Reeshad Khan, Ph.D.

Computer Vision & Autonomous Systems | ADAS/Robotics Software | BEV Perception & Planning
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Executive Summary

Ph.D. in Computer Science from the University of Arkansas (dissertation defended December 8, 2025). Research focuses on efficient 3D perception, BEV-based autonomous perception and planning, diffusion-based restoration, multimodal sensor fusion, and robust learning under noisy and resource-constrained settings. Experienced in designing end-to-end perception-to-planning systems and simulation-driven evaluation. Strong implementation proficiency in Python and C/C++, with a focus on modular software design, reproducibility, and deployment realism (latency/memory considerations, ONNX export, TensorRT benchmarking).

Core Technical Skills

Core Areas: Computer Vision, Multisensor Fusion, BEV Perception, Generative Models, Edge AI, Autonomous Systems
Programming: Python, C/C++, Java, MATLAB, R, Bash; strong Linux-based development workflows
Frameworks/Libraries: PyTorch, TensorFlow, JAX, MMDetection3D, Detectron2, OpenCV, NumPy/SciPy
Robotics & Autonomy: ROS, ROS2, CARLA, SUMO, Unity; localization/ego-motion integration; SLAM familiarity
Optimization & Systems: CUDA, TensorRT, pruning, quantization, HPC training; profiling and real-time performance tradeoffs
DevOps/Tools: Docker, Git, Jenkins, CI/CD; experiment logging, metric tracking, visualization pipelines; dataset-centric evaluation

Education

Ph.D., Computer Science — Aug 2021 - Dec 2025
University of Arkansas — *Fayetteville, AR*

- Dissertation (defended Dec 8, 2025): *Efficient Deep Neural Networks for Autonomous Perception*
- Advisor: Dr. John Gauch
- Research focus: BEV-based autonomous perception, efficient neural networks, multimodal sensing, uncertainty-aware learning, diffusion models; simulation-driven evaluation.

M.S., Computer Science — May 2024
University of Arkansas — *Fayetteville, AR*

- Research focus: medical imaging and unsupervised restoration (MRI denoising and reconstruction).

- Developed and evaluated noise-aware / uncertainty-aware denoising pipelines, including diffusion-based restoration and risk-estimation ideas.
- Conducted large-scale experimentation and ablations; implemented reproducible training/evaluation workflows on GPU servers.
- Publications from this research include:
  - *Learning From Oversampling: A Systematic Exploitation of Oversampling to Address Data Scarcity Issues in Deep Learning-Based MRI Reconstruction* (IEEE Access, 2024).
  - *From Noise Estimation to Restoration: A Unified Diffusion and Bayesian Risk Approach for Unsupervised Denoising* (VISAPP, 2025).
  - *Adaptive Extensions of Unbiased Risk Estimators for Unsupervised MRI Denoising* (CVC, 2026; accepted).

M.S., Computer Science and Technology Jul 2019 - Jul 2021
Chang'an University *Xi'an, China*

- Chinese Government Belt and Road Scholarship.
- Focus: intelligent transportation research, simulation-driven experimentation (SUMO + Unity), and data-driven modeling.

B.S., Computer Science and Engineering Sep 2012 - Apr 2016
University of Liberal Arts Bangladesh *Dhaka, Bangladesh*

- Undergraduate training in software engineering, algorithms, systems, and programming foundations.

Academic Appointments & Research Experience

Graduate Research Assistant Aug 2021 - Dec 2025
Dept. of Computer Science and Computer Engineering, University of ArkansasFayetteville, AR

- Conducted doctoral research on efficient neural networks, BEV-based autonomous perception and planning, diffusion models, and uncertainty-aware learning.
- Developed lightweight multi-task perception models for autonomous and edge systems (Tiny-BEV).
- Designed diffusion-based and Bayesian risk estimation frameworks for blind MRI denoising and reconstruction.
- Built and maintained multi-GPU HPC training pipelines and large-scale ablation studies.
- Managed GPU clusters and research pipelines; mentored undergraduate and M.S. students in research, experimentation, and paper writing.

Teaching Assistant Jan 2022 - Dec 2025
Dept. of Computer Science and Computer Engineering, University of ArkansasFayetteville, AR

- Courses: Operating Systems; Software Engineering; Programming Paradigms; Programming Foundations I & II.

- Led labs and recitations, held office hours, graded assignments/exams, and mentored student projects.
- Designed hands-on labs and project-based modules to improve student engagement and outcomes.

Research Assistant Aug 2019 - Jul 2021
NeemSys Lab, Chang'an University *Xi'an, China*

- Developed an integrated SUMO + Unity simulation environment for intelligent transportation research.
- Designed immersive driving scenarios where human drivers navigated simulated traffic environments.
- Collected and analyzed EEG data to study driver mental state, cognitive load, and attention under varying traffic conditions.
- Developed transformer-based neural networks for sequential EEG analysis and mental-state recognition.
- Conducted simulation-driven experiments combining transportation modeling, human behavior, and machine learning.

