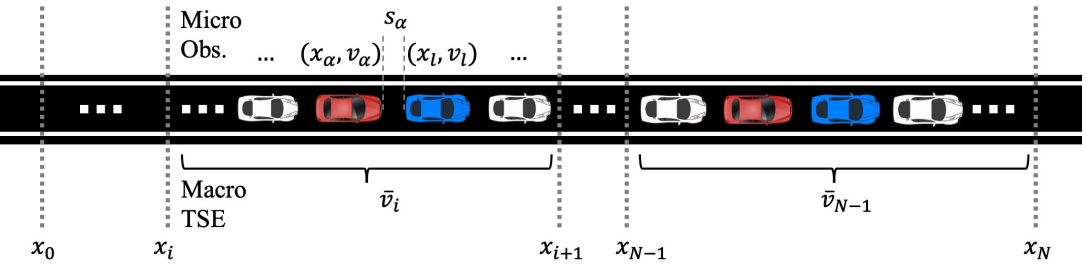
Cooperative Driving for Speed Harmonization in Mixed-Traffic Environments

University of California, Berkeley

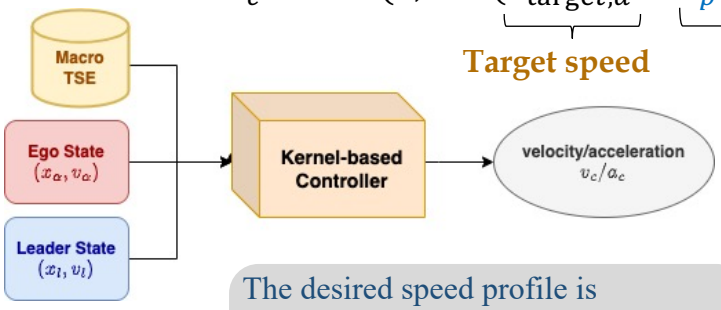
How to develop **a controller**, to generate the **instant velocity/acceleration** for the controlled AV to **guide human-driven vehicles** and **smooth the traffic flow**?



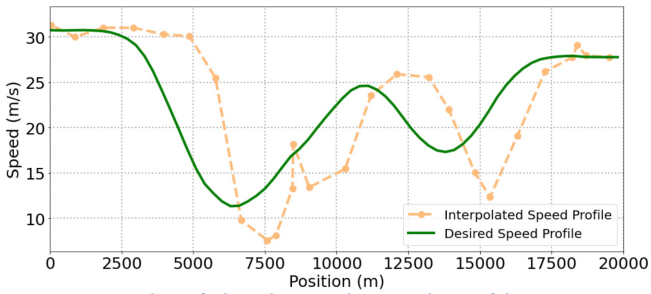
Kernel-based Controller Design

$$v_c = \max(0, \min(v_{\text{target},\alpha} + k_p(h_\alpha - h_{\text{des}}) + k_d(v_l - v_\alpha), v_{\text{fs}})$$

Target speed | Gap Regulation | Safety Filter

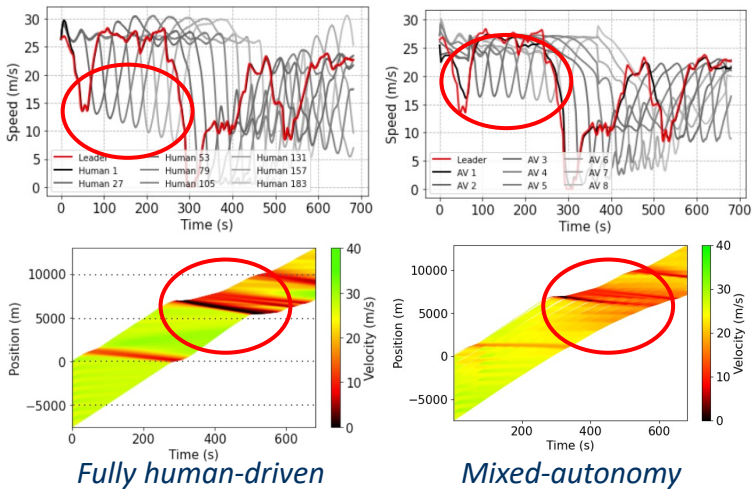


The desired speed profile is **significantly smoother** and can proactively **slow down in advance** to help alleviate huge speed oscillations.



An example of the desired speed profile generated from space-mean speed pairs (orange dots).

Simulation Results

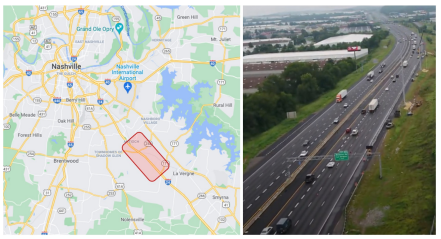


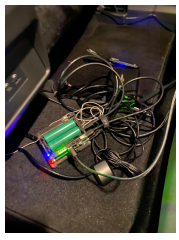
Fully human-driven | *Mixed-autonomy*

Our proposed method could achieve **significant wave smoothing effects** (as red circles highlighted) with few AVs (**4% market penetration**).

100 AV Field Test on I-24 Highway

We conducted an experiment deploying **100 AVs** mixed with **normal HVs** onto the I-24 highway during morning commute in mid-November 2022.







AV Composition:

Nissan Rogue: **97X**
Toyota RAV4: **2X**
Cadillac XT5: **1X**

@ Zhe Fu; joint work with Abdul Rahman Kreidieh, Alexandre Bayen