Ehsan Sabouni

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Summary

Robotics and embedded systems engineer with 3+ years experience in autonomous vehicles, robot navigation, control algorithms, and embedded software development. Skilled in C++, Python, Linux, and real-time systems.

Core Competencies

Keywords Autonomous Vehicles | Robotics | Path Planning |Control Systems | Optimization | Trajectory Optimization | Model Predictive Control | Motion Planning

Skills

Programming Python | C/C++ | Matlab/Simulink | LaTeX | PLC programming
Framework ROS | SLAM | Casadi | Ipopt | Gurobi | PyTorch | CUDA | Scikit-learn | TDD
Software Matlab/Simulink | LabVIEW | PTV Vissim | SUMO | CARLA | Ubuntu | OptiTrack
Hardware Nvidia Jetson | LIDAR | IMU | DC motor

Education

/4.0 **PhD in System Engineering**, *Boston University* | Boston, USA *2020-2025*

Research:Multi-agent Safety-critical Control Algorithms for Connected and Autonomous Vehicles.
Advisor: Prof. Christos Cassandras.

3.98/4.0 **Master of Science in System Engineering**, *Boston University* | Boston, USA *2020-2023*

Research:Hierarchal Coordination with Safe Motion Planning for Connected and Autonomous Vehicles in Transportation Networks.
Advisor: Prof. Christos Cassandras.

18.88/20 **Bachelor of Electrical Engineering**, *Isfahan University of Technology* | Isfahan, Iran *2014-2018*

Courses: Optimization | Motion planning | Nonlinear control | Reinforcement learning | Data structures and algorithms

Research Experience

Safe and Secure Motion Planning for CAVs in Transportation Network *June 2021 -*

Cloud-Supported Optimal and Secure Coordination of Connected Automated Vehicles for Smart Cities

- Designed event-based **Control Barrier Functions** in **Matlab** with safety guarantee for optimizing decentralized control of connected and autonomous vehicles on highway ramps.
- Verified the event-triggered control barrier function framework with safety guarantee using **ROS nodes** for autonomous vehicles through through hardware-in-the-loop testing (**mobile robots**).
- Implemented **model predictive control** and control barrier function approaches to achieve **sample-based motion planning** for autonomous vehicles.
- Collaborated on **CAV security**, developing **attack detection**, **mitigation mechanisms**, and **resilient control** methods for the transportation network.
- Designed decentralized optimal merging control for connected and autonomous vehicles using **Casadi**'s model predictive control and control barrier functions in mixed traffic scenarios simulated in **Vissim** alongside human-driven vehicles.

Smart City *March 2023 -*

BU's Robotics and Autonomous Systems Teaching and Innovation Center (RASTIC)

- **Leading** a team to design a smart city and develop **path planning** and safe motion planning algorithms for a fleet of fully autonomous vehicles (ongoing work).

Social Optimality in Mixed Mobility *July 2022 -*

An Online Learning Framework for Socially Emerging Mixed Mobility

- Developing **online learning** framework aiming at distributing travel demand in a given transportation network resulting in a socially-optimal mobility system (ongoing work).

Efficient Data Retrieval for Search Engines *Jan 2023 - April 2023*

Data Structure and Algorithm (Course Project)

- Collaborated closely with with cross-functional engineering team to successfully implement an inverted index system, enabling efficient retrieval of tweets from a **database** using **C++**.

Safe Motion Planning Using Perception *Sep 2023 -*

Deep Learning (Course Project)

- Developing motion planning algorithm using **PyTorch** and **deep learning** in **CARLA** simulator to enhance multi-agent control system safety through **sensor fusion** of **perception data** and control barrier functions integration.

Side Projects *June 2021 -*

Online Courses and Interesting Projects

- Created a drone simulator in **python** to test **motion planning and control** algorithms before field deployment.
- Developing motion planning algorithms for multi-agent systems using **reinforcement learning** and model predictive control.

Awards

2020 **Dean's Scholarship for Doctoral Studies**, Boston University *US*

2023 **Outstanding Student-Paper Awards**, 2023 IEEE Conference on Control Technology and Applications (CCTA) *US*

Publications

journals *Sep 2022*

- **Sabouni E.**, Cassandras C. G., Xiao W., and Meskin N. (2022). Optimal Control of Connected Automated Vehicles with Event/Self-Triggered Control Barrier Functions. To appear on Automatica.

Conferences *Sep 2021 -*

- **Sabouni E.**, Ahmad HM, Xiao W., Cassandras. CG, Li W. Optimal Control of Connected Automated Vehicles with Event-Triggered Control Barrier Functions: a Test Bed for Safe Optimal Merging, 7th IEEE Conference on Control Technology and Applications (CCTA) 2023.
- **Sabouni E.**, Sabbir Ahmad, H. M., Cassandras, C. G., and Li, W. Merging control in mixed traffic with safety guarantees: a safe sequencing policy with optimal motion control. Proc. of 2023 IEEE International Intelligent Transportation Systems Conference, 2023.
- HM Ahmad, **Sabouni E.**, Xiao W. , Cassandras C.G , Li W. Trust-Aware Resilient Control and Coordination of Connected and Automated Vehicles, Proc. of 2023 IEEE International Intelligent Transportation Systems Conference, 2023.
- **Sabouni E.**, and Cassandras C. G. Optimal Merging Control of an Autonomous Vehicle in Mixed Traffic: an Optimal Index Policy. 22nd IFAC World Congress Yokohama, Japan, July 9-14, 2023.
- Ahmad, H. S., **Sabouni, E.**, Xiao, W., Cassandras, C. G., and Li, W. Evaluations of Cyberattacks on Cooperative Control of Connected and Autonomous Vehicles at Bottleneck Points. In Symposium on Vehicles Security and Privacy (VehicleSec) 2023.