Emulating Emerging Autonomous Vehicle Technologies to Understand their Impact on Urban Congestion

Jorge Laval, Srinivas Peeta, Georgia Tech

Challenges

- Current AVs exacerbate congestions
  - Posting difficulties in future AV deployments
- Future AVs based on Neural net model
  - End-to-end vision-based longitudinal control
- Understand how the control components affect **stability**
- Design control pipelines to maximize string stability

Solutions

- Data collection for understanding AV longitudinal behaviors
- Physics-based regularized imitation learning and reinforcement learning for string stability enhancements
- Carla simulator for training reinforcement learning-based string-stable controller
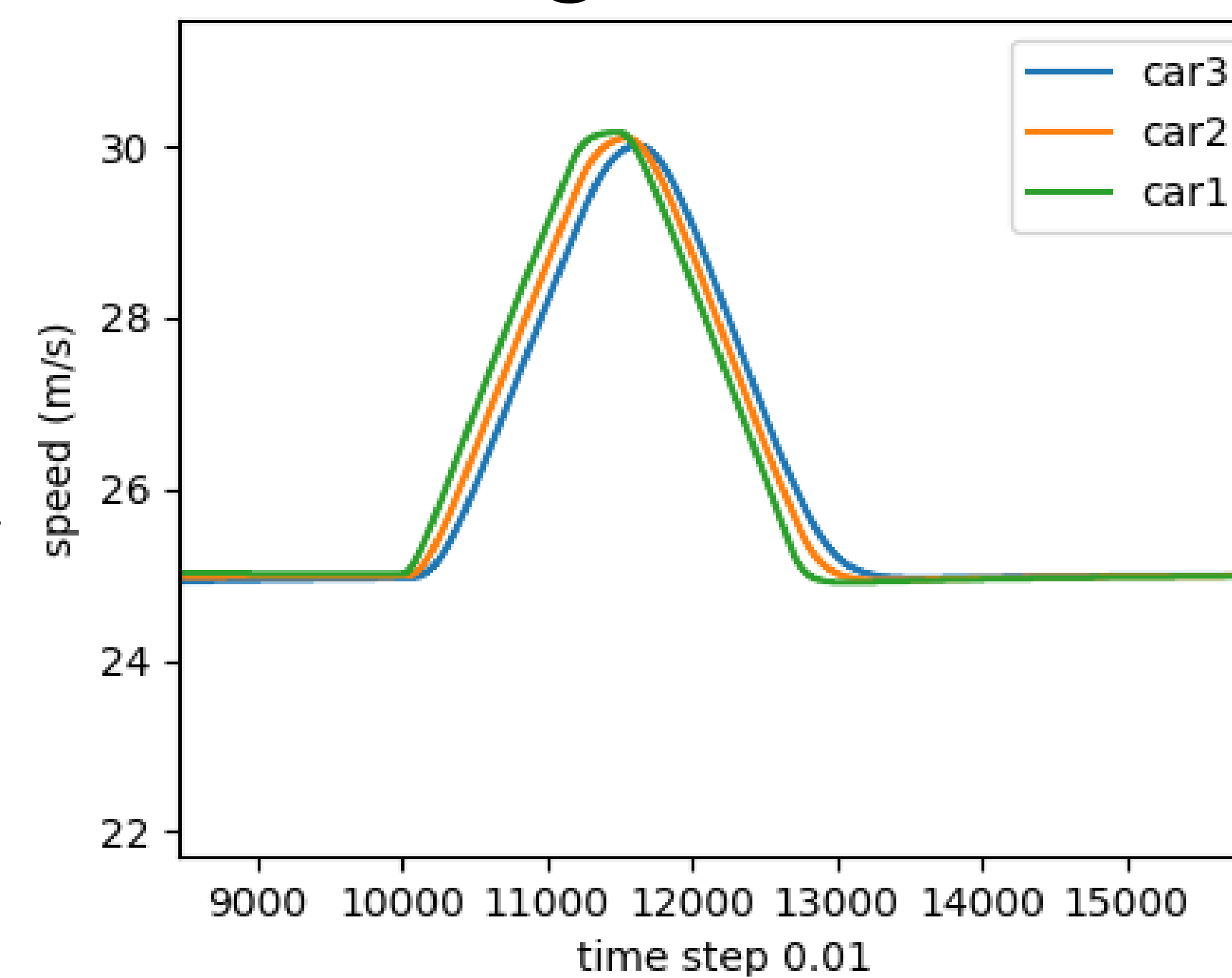- Real-car experiments for testing and validating the proposed methods

