

## Summary

**2 years** of research experience in developing machine learning models for medical applications, **4 years** at the intersection of autonomous driving and cooperative perception.

## Research Experience

University of Central Florida   Research Assistant	05/2023 – present
Ford Motor Company   Research Intern	06/2020 – 08/2020
University of Central Florida   Research Assistant	08/2018 – 05/2020

## Education

University of Central Florida   PhD, Computer Engineering	07/2025
University of Central Florida   MS, Computer Engineering	04/2022
Bangladesh University of Engineering and Technology   BS, Electrical and Electronic Engineering	02/2017

## Projects

### WaveFormer: A 3D Transformer with Wavelet-driven feature representation for Efficient Medical Image Segmentation

- developed a neuro-inspired transformer architecture for organ & tumor segmentation
- improved performance on multiple medical benchmarks at 1/7th compute cost
- ablation studies confirm the benefits of the proposed learning paradigm

### Gesture and Surgical Activity Detection from Radical Prostatectomy (ongoing, recently started)

- developing models for gesture recognition and prediction of post-operative outcomes from robotic prostatectomies

### Automated Vehicle Marshaling System (ongoing, paper under review)

- generated synthetic warehouse scenarios as testing grounds to assess communication QoS
- proposed novel application and medium access protocol to support remote driving under V2X coverage
- incorporating protocol parameters to scale for high-throughput tele-operated driving in larger ground

### Bandwidth-efficient Collaborative Vision Transformer (ongoing)

- working on channel-optimized feature generation under V2X coverage
- experimenting with novel feature fusion for stronger overall perception in multi-agent setting

### Cooperative Steering Control for Autonomous Driving

- introduced one of the earliest CNN-LSTM network for end-to-end AV control
- simulated look-ahead at ego vehicle in data-loader to emulate V2X-equipped behavior

### Infrastructure-assisted Tolling

- prototyped a V2I-based tolling service for tele-operated driving support
- enhanced LTE D2D medium access layer with multi-priority aperiodic packet handling

### Scalability in Cellular-V2X

- enhanced transmission rate control that reduces latency by upto 25% in congested traffic
- generated synthetic traffic scenarios on I-405 highway for scalability research
- co-authored a congestion control algorithm for advanced safety services
- applied for patent and proposed for 3GPP standardization

### Dynamic-Object-Map-based Architecture for Cooperative Vehicle Safety Systems

- enabled centralized in-vehicle map to enhance autonomous navigation
- laid out platform to build advanced vehicular safety protocols


## Point-to-Point Driver Messenger System

- enabled arbitration in critical driving maneuver via local object map sharing
- defined a scenario detection and target recognition module to notify driver intent

## Publications

- Scalable Cellular-V2X Solution: Large-Scale Deployment Challenges of Connected Vehicle Safety Networks; *Automotive Innovation*; vol 7
- Optimized Control-centric Communication in Cooperative Adaptive Cruise Control Systems; *IEEE VTC 2024*
- Predictive Model-based and Control-aware Communication Strategies for Cooperative Adaptive Cruise Control; *IEEE OJ-ITS 2023*
- On Batching Acknowledgements in C-V2X Services; *IEEE VTC 2023*
- Addressing Rare Outages in CV2X with Time-controlled One-shot Resource Scheduling; *TechRxiv 2023*
- Performance Analysis of V2I Zone Activation and Scalability for C-V2X Transactional Services; *IEEE VTC 2022*
- Performance Analysis of Cellular-V2X with Adaptive and Selective Power Control; *IEEE CAVS 2020*
- Controlling Steering Angle for Cooperative Self-driving Vehicles utilizing CNN and LSTM; *IEEE IV Symposium 2019*
- Connected and Autonomous Vehicles in the Deep Learning Era.; *IEEE IV Symposium 2019*
- Dynamic Object Map based Architecture for Robust CVS Systems; *SAE Technical Paper*
- Finite State Markov Modeling of C-V2X Erasure Links for Stability Analysis of Platooning Applications; *IEEE Syscon 2022*
- A Maneuver-based Urban Driving Dataset and Model for Cooperative Vehicle Applications; *IEEE CAVS 2020, Canada*
- Connected Autonomous Vehicles in the Deep Learning Era: A case study on Computer-guided Steering; *Handbook of Pattern Recognition and Computer Vision*, 6<sup>th</sup> ed. p365-384; 2020

## Patents

- One-shot Transmission for V2X Messaging  (under review)

## Teaching Experience

### Collaborative Perception | Invited talk, UCF

- presented current state-of-the-art on collaborative perception

### Algorithms for Machine Learning | Instructor, UCF

- designed course curriculum and evaluation strategies
- lectured core-to-advanced ML topics to ~250 students
- mentored in ideation and development of self-directed projects

### Digital Systems and Computer Organization | Graduate Teaching Assistant, UCF

- instructed courses and projects on FPGA using Verilog and low-level assembly language

## Skills

- Programming: Python, C, C++
- Frameworks: PyTorch, MONAI, Scikit-learn, OpenCV, NS3
- Computation: MATLAB, Simulink
- DevOps: Kubernetes, Bash scripting, Linux, Git