# Muhammad Monjurul Karim

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**RESEARCH INTERESTS**

**Data-driven methodologies and algorithms for advanced transportation safety, mobility, and resilience**

- Transportation data science
- Intelligent transportation systems
- Traffic sensing and advanced computing
- Predictive analytics
- Connected and autonomous vehicles
- Anomaly detection & incident management

**EDUCATION**

**Stony Brook University**, Stony Brook, NY

Ph.D., Civil Engineering, 2023

Dissertation: Deep learning-based dashcam video analysis for roadway safety enhancement: accident anticipation, risky agent localization, and trajectory prediction

**Missouri University of Science and Technology**, Rolla, MO

M.S., Systems Engineering, 2020

Thesis: Computer vision based deep learning models for cyber physical systems

**Bangladesh University of Engineering & Technology**, Bangladesh

B.S., Industrial & Production Engineering, 2014

**EXPERIENCES**

**Postdoctoral Scholar** (Jun 2023 - Present)

Smart Transportation Applications & Research (STAR) Lab, Department of Civil & Environmental Engineering, University of Washington, Seattle, WA

- Perform research aimed at designing and developing intelligent transportation systems through multimodal sensing, deep learning, and data analytics
- Supervise student research at STAR Lab
- Write research proposals and grant applications
- Communicate the lab research output to project sponsors, companies, media, and the public

**Research Assistant** (Aug 2023 - Jun 2023)

Department of Civil Engineering, Stony Brook University, Stony Brook, NY

- Developed deep learning based state-of-the-art traffic accident anticipation system using computer vision data
- Conducted research on the use of deep learning for video analysis in various scenarios, such as self-driving cars, traffic monitoring, and bridge inspection
- Co-instructed a graduate course "Data Analytics for Engineering Systems

**Research Assistant** (Aug 2018 - Jul 2020)

Department of Engineering Management & Systems Engineering, Missouri University of Science & Technology, Rolla, MO

- Developed computer vision based deep learning models for creating cyber physical systems
- Implemented image processing techniques such as object detection, semantic segmentation, and image recognition to develop models that can interact with the physical world

**Assistant Manager** (Feb 2015 - Jul 2018)
Abul Khair Steel Melting Ltd., Bangladesh
- Developed and implemented production schedules to ensure timely delivery of goods to customers
- Monitored inventory levels and adjusted production plans as necessary to prevent stockouts, led a team of 26 people

**HONORS AND AWARDS**

2025 Young Scholar Award from TRB AED30 (Information Systems and Technology) Standing Committee (2025)

Civil Engineering (CIV) Research Merit Award for outstanding graduate research, Stony Brook University (2022)

Honorable mention – Graduate Student Research Symposium Competition, Department of Civil Engineering, Stony Brook University (2022)

Finalist for the Student AI Research Poster Competition, American Society of Civil Engineers Transportation & Development Institute (ASCE T&DI) (2021)

2nd place, Graduate Student Poster Competition, USDOT INSPIRE University Transportation Center (UTC) (2020)

2nd place, Graduate Student Poster Competition, Intelligent Systems Center, Missouri University of Science and Technology (2019)

First Runner up – Best paper Award, Complex Adaptive Systems Conference (2019)

**JOURNALS**

1. **Karim, M. M.**, Shi, Y., Zhang, S., Wang, B., Nasri, M., Wang, Y. (2025). Large language models and their applications in roadway safety and mobility enhancement: A comprehensive review, *Artificial Intelligence for Transportation*, doi: 10.1016/j.ait.2025.100004.

2. **Karim, M. M.**, Wang, B., Wang, Y. (2025). Thermal-Forecast: Traffic Trajectory Prediction in Challenging Nighttime Conditions Using Thermal Imaging, Accepted, *Transportation Research Record*.

3. **Karim, M. M.**, Qin, R., Wang, Y. (2024). Fusion-GRU: A Deep Learning Model for Future Bounding Box Prediction of Traffic Agents in Risky Driving Videos, *Transportation Research Record*, doi: 10.1177/03611981241230540.

4. **Karim, M.M.**, Yin, Z., Qin, R. (2023). An attention-guided multistream feature fusion network for early localization of risky traffic agents in a driving videos, *IEEE Transaction on Intelligent Vehicles*, doi: 10.1109/TIV.2023.3275543.

5. **Karim, M.M.**, Li, Y., Qin, R. (2022). Toward explainable artificial intelligence (XAI) for early anticipation of traffic accidents. *Transportation Research Record*, 2676(6), 743-755.

6. **Karim, M. M.**, Li, Y., Qin, R., Yin, Z. (2022). A dynamic Spatial-temporal attention network for early anticipation of traffic accidents. *IEEE Transactions on Intelligent Transportation Systems*, 23(7), 9590-9600.

7. **Karim, M.M.**, Qin, R., Chen, G., Yin, Z. (2021). A semi-supervised self-training method to develop assistive intelligence for segmenting multiclass bridge elements from inspection videos. *Structural Health Monitoring* 21(3), 835-852.

8. Li, Y., **Karim, M.M.**, Qin, R. (2022) A Virtual-Reality-Based Training and Assessment System for Bridge Inspectors With an Assistant Drone, *IEEE Transactions on Human-Machine Systems*, 52(4), 591-601, doi: 10.1109/THMS.2022.3155373.

9. Zhang, C., **Karim, M.M.**, Qin, R. (2023). A multitask deep learning model for parsing bridge elements and segmenting defect in bridge inspection images. *Transportation Research Record*, DOI: 10.1177/03611981231155418.

10. Li, Y., **Karim, M.M.**, Qin, R., Sun, Z., Wang, Z., Yin, Z. (2021). Crash report data analysis for creating scenario-wise, spatio-temporal attention guidance to support computer vision- based perception of fatal crash risks. *Accident Analysis and Prevention* 151, pp. 105962.