Broader Impact on society

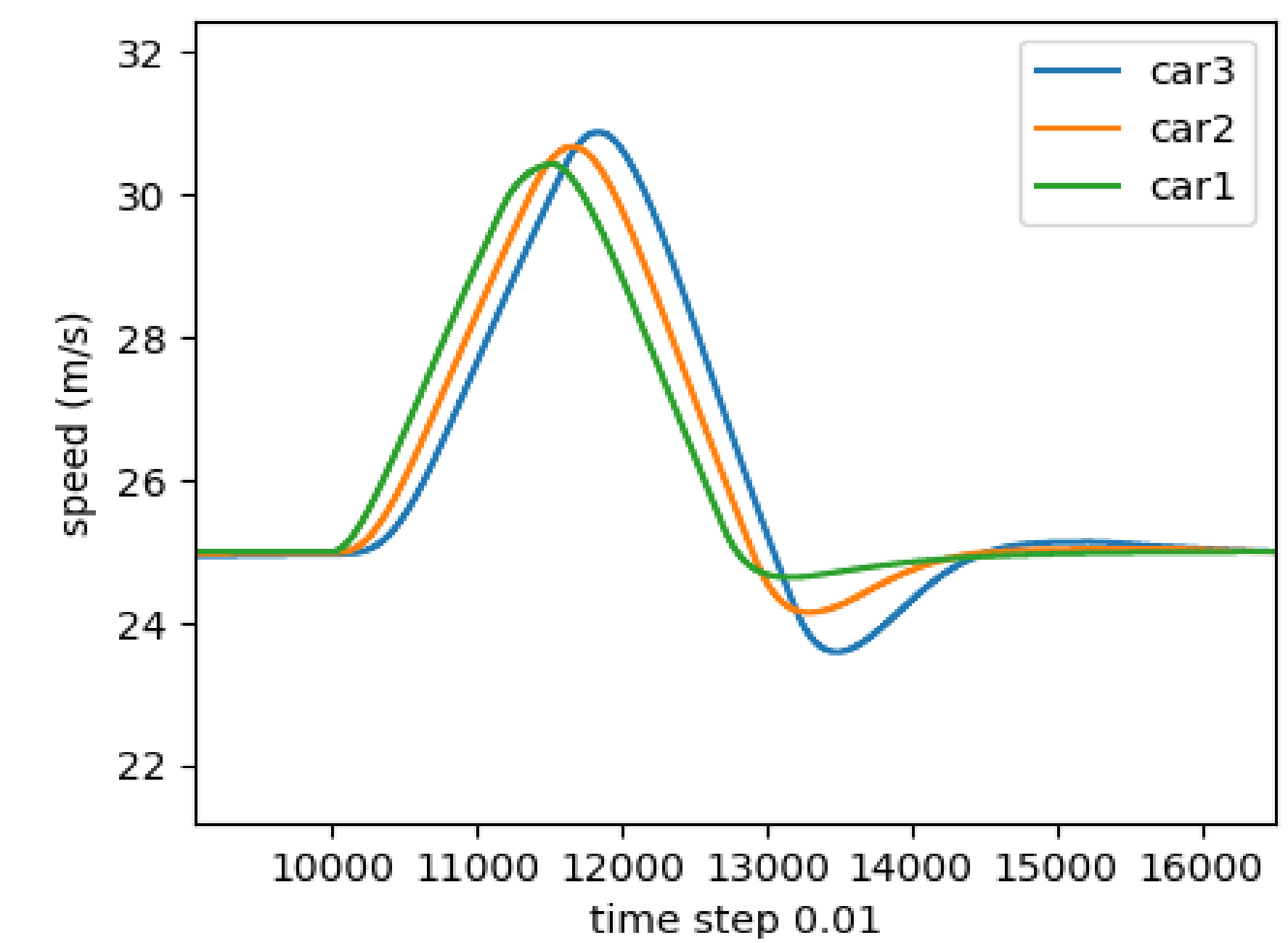- Less congestions when AVs become prevalent
- Benefitting all commuters

