM Student Travel Award, SIAM International Conference on Data Mining, 2023.
- 1st Place - PhD/Postdoc Completed Research Track, IS Research Symposium, UMBC, 2022.
- Student Scholarship, ACM SIGKDD-2022 .
- Student Scholarship, AAAI-2021 and AAAI-2022.
- 2nd Place -Ph.D./Postdoc Completed Research Track, IS Poster Day, UMBC, 2021.
- Audience Choice Award, IS Poster Day, UMBC, 2021.
- Dean's Award, University of Dhaka, Bangladesh, 2016.
- NST Fellowship for Research, Ministry of Science and Technology, Bangladesh, 2016.

Publications

- **Federated Competing Risk Analysis**
  Md Mahmudur Rahman and Sanjay Purushotham
  CIKM - Conference on Information and Knowledge Management 2023
- **FedPseudo: Privacy-Preserving Pseudo Value-Based Deep Learning Models for Federated Survival Analysis**
  Md Mahmudur Rahman and Sanjay Purushotham
  KDD - ACM Conference on Knowledge Discovery and Data Mining 2023 [**Paper**] [**Code**]
- **Multi-state Survival Analysis using Pseudo value-based Deep Neural Networks**

Md Mahmudur Rahman and Sanjay Purushotham
SDM - SIAM International Conference on Data Mining 2023 [**Paper**]

- **Fair and interpretable models for survival analysis**
  Md Mahmudur Rahman and Sanjay Purushotham
  KDD - ACM Conference on Knowledge Discovery and Data Mining 2022 [**Paper**] [**Code**]
- **DeepPseudo: pseudo value based deep learning models for competing risk analysis**
  Md Mahmudur Rahman, Koji Matsuo, Shinya Matsuzaki, and Sanjay Purushotham
  AAAI - AAAI Conference on Artificial Intelligence 2021 [**Paper**] [**Code**]

Workshop and Symposium Presentations

- **Communication-Efficient Pseudo Value-Based Random Forests for Federated Survival Analysis**
  Md Mahmudur Rahman and Sanjay Purushotham
  AAAI - AAAI Fall Symposium Series - SPACA: Survival Prediction Algorithms, Challenges & Applications 2023 [**Link**]
- **Federated learning for competing risk analysis in healthcare**
  Md Mahmudur Rahman and Sanjay Purushotham
  KDD - International Workshop on Federated Learning for Distributed Data Mining 2023 [**Paper**] [**Link**]
- **FedPseudo: Pseudo value-based Deep Learning Models for Federated Survival Analysis**
  Md Mahmudur Rahman and Sanjay Purushotham
  KDD - DSHealth: Workshop on Applied Data Science for Healthcare 2022 [**Paper**] [**Link**]
- **Pseudo value-based Deep Neural Networks for Multistate Survival Analysis**
  Md Mahmudur Rahman and Sanjay Purushotham
  KDD - DSHealth: Workshop on Applied Data Science for Healthcare 2022 [**Paper**] [**Link**]
- **A Pseudo Value Based Interpretable Neural Additive Model for Survival Analysis**
  Md Mahmudur Rahman and Sanjay Purushotham
  AAAI - Workshop on Trustworthy AI for Healthcare 2022 [**Link**]
- **PseudoNAM: A Pseudo Value Based Interpretable Neural Additive Model for Survival Analysis**
  Md Mahmudur Rahman and Sanjay Purushotham
  AAAI - Human Partnership with Medical AI: Design, Operationalization, and Ethics Science-Guided AI 2021 [**Paper**]
- **DeepPseudo: A Deep learning approach based on Pseudo values for Competing Risk Analysis**
  Md Mahmudur Rahman and Sanjay Purushotham
  KDD - Workshop on Applied Data Science for Healthcare 2022 [**Link**]

Research Experience

- **Graduate Research Assistant (with Dr. Sanjay Purushotham)** Aug 2019 – Present
  Department of Information Systems, University of Maryland-Baltimore County.
  - Introduced several novel statistical-informed machine learning methods to advance the state-of-the-art of multi-state survival analysis in order to build better healthcare.
  - Investigated challenges and solutions for achieving fair and interpretable survival predictions in the presence of censoring to ensure equitable and trustworthy predictions.
  - Developed privacy-preserving and communication-efficient federated learning techniques for survival analysis to address the challenges posed by limited healthcare data, data heterogeneity, and stringent privacy regulations on data sharing.
- **Research Assistant** June 2015 – August 2015
  Aspire to Innovate (a2i) Program, ICT Division, Bangladesh, Supported by UNDP.
  - Designed questionnaires and collected data through field visits to support research projects. By leveraging my survey design and data collection skills, I ensured that data was collected efficiently and accurately.
  - Performed exploratory and statistical analysis using statistical tools such as SPSS. Using my

expertise in statistical analysis, I identified trends and patterns in the data, providing valuable insights for policy-making.

