



Perceptive Stochastic Coordination in Mass Platoons of Automated Vehicles

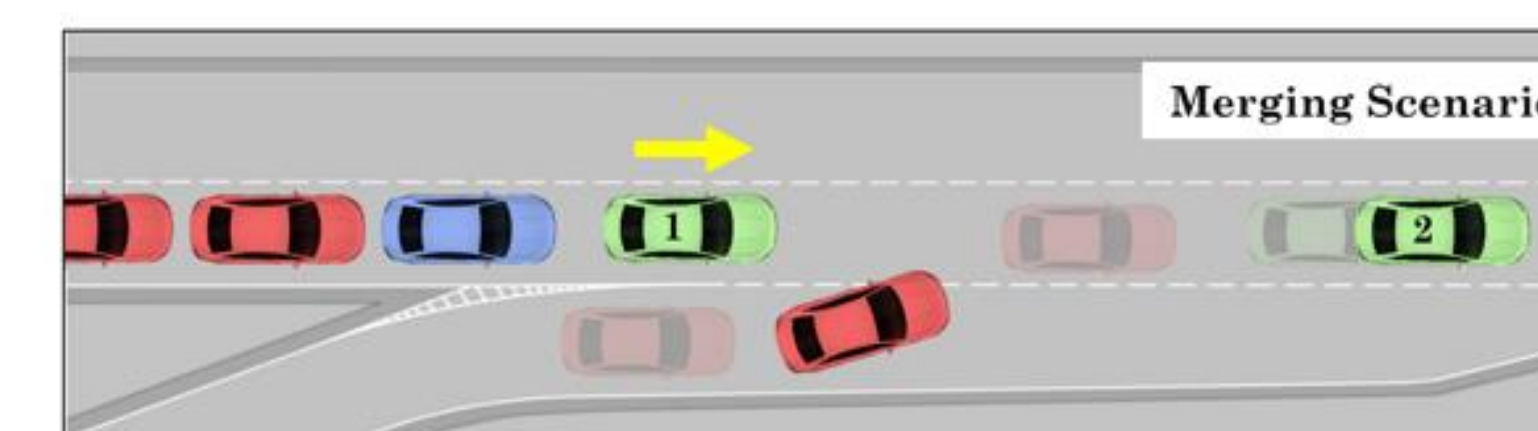
