CPS: Medium: Collaborative Research: Collective Intelligence for Proactive Autonomous Driving (CI-PAD)

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https://sites.google.com/view/cpsci-pad/home?authuser=2

Introduction

- Transportation system: one of the most important infrastructure for our society
- Efforts along two paths: 1) improved intelligence for individual vehicles: from ADAS to autonomous driving; 2) enhanced infrastructure with intelligence and connectivity. → **Can these two paths merge?**
- Passive mindset of autonomous driving → **Can the autonomous vehicles be proactive?**

Challenges

- **Hybrid** system with mixed intelligence and/or connectivity
- **Heterogeneity** in information and actions
- High **complexity** and fast **dynamics**
- **Information sharing** requirements for cooperation

Scientific Impact

- Studies on a highly dynamic complex CPS, including machine-machine and human-machine interactions
- Interdisciplinary research in signal processing, statistical learning, optimization, as well as communications and networking

Solution: Proactive Driving with Collective Intelligence

- **Module 1: Scene construction**
  - Multi-modal multi-view sensing to exploit perspectival diversity
  - Comprehensive, general and optimal scene construction
- **Module 2: Situational Interpretation**
  - Physics-level: cooperative tracking
  - Maneuver-level: behavioral characterization
  - Interaction-level: complex interactions with big hypothesis
- **Module 3: Decision Making and Planning**
  - Inter-vehicle impact map
  - Dual-layer game towards proactive driving
- **Supportive Module: Communications Considerations**
  - High-rate and low-latency communication support
  - Robustified modes of collective intelligence

Broader Impact on Society

- Next-generation intelligent transportation system design
- Combination of autonomous driving with traditional transportation system users
- Multi-disciplinary solution to large complex CPS in a holistic manner

Broader Impact – Education and Outreach

- Integration of research and education
- Seeking missing women in engineering
- Undergraduate education and research
- Outreach to K-12

Broader Impact Outcomes

- 2-3 Software/Tool developed for data analytics in transportation systems
- Course updates on two courses
- Mentoring female engineering students for their graduate school applications

2022 NSF Cyber-Physical Systems Principal Investigators' Meeting
November 8-9, 2022

Award ID#: 2103256
1932139