- Analyzed data from the Bangladesh National Portal, a platform for citizens to access government services and information. By conducting an in-depth analysis, I prepared a comprehensive report that identified key areas for improvement and helped guide policy-making decisions.

Teaching and Mentoring Experience

- **Graduate Teaching Assistant** for "Deep Learning" Jan 2023 – May 2023
  Department of Information Systems, University of Maryland-Baltimore County.
  - Graded assignments, homework, and exam papers for a class of 40 students.
  - Conducted one-on-one discussions with students who needed help understanding course materials.
- **Mentor** June 2021 – August 2021
  NSF-REU Project, University of Maryland-Baltimore County.
  - Guided an undergraduate student to achieve his medical image segmentation project goal.
- **Lecturer**, Bangladesh University of Business and Technology. Jun 2017 -Sep 2017
  - Designed and taught three statistics courses, covering topics such as business statistics, regression analysis, probability, and time series analysis.
  - Monitored student progress and provided constructive feedback and guidance.
  - Encouraged group discussions and class participation to develop strong communication and teamwork skills.
- **Graduate Teaching Assistant** Jan 2017 – Apr 2017
  East West University, Dhaka, Bangladesh
  - Taught the application of R in the Design of Experiment and Multivariate Analysis to a class of 20 graduate students.
  - Graded assignments, homework, and exam papers and designed the course materials.
  - Helped faculty members to prepare their lectures and presentations.
- **Instructor** Sep 2016 – Dec 2016
  East West University, Dhaka, Bangladesh
  - Taught statistical learning with SPSS and R to three classes of a total of 120 students.
  - Graded assignments, homework, and exam papers.
  - Assisted students in understanding the course materials.

Professional Experience

- **Deputy Director** Dec 2020 - Present (Study Leave)
  Statistics Department, The Central Bank of Bangladesh.
- **Assistant Director** Apr 2018 - Dec 2020
  Balance of Payment Section, Statistics Department, The Central Bank of Bangladesh.
  - Identified and visualized the key patterns and trends in Bangladesh's Export Receipts & Central Account data by analyzing them using the Enterprise Data Warehouse system that helped my manager make informed decisions on strategic initiatives.
  - Prepared the quarterly and annual reviews on Export Receipts of Goods & Services. By providing insights into the country's export performance, we support the government in its efforts to promote economic growth and attract foreign direct investment.
  - Led a team that established a Data Science section in my department, which lays a foundation for a more data-driven culture.

Technical Strengths

- **Programming Languages:** Python, R
- **ML Frameworks:** TensorFlow, Keras, PyTorch, Numpy, Pandas, Matplotlib, scikit-learn, TFF, PySyft, FEDML
- **Statistical Tools:** STATA, SPSS, SAS, KNIME, EViews, Rshiny
- **Utilities:** LaTeX, Anaconda, Git, Jupyter Notebook, SQL, Microsoft Office, Tableau, Linux

Professional Affiliation and Activities

- Reviewer for 58th Annual Conference on Information Sciences and Systems (CISS)
- Reviewer for Artificial Intelligence in Medicine
- Reviewer for Journal of Machine Learning Research
- Reviewer for IEEE PerCom
- Student Member of Association for the Advancement of Artificial Intelligence (AAAI)
- Student Member of ACM SIGIR
- Volunteer at ACM SIGKDD conference 2023
- Volunteer at ACM SIGKDD conference 2022
- Volunteer at AAAI conference 2021

Projects

- **Project 1: Novel Data-Driven Methods to Analyze Heterogeneous Healthcare Data**

  National Science Foundation (NSF)

  - Developed a general framework with pseudo value-based deep learning models for solving complex survival analysis problems, such as competing risk analysis, and multi-state modeling.
  - Introduced multiple censoring-based fairness definitions and developed fair and interpretable deep learning models for survival analysis to ensure equitable and trustworthy survival predictions.

- **Project 2: Trustworthy and Robust Federated Learning for Computational Healthcare**

  National Science Foundation (NSF)

  - Developed privacy-preserving federated learning frameworks, FedPseudo and Fedora, for survival analysis and competing risk analysis, respectively.
  - Addressed the critical challenges in distributed survival data analysis, such as data heterogeneity, non-uniform censoring, and data privacy.
  - Developed communication-efficient pseudo value-based federated forest framework for survival analysis.