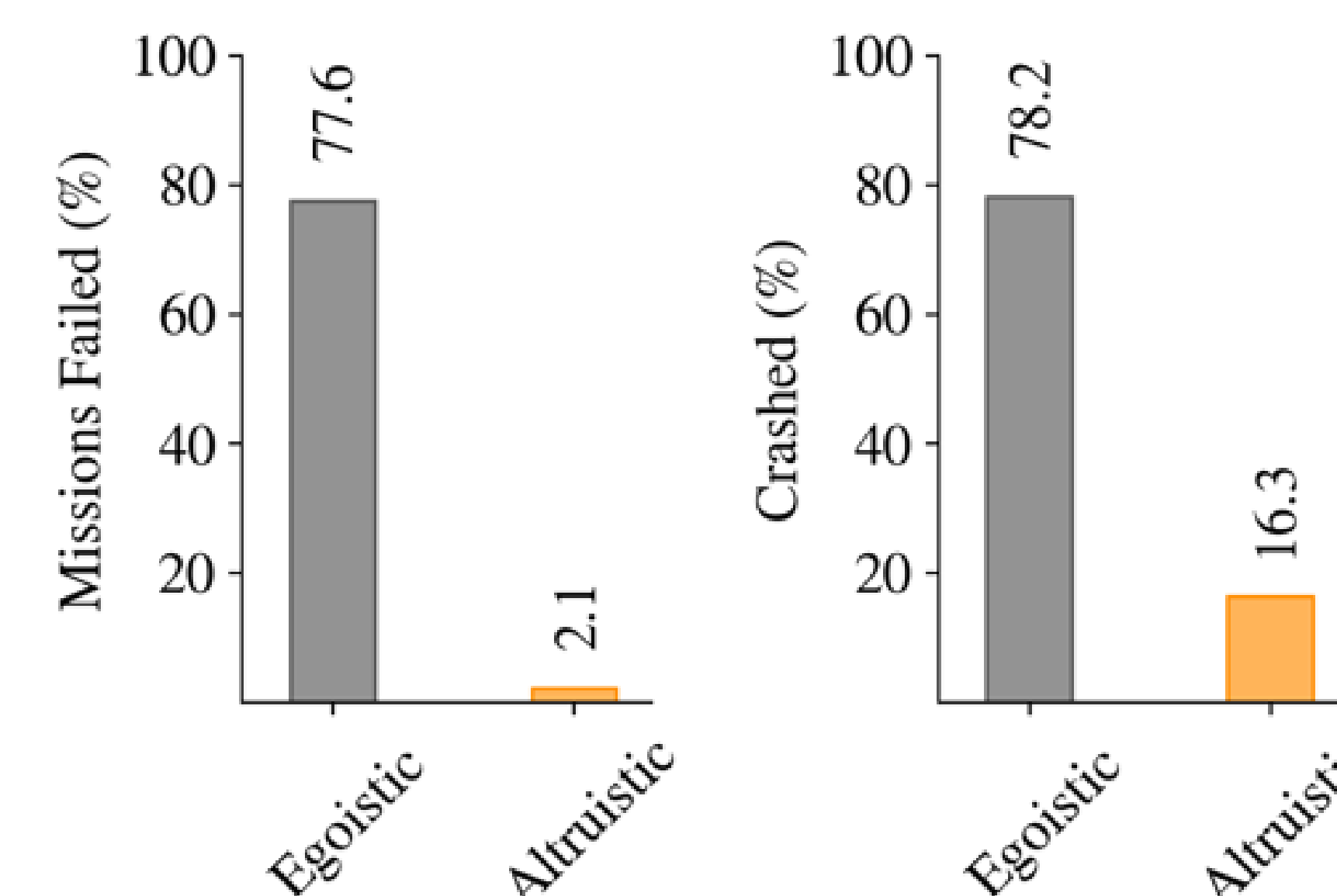
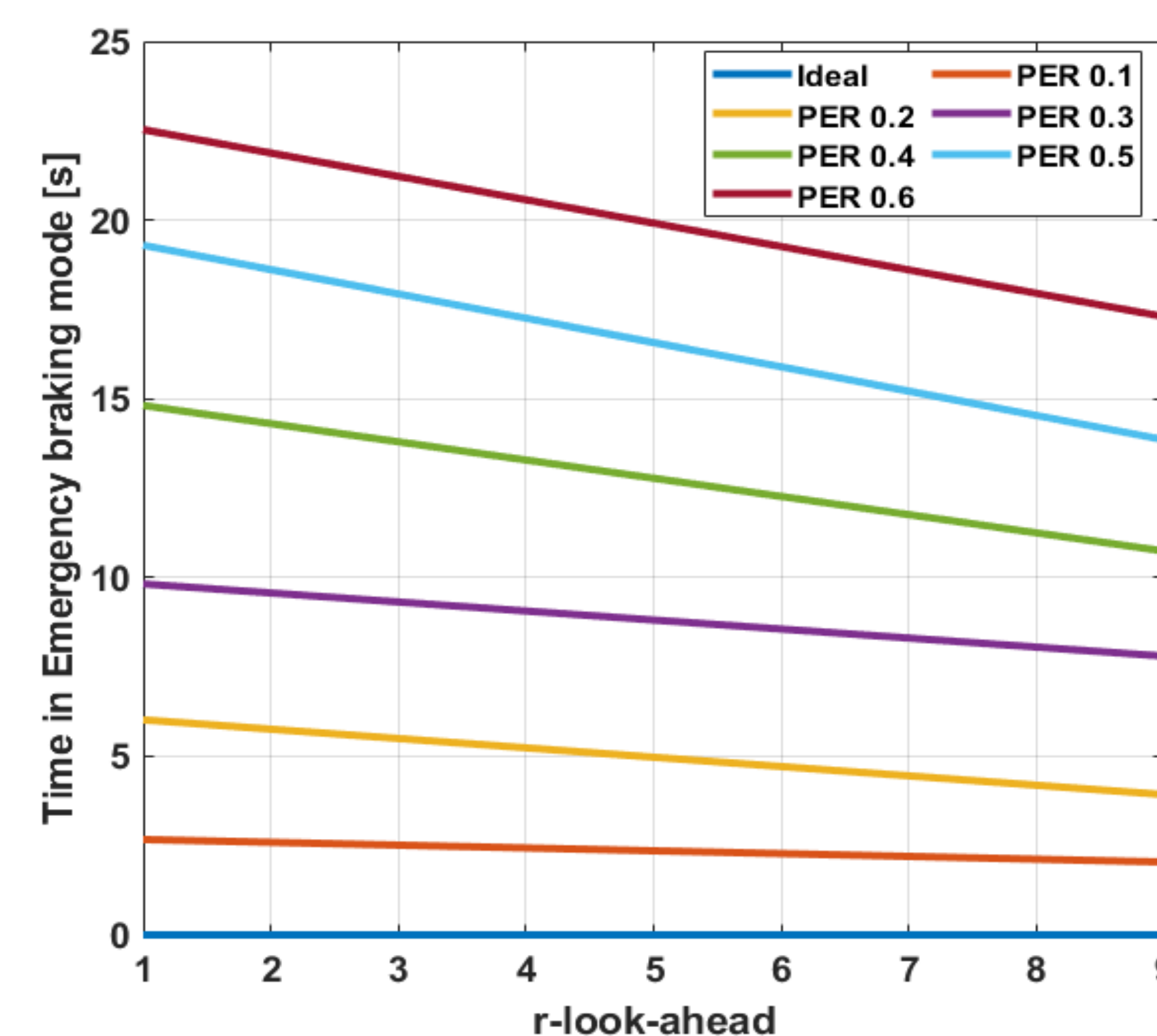
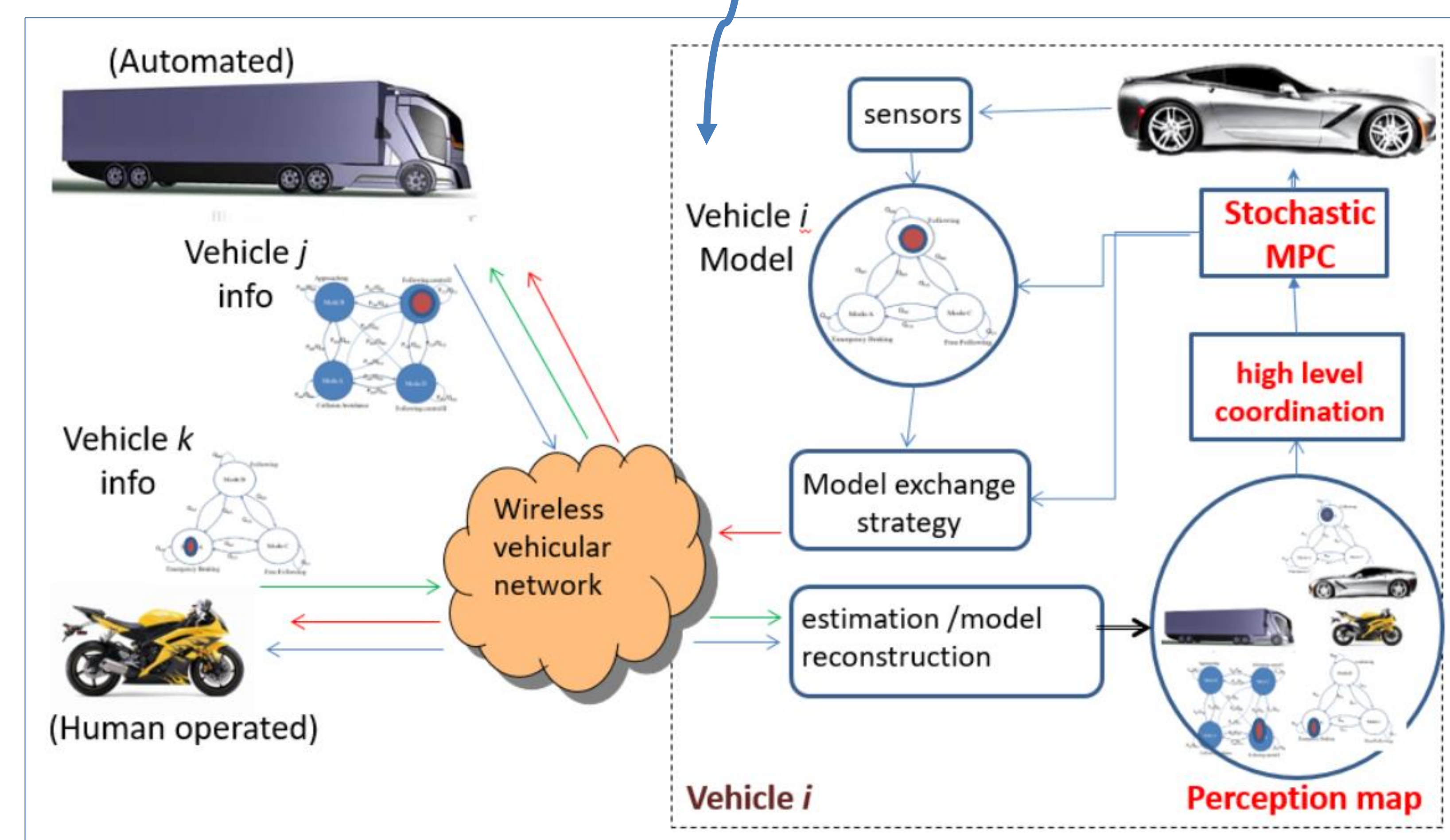
