

Md Hasibur Rahman

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Research Profile

PhD candidate in Computer Science at Missouri University of Science and Technology (GPA 4.00/4.00; expected Aug 2026) specializing in **computational image sequence analysis, spatiotemporal modeling, multi-object tracking, and machine learning for dynamic visual data**. My research focuses on robust detection, association, and temporal reasoning for small or weak targets in challenging environments with clutter, motion, partial observability, and noisy measurements. I have built end-to-end pipelines spanning dataset curation, model design, temporal learning, multimodal integration, ROS2-based experimentation, and deployment-oriented evaluation using 2D/3D sensing data. My broader goal is to develop reliable learning systems for **tracking, dynamic behavior analysis, and robust inference from time-varying image sequences**.

Research Interests

- Computational image sequence analysis, spatiotemporal modeling, and dynamic visual data understanding
- Multi-object tracking, temporal association, and robust inference from noisy image sequences
- Small-target detection, weak-signal perception, and motion-aware learning under clutter and partial observability
- 2D/3D image analysis, multimodal visual sensing, and dynamic scene understanding
- Machine learning, statistical pattern recognition, and computational sensing for biological and real-world image data

Research Experience

Graduate Research Assistant, Department of Computer Science Aug 2022 – Present
Missouri University of Science and Technology Rolla, MO

- Conduct research on **spatiotemporal modeling, small-target detection, multi-object tracking, and robust inference from dynamic visual data** in challenging real-world environments.
- Created an **augmented detection and tracking dataset** to support research on weak-target perception and temporal visual analysis, published in *IEEE Applied Imagery Pattern Recognition Workshop (AIPR), 2023*.
- Curated **UAVSwarm-W2C**, a real-world benchmark for multi-object tracking with substantial variation in motion, visibility, density, clutter, and platform movement, enabling systematic study of temporal association under adverse conditions.
- Developed **STARD-Net**, a spatiotemporal attention-based model for detection of **small and weak targets** in dynamic scenes, published in *ACM Transactions on Spatial Algorithms and Systems (TSAS), 2025*. Demonstrated strong robustness under motion, limited spatial support, and changing viewpoints.
- Developed **V-USDT**, a tracking framework leveraging temporal consistency and structured group constraints to improve multi-object association over time, published in *Proc. IEEE International Conference on Mobile Data Management (MDM), 2025*. Improved tracking from **MOTA 87.1 to 90.4** and **IDF1 91.1 to 93.1**, while reducing misses from **78.24 to 63.29**.
- Developed **KRAfT** (*Kalman Residual Diffusion with Formation Awareness for UAV Swarm Tracking*), to appear in *IEEE International Conference on Pattern Recognition (ICPR), 2026*. Introduced a geometry-aware temporal tracking framework combining residual motion modeling, association, and conservative recovery of missed targets; achieved **HOTA** scores of **80.37, 70.59, and 65.31** across challenging benchmarks.
- Built pipelines for **dynamic 2D/3D sensing data**, including temporal aggregation, clustering, multimodal preprocessing, and cross-stream fusion analysis for noisy, partially observed scenes.
- Worked with **camera, LiDAR, and radar** data in ROS2-compatible environments, including synchronization, preprocessing, temporal accumulation, and deployment-oriented experimentation on NVIDIA Jetson AGX Orin.
- Designed reproducible benchmarking and stress-testing protocols for clutter, occlusion, missing observations, sensor degradation, and outlier conditions, with emphasis on reliable temporal inference from imperfect image sequences.
- Received a **NAIRR Pilot Resource Allocation** supporting large-scale experimentation on **A100/H100-class** GPU infrastructure.

Publications (Selected)

- **M. H. Rahman** and S. Madria, “KRAFT: Kalman Residual Diffusion with Formation Awareness for UAV Swarm Tracking,” *to appear in IEEE International Conference on Pattern Recognition (ICPR)*, 2026.
- **M. H. Rahman** and S. Madria, “STARD-Net: SpatioTemporal Attention for Robust Detection of Tiny Airborne Objects from Moving Drones,” *ACM Transactions on Spatial Algorithms and Systems (TSAS)*, 2025.
- **M. H. Rahman** and S. Madria, “V-USDT: Vision-Based UAV Swarm Detection and Tracking by Leveraging Swarm Formation Constraints,” *Proc. IEEE International Conference on Mobile Data Management (MDM)*, 2025.
- **M. H. Rahman** and S. Madria, “An Augmented Dataset for Vision-based Unmanned Aerial Vehicles Detection and Tracking,” *Proc. IEEE Applied Imagery Pattern Recognition Workshop (AIPR)*, 2023.

Education

Missouri University of Science and Technology (Missouri S&T) Rolla, MO
PhD, Computer Science Aug 2022 – Aug 2026 (expected)

GPA: 4.00/4.00

Dissertation: Robust Detection and Tracking of Unmanned Aerial Vehicles in Challenging Aerial Environments

Selected Coursework: Deep Learning, Machine Learning in Computer Vision, Data Mining, Advanced AI, Cloud and Big Data Management

Rajshahi University of Engineering & Technology (RUET) Rajshahi, Bangladesh
BSc, Computer Science and Engineering Dec 2017

GPA: 3.74/4.00

Thesis: Predicting Students’ Academic Performance Using Data Mining Techniques

Teaching & Mentoring

Graduate Teaching Assistant, Missouri S&T During PhD

- Supported laboratory instruction and technical mentoring for Big Data platforms including Hadoop, Spark, Hive, HBase, MongoDB, and MATLAB.

Lecturer, Computer Science & Engineering, BUBT Feb 2018 – Jul 2022

- Taught Data Mining, IoT, Operating Systems, and Data Structures; supervised undergraduate projects in machine learning and computer vision.

Technical Expertise

- **Computational Image Analysis and ML:** spatiotemporal modeling, multi-object tracking, small-target detection, temporal association, attention mechanisms, ConvLSTM, multimodal learning
- **Dynamic 2D/3D Data Processing:** noisy image sequence analysis, temporal accumulation, clustering, multimodal preprocessing, cross-stream fusion
- **Programming and Frameworks:** Python, C, C++, SQL, PyTorch, TensorFlow, OpenCV, NumPy, Pandas, scikit-learn
- **Systems and Experimentation:** Linux, Git, GPU experimentation, benchmarking, MATLAB, ROS2