STEAD: Smoothing Traffic via Energy-efficient Autonomous Driving

Alex. Bayen, PI (UC Berkeley), George Pappas (UPenn), Benedetto Piccoli (Rutgers), Dan Work (Vanderbilt)

STEAD project is integrated in broader CIRCLES consortium: https://circles-consortium.github.io/

Challenge: Provide theoretical framework for mobile traffic control. Demonstrate the algorithm on flow smoothing scenarios for an actual freeway, with level 2 enabled CAVs.

Scientific impact: advances in mean field theory, ODE/PDE optimal control, deep-RL. Integration of learning over microsimulation, advanced energy modeling (used in reward shaping), and dashboarding. Demonstration of transfer (incl. transfer learning) to hardware platforms (Toyota RAV4).

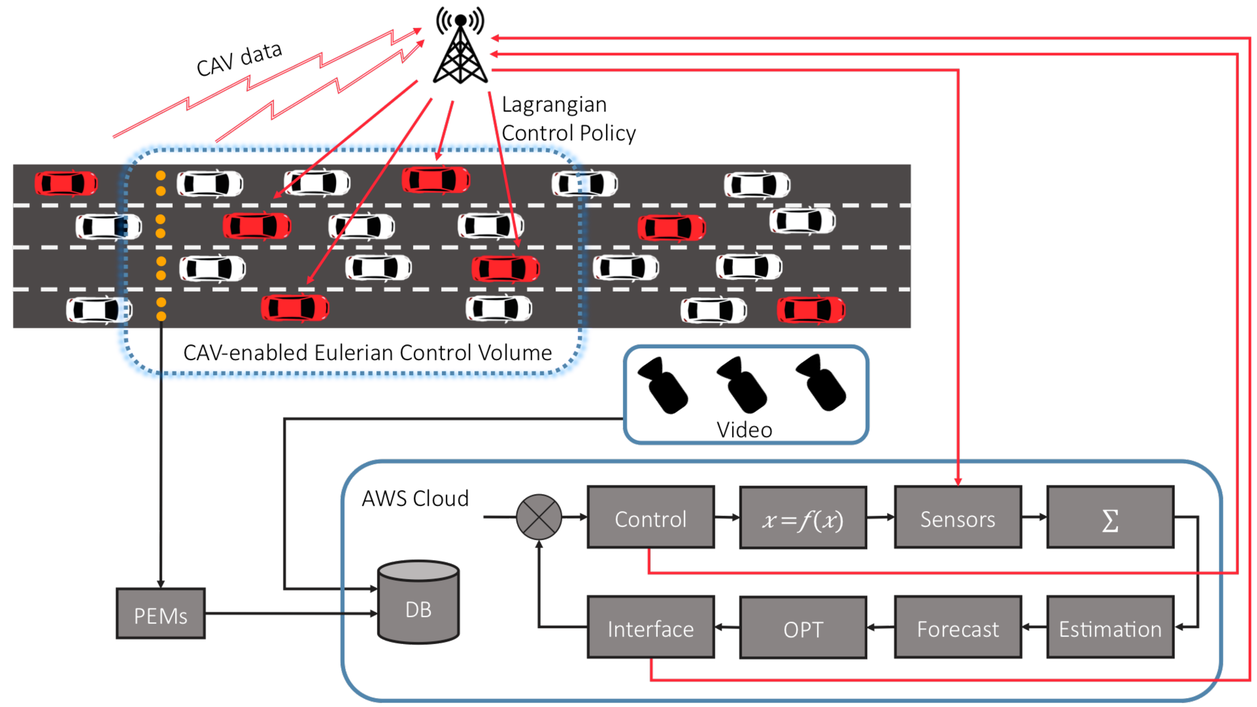
Technical approach: pipelining.

(1) Theoretical / algorithmic design;

(2) implementation and dashboarding (in microsimulation);

(3) co-simulation (software/hardware in the loop);

(4) hardware deployment (migration of algorithms in vehicle OS, ROS), testing and analytics.



Broader impacts: Elimination of stop and go waves can reduce the energy inefficiency of freeways by over 10% with less than 5% penetration rate of level-2 enabled CAVs.

Broader impacts: education and outreach: Alignment with California's (and the US) priorities in transportation AB 32 (California's Global Warming Solution Act, 2006), SB 375 (2008). Executive Order N-79-20 (2020), 2045 ZEV targets.

Broader impact: potential impact:

- No VMT/TTT increase/decrease, no induced demand, no demand management
- Significant improvement for safety (stop-and-go induced crash reduction)

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