Summer Mentor Summer 2024
NCREPT (RIOT) Lab, University of Arkansas *Fayetteville, AR*

- Mentored 12 undergraduate students on a hands-on cybersecurity testbed project.
- Guided system design, threat modeling, experimentation, and evaluation of adversarial scenarios.
- Supported student poster presentations and collaborative research outcomes.

Research & Engineering Experience (Project-Detailed)

Project A — Radar-Vision BEV Trajectory Prediction & Closed-Loop ADAS Validation (Current)

System: EdgeVLA-BEV (Camera + Radar → BEV → Trajectory)
High-level goal: Build a deployment-oriented perception-to-planning prototype that supports offline training and closed-loop simulation evaluation under realistic sensing challenges.

Problem addressed

- Predict safe and stable ego trajectories under partial observability (occlusions), sensor noise, and adverse conditions.
- Support modular integration (perception/fusion/planning interfaces) and evaluate in a closed-loop simulator.
- Build with explicit attention to deployability: runtime cost, memory footprint, and robustness stress tests.

Methods and architecture (end-to-end)

- **Inputs (typical):** multi-camera surround images (e.g., 6 views) and a radar-derived BEV grid representation.
- **Camera encoder:** lightweight per-camera backbone producing compact multi-view features.
- **BEV lifting:** camera-to-BEV projection using coarse depth binning and precomputed rays/frustums for efficiency.
- **Radar BEV encoder:** CNN-based encoder consuming voxelized radar BEV channels (e.g., point count, Doppler statistics, RCS features, time delta).
- **Fusion:** deployable BEV fusion via channel mixing (1×1 conv) + small attention or axial/window blocks to capture spatial interactions.
- **Trajectory head:** waypoint prediction head producing ego-frame waypoints over a fixed horizon; optionally predicts auxiliary risk/safety signals.

Software integration (ROS/ROS2 + modularity)

- Designed the project to be modular with interfaces aligned to ROS/ROS2-style node separation:
  - perception nodes: image preprocessing, camera feature extraction, radar BEV building
  - fusion node: BEV fusion and intermediate visualization outputs
  - planning node: trajectory generation and optional risk/safety signals
  - evaluation harness: closed-loop rollouts and metric aggregation
- Emphasized reproducible configs and consistent input/output tensor contracts to reduce integration friction.

Localization / SLAM signals (trajectory stabilization)

- Incorporated ego pose / motion priors (e.g., velocity, yaw rate, pose alignment) to stabilize BEV alignment and planning outputs.
- Used localization/SLAM-style signals conceptually for temporal alignment between sensor frames and consistent coordinate frames.

Training and losses

- Imitation learning losses for waypoint regression (e.g., robust Huber regression).
- Trajectory smoothness regularization (second-difference penalty) to reduce jerk and improve closed-loop stability.
- Robustness hooks: sensor corruption (fog/blur/noise/dropout/latency) to measure and improve safety margins.

Simulation and validation (CARLA closed-loop)

- Closed-loop evaluation harness to test route completion/progress, collisions/infractions per distance, and stability under weather/lighting variations.

- Qualitative artifacts: BEV overlays (predicted vs GT), camera overlays, rollout visualizations, episode summaries.

Tools and implementation

- Languages: Python, C/C++
- Frameworks: PyTorch; export/benchmark workflows using ONNX and TensorRT
- Sim/Robotics: CARLA; ROS/ROS2 integration patterns; localization/SLAM signal usage

Skills acquired / strengthened

- End-to-end ADAS prototyping from perception to planning with modular integration.
- Closed-loop evaluation mindset: metrics, failure-mode analysis, robustness stress testing.
- Practical sensor-fusion engineering: representation design, synchronization concerns, debugging tools.
- Deployment awareness: runtime/memory tradeoffs, exportability, performance benchmarking.

Project B — Human-in-the-Loop Driving Simulation with EEG-Based Driver State Prediction (M.S. Research)

System: SUMO + Unity Driving Simulator + EEG Modeling; evaluated later in CARLA
Demo: https://youtu.be/llEssP02i2k?si=f0mPutIFQTkKoeZb

Problem addressed

- Create controlled, repeatable accident-prone driving scenarios and measure real driver responses.
- Predict driver mental/emotional state and behavior to inform decision-making in complex traffic situations.

Simulation environment design (SUMO + Unity)

- Used SUMO to generate traffic flows, interactions, and parameterized conflict situations.
- Built a Unity-based interactive simulator with scenario scripting and instrumentation for telemetry logging.
- Emphasized scenario diversity and repeatability to build datasets for modeling.

Multimodal data collection (EEG + driving telemetry)

- Collected synchronized EEG signals and driving behavior data in controlled simulation conditions.
- Curated datasets for mental-state recognition with careful alignment and labeling.

Modeling approach

- Developed transformer-based neural networks for sequential EEG analysis and mental-state recognition.
- Evaluated generalization across scenario types and robustness to physiological noise.

Evaluation transfer to CARLA

- Revalidated components in CARLA to assess consistency under a standard autonomous driving simulation framework.

