CPS: Breakthrough: A Dynamic Optimization Framework for Connected Automated Vehicles in Urban Environments

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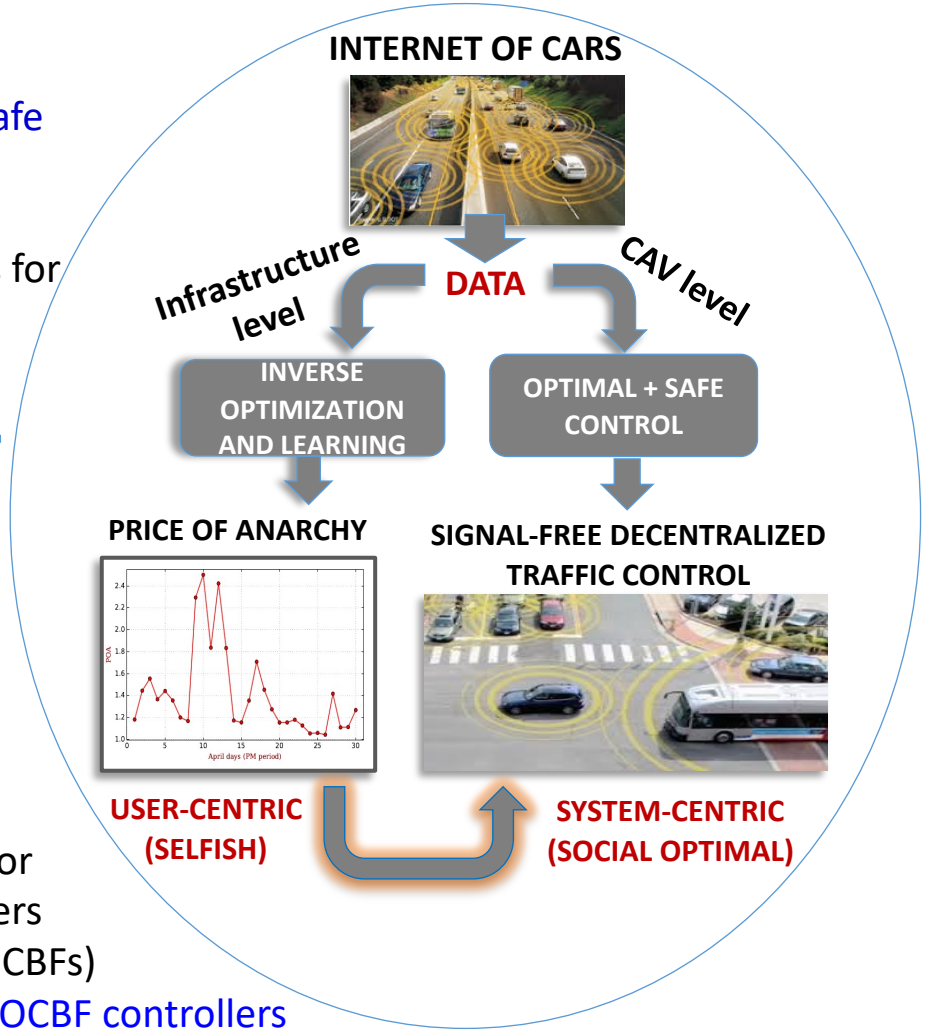
CHALLENGE:

- Make self-driving Optimal + Provably Safe
- Learn from data to transition from Selfish to Social optimality
- Develop real-time on-board controllers for *Connected Automated Vehicles* (CAVs)

SOLUTION:

- Infrastructure level:
  Use Inverse Optimization to infer User Objective Functions from Data
- CAV level:
  Track Optimal Control (OC) solutions for simple models with feedback controllers that satisfy Control Barrier Functions (CBFs) to guarantee safety constraints ➡ OCBF controllers



SCIENTIFIC IMPACT:

- Inverse Problems in CPS (from data to unknown objectives)
- Bridge the gap between Optimal Control for any dynamic system and Safety guarantees
- From planning to real-time control, including optimizing Mobility on Demand systems

BROADER IMPACT:

- Make self-driving cars a reality
- New crop of students with expertise in state-of-the-art Autonomous Systems
- Impact quantification: ~40% better transportation systems