Collaborative Research: CPS: Medium: Harmonious and Safe Coordination of Vehicles with Diverse Human / Machine Autonomy

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https://www.cs.uic.edu/~wenhao/NSF_CPS_Mixed_Autonomy/

Challenges:

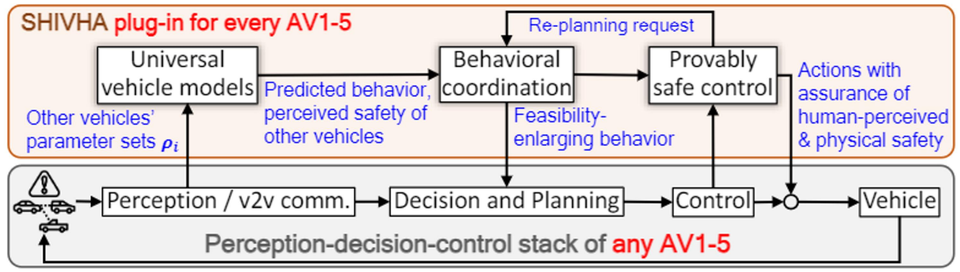
- How to enable vehicles with varying autonomy by humans and AI to understand and predict each others' driving behaviors.
- How to accommodate individual perceived safety for altruistic behavior designs of vehicle autonomy.
- How to create decentralized behavioral coordination and provable safety-critical control of vehicles with mixed and varying autonomy to safely interact in a socially compliant manner.

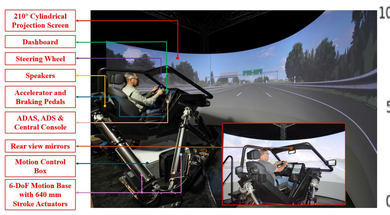
Solutions:

1. Develop universal behavioral modeling, safety assessment, and uncertainty characterization for vehicles of diverse levels of human/machine autonomy.
2. Design decentralized semi-cooperative behavioral coordination framework of mixed autonomy in highway traffic for collective safety.
3. Devise interaction-aware safety-critical control methods for ego autonomous vehicles to reliably track the rendered trajectory with safety assurance.

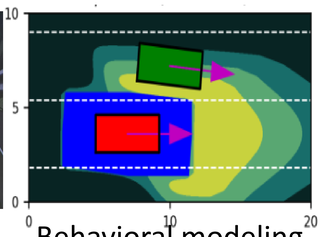
Scientific Impact:

- Behavioral modeling and safety assessment provide a means of simulating realistic driving behaviors and analyzing risks in mixed-autonomy traffic.
- Multi-agent behavioral coordination has relevance to decentralized decision-making problems in other CPS applications like manufacturing, warehousing, and healthcare where safe human-robot interaction is critical.

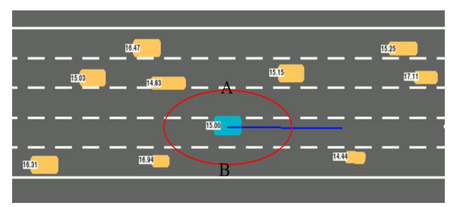




Data collection & validation



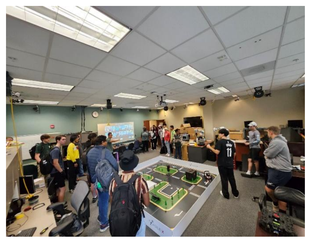
Behavioral modeling & risk assessment



Decentralized multi-agent behavioral coordination

Broader Impact:

- The research may provide new methods and transformative impacts on other domains requiring harmonious and safe coordination of robots with varying AI autonomy and humans, such as manufacturing, warehousing, and healthcare applications.
- The project involves curriculum development and leverage resources at UIC and UT Austin to encourage graduate, undergraduate, and K-12 students from URM and marginalized groups.
- Recruit REUs working on this research in collaboration with graduate students at UIC and UT Austin.





- Two courses being enriched; Four REUs/year participating the project.

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