Tools

- Simulators: SUMO, Unity, CARLA
- ML/Implementation: Python; EEG preprocessing; sequential modeling

Project C — Efficient BEV Perception and Distillation (TinyBEV)

Problem addressed

- Enable real-time, camera-only BEV perception suitable for edge and resource-constrained deployment.

Approach

- Developed a fast BEV student model distilled from a stronger multi-task teacher (cross-modal knowledge distillation).
- Focused on multi-task BEV perception/planning tradeoffs and efficient architecture design.

Tools

- PyTorch; MMDetection3D-style pipelines; GPU training and ablation studies.

Project D — Diffusion + Bayesian Risk for Unsupervised MRI Denoising (Bayesian-PGURE)

Problem addressed

- Blind denoising and restoration without paired ground truth; robust risk estimation under unknown noise.

Approach

- Unified diffusion-based restoration with Bayesian risk estimation for unsupervised denoising.

Tools

- PyTorch/TensorFlow; large-scale experimentation; reproducible training pipelines.

Project E — Optics-Sensor-Model Co-Design for Segmentation (Learning to Sense for Driving)

Problem addressed

- Improve downstream segmentation via joint optimization of optics/sensor/model in a differentiable RAW-to-task pipeline.

Approach

- Sensor-aware learning and co-design for robust semantic segmentation under sensing constraints.

Tools

- PyTorch/JAX; differentiable sensing components; controlled evaluation protocols.

Project F — Deep MRI Reconstruction with Oversampling (IEEE Access 2024)

Problem addressed

- Address data scarcity/imbalance and improve MRI reconstruction performance via systematic oversampling strategies.

Approach

- Regularization approach exploiting oversampling for improved reconstruction under limited data.

Publications & Scholarly Output

Peer-Reviewed Journal Articles

- Ibsa Kumara Jalata, Reeshad Khan, Ukash Nakarmi. *Learning From Oversampling: A Systematic Exploitation of Oversampling to Address Data Scarcity Issues in Deep Learning-Based MRI Reconstruction.* IEEE Access, 2024.

Peer-Reviewed Conference Papers

- Reeshad Khan, John Gauch. *Adaptive Extensions of Unbiased Risk Estimators for Unsupervised MRI Denoising.* Computer Vision Conference (CVC), Amsterdam, 2026. (Accepted)
- Reeshad Khan et al. *From Noise Estimation to Restoration: A Unified Diffusion and Bayesian Risk Approach for Unsupervised Denoising.* VISAPP, 2025.
- Reeshad Khan et al. *TinyBEV: Cross-Modal Knowledge Distillation for Efficient Multi-Task BEV Perception and Planning.* ICCV (Workshop: WDFM), 2025.

Manuscripts Under Review

- Reeshad Khan, John Gauch. *Learning to Sense for Driving: Joint Optics-Sensor-Model Co-Design for Semantic Segmentation.* Under review, CVPR 2026.

Talks / Demos

- Driving simulator demo (SUMO+Unity+EEG): YouTube link

Grants and Sponsored Research

- Interdisciplinary Research Grant (University of Dhaka & University of Liberal Arts Bangladesh), *Hamigram Project*. Total Award: $12,000.

Licenses and Certifications

- Generative AI with Diffusion Models, NVIDIA, Issued Sep 2025.
- Fundamentals of Accelerated Computing with CUDA Python, NVIDIA, Issued Jan 2025.

Honors and Fellowships

- Reginald R. "Barney" & Jameson A. Baxter Graduate Fellowship (2024).
- EECS Graduate Fellowship, University of Arkansas (2023).
- College of Engineering Graduate Fellowship, University of Arkansas (2022).
- Chinese Government Belt and Road Scholarship (2019).

Professional Service

- Reviewer, IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2026.
- Reviewer, IEEE International Conference on Big Data, 2022.

Memberships

- IEEE Member / Young Professionals (Member ID: 99715477).

Leadership and Service

- Vice President, ULAB Computer Programming Club.
- Team Lead, National Hackathon (ICT Ministry, Bangladesh).
- Volunteer, National IT Festival, Bangladesh.

Selected Technical Competencies (Evidence by Project)

Competency	Evidence
Python/C/C++ implementation	Implemented training, evaluation, and modular perception pipelines; strong Linux development workflows.
Robotics simulation	CARLA (closed-loop evaluation), SUMO (traffic simulation), Unity (interactive simulation).
ROS/ROS2 familiarity	Modular system design aligned with ROS/ROS2 node boundaries and messaging patterns.
Perception + BEV fusion	BEV lifting/projection, radar BEV encoding, fusion modules, trajectory heads.
Efficient/edge AI	TinyBEV architecture and distillation for resource-constrained BEV autonomy.
Generative/restoration	Diffusion + Bayesian risk estimation for unsupervised denoising and reconstruction.
Performance awareness	CUDA/TensorRT, pruning/quantization, ONNX export and inference benchmarking mindset.

References

Available upon request.