Broader Impact on education and outreach
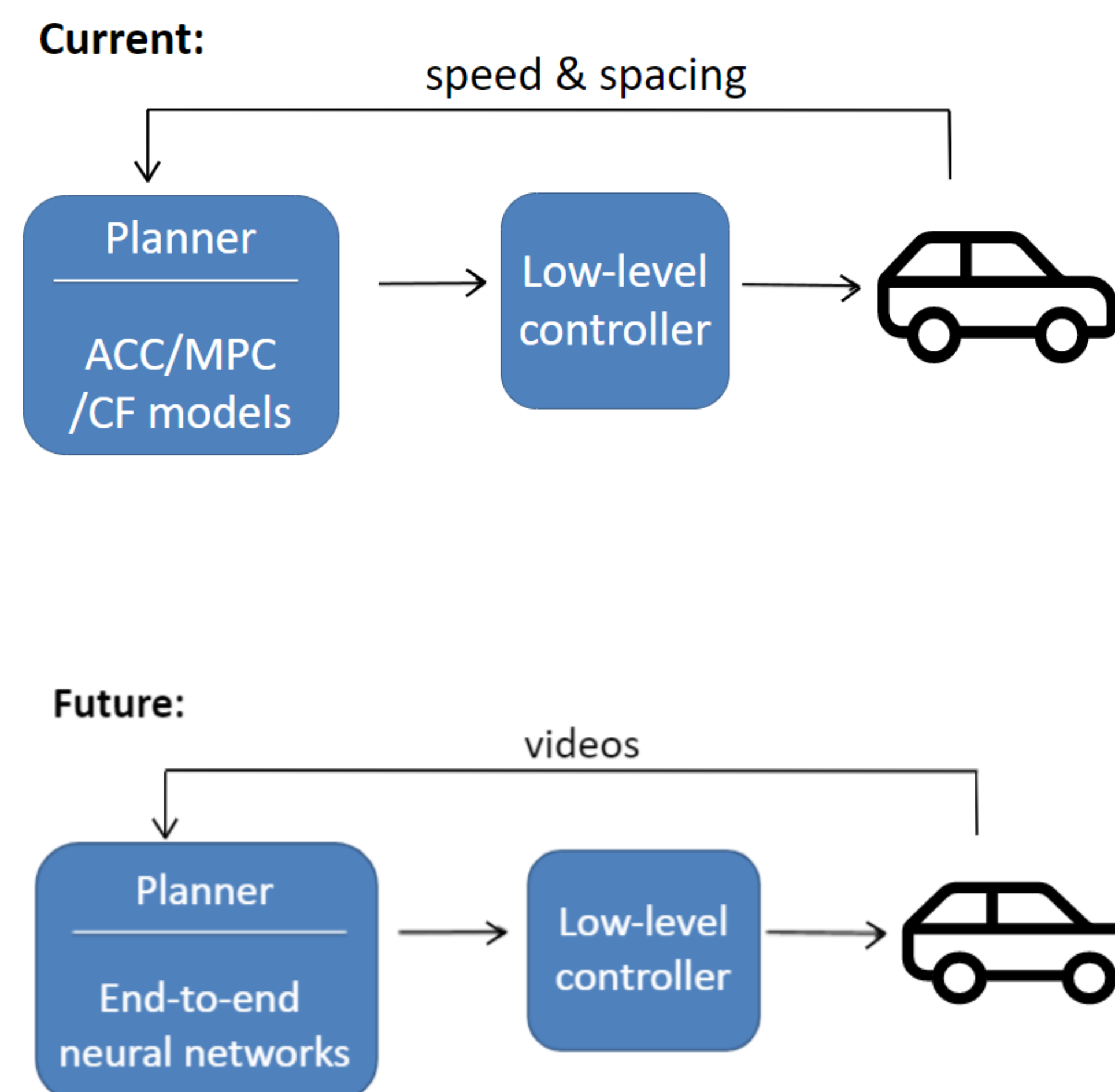
- Webinar/Medium/Github
- Paper preprints

String stable

String unstable

Control scheme

Scientific Impact

- Better understanding of
  - Current AV technologies
  - Regularization methods for AVs and traffic-related problems
- Understanding the impacts of low-level controller and acceleration/deceleration bound
- Alleviating congestions in other ML systems involving queues