**PEER-REVIEWED CONFERENCES**

11. Wang, B., Cai, Z., **Karim, M.M.**, Liu, C., Wang, Y. (2024). Traffic Performance GPT (TP-GPT): Real-time data informed intelligent chatbot for transportation surveillance and management. Submitted to *27th IEEE International Conference on Intelligent Transportation Systems*.

12. Li, Y., **Karim, M.M.**, Qin, R. (2023). A gaze data-based comparative study to build a trustworthy human-AI collaboration in crash anticipation. *ASCE 2023 International Conference on Transportation Development (ICTD'23)*. Austin, TX, USA. June 14-17, 2023.

13. **Karim, M.M.**, Li, Y., Qin, R., Yin, Z. (2021). A system of vision sensor based deep neural networks for complex driving scene analysis in support of crash risk assessment and prevention [Presentation]. *The 100th Transportation Research Board (TRB) Annual Meeting*, Virtual Meeting, January 5-29, 2021.

14. **Karim, M. M.**, Dagli, C. H. (2020). SoS meta-architecture selection for infrastructure inspection system using aerial drones. *2020 IEEE 15th International Conference of System of Systems Engineering (SoSE)* (pp. 23-28). IEEE.

15. **Karim, M. M.**, Dagli, C. H., Qin, R. (2020). Modeling and simulation of a robotic bridge inspection system. *Procedia Computer Science*, 168, 177-185.

**IN-PREPARATION**

16. **Karim, M.M.**, Wang, B., Wang, Y. (2023). Enhancing intersection safety in challenging environments: a transformer-based approach for extreme weather conditions.

17. **Karim, M.M.**, Wang, Y. (2023). Spatio-temporal adaptive transformer for urban traffic forcasting.

**FUNDED RESEARCH**

- Co-PI with Yinhai Wang (PI). Next-Gen Transportation Analytics: Enabling Large Language Models in Traffic Frameworks, $75,000, Aug 2024 - Aug 2026, PacTrans UTC.

**TEACHING EXPERIENCE**

**Instructor** (Autumn 2023)
Department of Civil and Environmental Engineering, University of Washington, Seattle, WA
Course: CET 590 (Traffic Systems Operations)

- Full instructor for this course. This course teaches traffic control system concepts, components, and algorithms. Major topics of this course include, traffic control systems, timing plan design, traffic flow characteristics, driver behavior modeling, vehicle actuated programming, and simulation. Vissim traffic simulation package is also taught in this course to evaluate the performance of traffic operation plans.

**Co-Instructor** (Spring 2025)
PacTrans Workforce Institute, University of Washington, Seattle
Course: AI 101 (Introduction to Artificial Intelligence for Transportation Professionals)
- This short course is designed and delivered for transportation professionals from the Washington State Department of Transportation (WSDOT)

**Co-Instructor** (Fall 2021, Fall 2022)
Department of Civil Engineering, Stony Brook University, Stony Brook, NY
Course: CIV 555 (Analytics for Engineering Systems)
- Independent instructor on two learning modules: Neural Network Fundamentals and Introduction to Deep Learning
- Designed and prepared course materials including python code, datasets, examples, lecture notes, and homework assignments to teach
- Delivered five lectures totaling 400 minutes in each semester public
- Designed and graded assignments, and maintained office hours to assist students

**Guest Lecturer** (Spring 2022)
Department of Civil Engineering, Stony Brook University, Stony Brook, NY
Course: CIV 355 (Data Analytics for Civil Engineering Systems)
- Delivered a lecture to teach Neural Network to undergraduate students

**STUDENT MENTORING**

**Graduate Students**
- Bingzhang Wang, Department of Civil and Environmental Engineering, University of Washington
- Yan Shi, Department of Civil and Environmental Engineering, University of Washington

**Undergraduate Students**
- Drew Racz, Department of Civil Engineering, Stony Brook University
- Ziming Li, Department of Computer Science, Stony Brook University
- Yanguang Gong, Department of Computer Science, Stony Brook University
- Gary Liu, Department of Civil Engineering, Stony Brook University
- Michael Incardona, Department of Civil Engineering, Stony Brook University

**Technical SKILLS**

Programming Language: Python, PhP, Matlab, C, SQL
Autodifferentiation Framework: PyTorch, Tensorflow, Keras
Python Package: Numpy, Scipy, Sk-learn, OpenCV, Matplotlib, Pandas
Simulation: VISSIM, AnyLogic
Operating System: Linux, MS Windows
Distributed Version Control: Git
Document Preparation: Latex, MS Word

**SERVICES AND OTHERS**

**Editorial Board Member**: International Journal of Transportation Engineering and Technology (IJTET)

**Reviewer**: Applied Artificial Intelligence, The Journal of Supercomputing, IEEE International Conference on Intelligent Transportation Systems, Signal, Image and Video Processing, Transportation Research Board (TRB) Annual Meeting

**Committee Member**:

- TRB AED30 Information Systems and Technology Committee
- University of Washington Transportation Visioning Committee
- ASCE T&DI Artificial Intelligence in Transportation Committee
- ASCE T&DI Data Sensing & Analytics Committee

**Society Membership**: ASCE, ITE, ACM

**Outreach**: (1) Contributed as a team member to the University of Washonton's organizing team for the ARPA-I National Listening Tour Workshop; (2) PhD student Coordinator for open House program organized by Civil Engineering Department at Stony Brook University; (3) Facilitator and presenter at a workshop for a Pre-College Initiative (PCI) program organized by National Society of Black Engineers (NSBE) to demonstrate the driving simulator-based research

**Writer**: Towards Data Science online blog