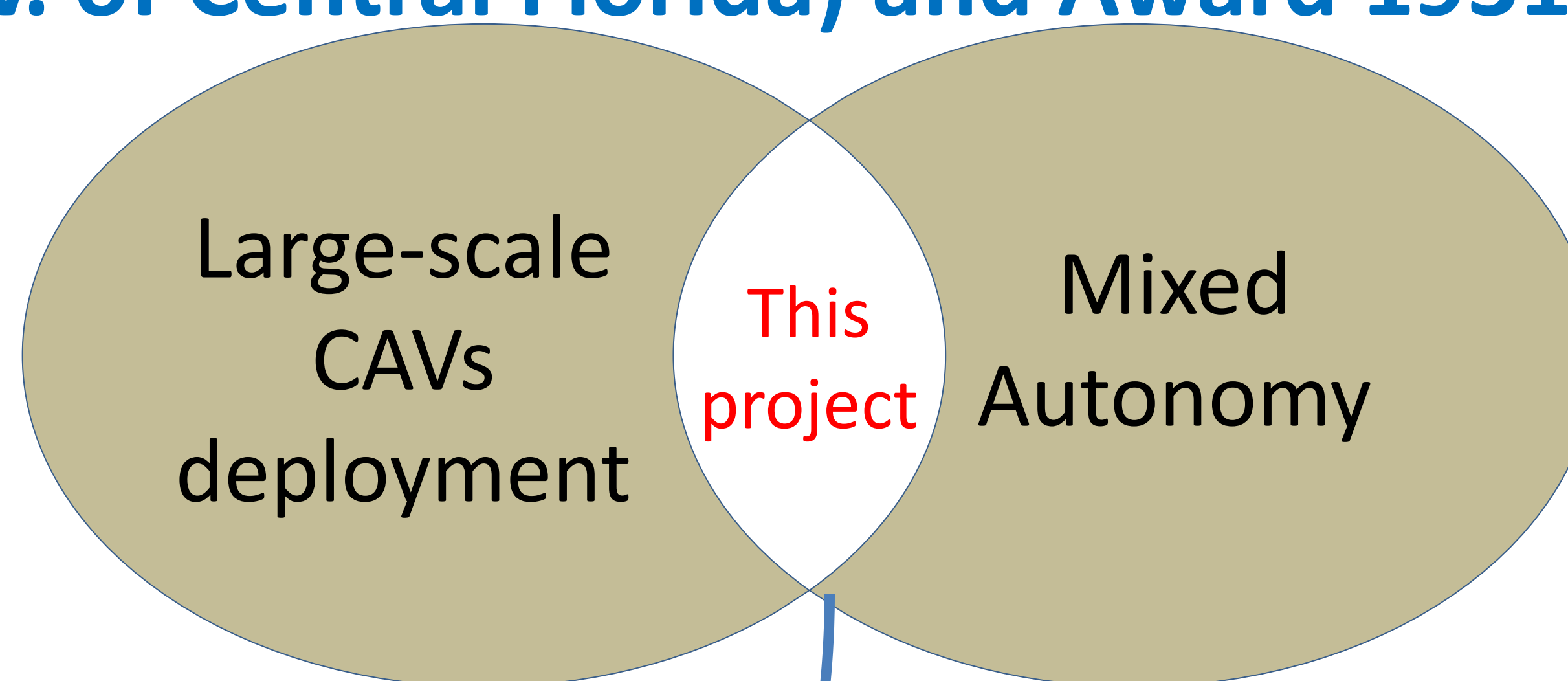
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Challenge:

- **Problem setting:** A network of CAVs, where information exchange is in the form of complex models of behavior over an unstructured network (broadcast vehicular networks), and where control is performed in a stochastic MPC setting.
- **Challenge 1:** Coordination of mass platoon is exacerbated by the interference of human actors in operation of CAVs.
- **Challenge 2:** System performance quickly deteriorates in the presence of communication issues or excessive application demands in mass platoons of CAVs.
- **Challenge 3:** When handling human interference in a platoon, safety and efficiency are incompatible objectives.

Solution:

- Proposed technical approach is to jointly optimize control and communication design, and to utilize the concepts of event-triggered control and cost-triggered communication.
- Key contributions in Year 2 included:
 - Stochastic models describing interfering vehicle movements were developed
 - Communication topology and policies developed
 - System modeled as a discrete hybrid stochastic automata (DHSA) and a discrete hybrid stochastic MPC was designed with Five modes: free following, warning, danger, emergency braking, and lane change.



Scientific Impact:

- Communication-aware control and control-aware communication, as proposed in this project in an integrated setting, is applicable to other CPS domains where multiple agents need to coordinate their actions.
- The human-driven vehicle models and perception maps designed in this project are useful for other autonomous driving tasks as well.

Broader Impact:

- Extending platoon reach to hundreds rather than 5-10 vehicles;
- Allowing for much safer and more efficient highways, reducing spacing between vehicles by at least two fold, doubling the capacity;
- Who will care?
- Recruited several undergraduate and graduate students from underrepresented groups (Hispanic and female)