Kaleem Nawaz Khan

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Areas of Interest: Networked Sensing, Autonomous Systems, 3D Reconstruction and Novel View Synthesis

Research Focus

Building low-latency, high-accuracy, and scalable cooperative perception systems for autonomous vehicles. By enabling vehicles and infrastructure to exchange sensor data in real time with high precision, these systems help vehicles better understand their surroundings, keep traffic flowing smoothly, and make driving safer and more reliable.

Education

Rochester Institute of Technology (RIT), Rochester, New York
PhD Computing and Information Sciences Aug. 2022 – Present

National University of Computer and Emerging Sciences, Peshawar, KPK
Master of Science (Computer Science) Aug. 2015 – Dec. 2017

Research Experience

Research & Development Center, General Motors, Warren, Michigan
Research Intern (Mentor: Paolo Giusto) May. 2024 – Aug. 2024

- Developed a ML-based solution to enable smart off-loading of vehicular data and apps to edge/cloud
- Explored OMNET++ with Simu5G integration to investigate different network scenarios for vehicle-to-edge communication and data collection

Networked Sensing Systems Lab, RIT, Rochester, New York
Graduate Research Assistant (Advisor: Fawad Ahmad) Aug. 2022 – Present

- I develop fast, accurate, and scalable infrastructure-assisted and vehicle-to-vehicle cooperative perception systems.
- Additionally, I also explore collaborative, view-based 3D scene representations to enhance vehicles' perception beyond traditional approaches.

National Center of Artificial Intelligence, Peshawar, KPK
Research Team Lead (PI: M. Salman Khan) Apr. 2019 – Sep. 2020

- Led a diverse team in R&D to create innovative, domestically developed AI solutions for healthcare.
- We utilized deep learning and related technologies for screening to assist cardiology and hematology practitioners.

Research Projects

Real-time Cooperative Perception Framework with 3D Gaussian Splatting
MLP, SfM, Neural Radiance Fields, 3D Gaussian Splatting Mar. 2025 – Present

- Creating and real-time updating 3DGS models of the intersection using images from traffic cameras and vehicle-mounted cameras.
- Estimating dynamic objects in the scene based on the trained 3DGS models.
- Performing spatial reasoning on the 3DGS to identify blind spots and determine the most relevant information for vehicles to exchange.

Accurate, Real-time, and Scalable Multi-vehicle Cooperative Perception
C++, LiDAR, PCL, CUDA, CarLA Jun. 2024 – Mar. 2025

- Enabled high-accuracy cooperative perception while preserving scalability, addressing a key gap in existing systems.
- Added a refinement layer for vehicle point cloud alignment, reducing errors in existing methods.
- Employed grid-based spatial reasoning to minimize alignment latency and enable selective data sharing among vehicles.

Smart Vehicle-to-Edge Computation and Data Offloading
OMNET++, Simu5G, MEC, ML May. 2024 – Aug. 2024

- Enabled smart off-loading of vehicular data and apps to edge/cloud
- Used Simu5G to simulate complex 5G network scenarios involving moving vehicles, base stations, and edge servers.
- Generated simulated data on network latency, signal strength, and congestion under various conditions.

VRF: Vehicle Road-side Point Cloud Fusion
ROS, FAST-LIO, PCL, Open3D, Docker Sep. 2022 – Mar. 2024

- Tackle vehicles' sensor occlusion by enabling real-time sharing and accurate fusion of raw 3D data from roadside LiDARs.
- Decoupled vehicle and roadside point cloud alignment by aligning both to a 3D map and then enabling a direct alignment.
- Evaluation on real-world testbeds demonstrates VRF can fuse vehicle roadside point clouds with 20ms end-to-end latency and 5 cm positioning accuracy, thereby multiplying the vehicle's reaction time by a factor of 5.

Publications

Conferences

- **Khan, K. N.**, & Ahmad, F. (2025). ARC: Accurate, Real-time, and Scalable Multi-vehicle Cooperative Perception. In Proceedings of the ACM/IEEE International Conference on Embedded Artificial Intelligence and Sensing Systems (SenSys 2026).
- **Khan, K. N.**, Khalid, A., Turkar, Y., Dantu, K., & Ahmad, F. (2024, June). VRF: Vehicle Road-side Point Cloud Fusion. In Proceedings of the 22nd Annual International Conference on Mobile Systems, Applications and Services (pp. 547-560).
- Hasib, R., **Khan, K. N.**, Yu, M., & Khan, M. S. (2021, April). Vision-based human posture classification and fall detection using convolutional neural networks. In 2021 International Conference on Artificial Intelligence (ICAI) (pp. 74-79). IEEE.
- Qasim, S., **Khan, K.N.**, Yu, M. and Khan, M.S., 2021, April. Performance evaluation of background subtraction techniques for video frames. In 2021 International Conference on Artificial Intelligence (ICAI) (pp. 102-107). IEEE.
- Ahmad, B., Khan, F.A., **Khan, K.N.** and Khan, M.S., 2021, December. Automatic classification of heart sounds using long short-term memory. In 2021 15th International Conference on Open Source Systems and Technologies (ICOSST) (pp. 1-6). IEEE.
- Islam, M., **Khan, K.N.** and Khan, M.S., 2021, April. Evaluation of preprocessing techniques for U-Net based automated liver segmentation. In 2021 International Conference on Artificial Intelligence (ICAI) (pp. 187-192). IEEE.

Journals

- **Khan, K.N**., Khan, F.A., Abid, A., Olmez, T., Dokur, Z., Khandakar, A., Chowdhury, M.E. and Khan, M.S., 2021. Deep learning based classification of unsegmented phonocardiogram spectrograms leveraging transfer learning. Physiological measurement, 42(9), p.095003.
- **Khan, K.N.**, Ullah, N., Ali, S., Khan, M.S., Nauman, M. and Ghani, A., 2022. Op2Vec: An Opcode Embedding Technique and Dataset Design for End-to-End Detection of Android Malware. Security and Communication Networks, 2022(1), p.3710968.
- Salman Khan, M., Ullah, A., **Khan, K.N.**, Riaz, H., Yousafzai, Y.M., Rahman, T., Chowdhury, M.E. and Abul Kashem, S.B., 2022. Deep Learning Assisted Automated Assessment of Thalassaemia from Haemoglobin Electrophoresis Images. Diagnostics, 12(10), p.2405.
- Zeng, A., Wu, C., Lin, G., Xie, W., Hong, J., Huang, M., Zhuang, J., Bi, S., Pan, D., Ullah, N. and **Khan, K.N**., 2023. Imagecas: A large-scale dataset and benchmark for coronary artery segmentation based on computed tomography angiography images. Computerized Medical Imaging and Graphics, 109, p.102287.

Book Chapters

- Khan, M.S., Khan, F.A., **Khan, K.N.**, Rana, S.I. and Al-Hashemi, M.A.A., 2023. Advanced Deep Learning for Heart Sounds Classification. In Advances in Deep Generative Models for Medical Artificial Intelligence (pp. 225-248). Cham: Springer Nature Switzerland.

Selected Talks

VRF: Vehicle Road-side Point Cloud Fusion, Tokyo, Japan
ACM MobiSys 2024, International Conference on Mobile Systems, Applications, and Services 3 – 7 June. 2024

Academic Services

External Reviewer: IEEE Network Magazine, IEEE-TCE, IEEE-TBME, IEEE-JBHI, CMBBE
Membership: RIT-Doctoral Student Association, ACM-Student Member