

Multi-Risk Management based on Dynamic Cooperative Optimization for CAVs at Unsignalized Intersection

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Abstract

Our aim is reducing the traffic congestion at the unsignalized intersection by Connected Autonomous Vehicles (CAVs). This work presents the dynamic coordination optimization architecture to cooperate CAVs pass through the unsignalized intersection in minimum time and without collision.

Background and Motivation

1. Unsignalized intersections have greater potential to alleviate traffic congestion.
2. CAVs are better suited for navigating unsignalized intersections.
3. Cooperative driving among CAVs can more effectively reduce congestion and lower emissions.



Modeling

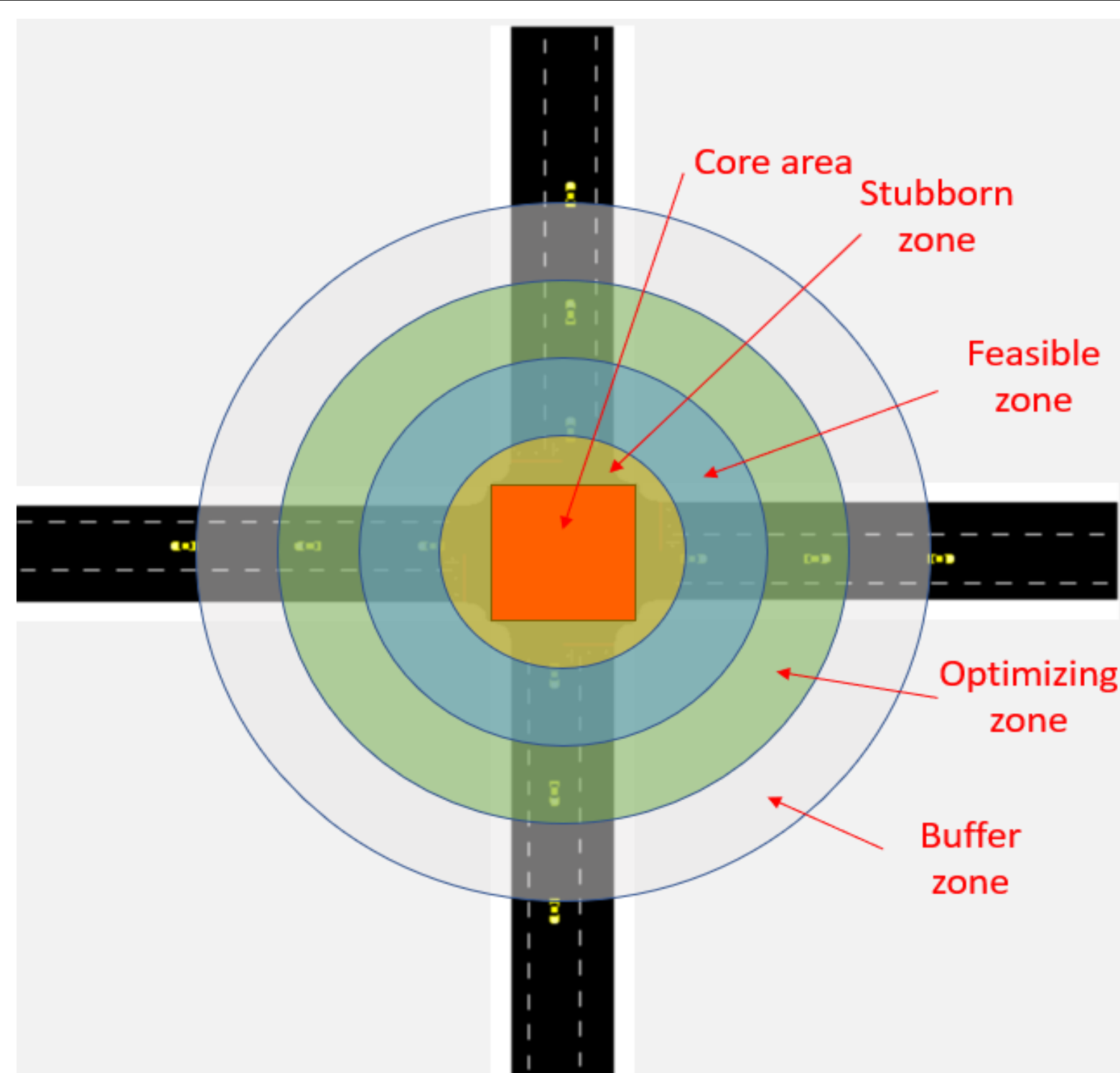


Figure 1: Model of the intersection

The unsignalized intersection is modeled as 4 different parts for different optimization priority. CAVs in the stubborn zone has the highest priority.

Negotiation

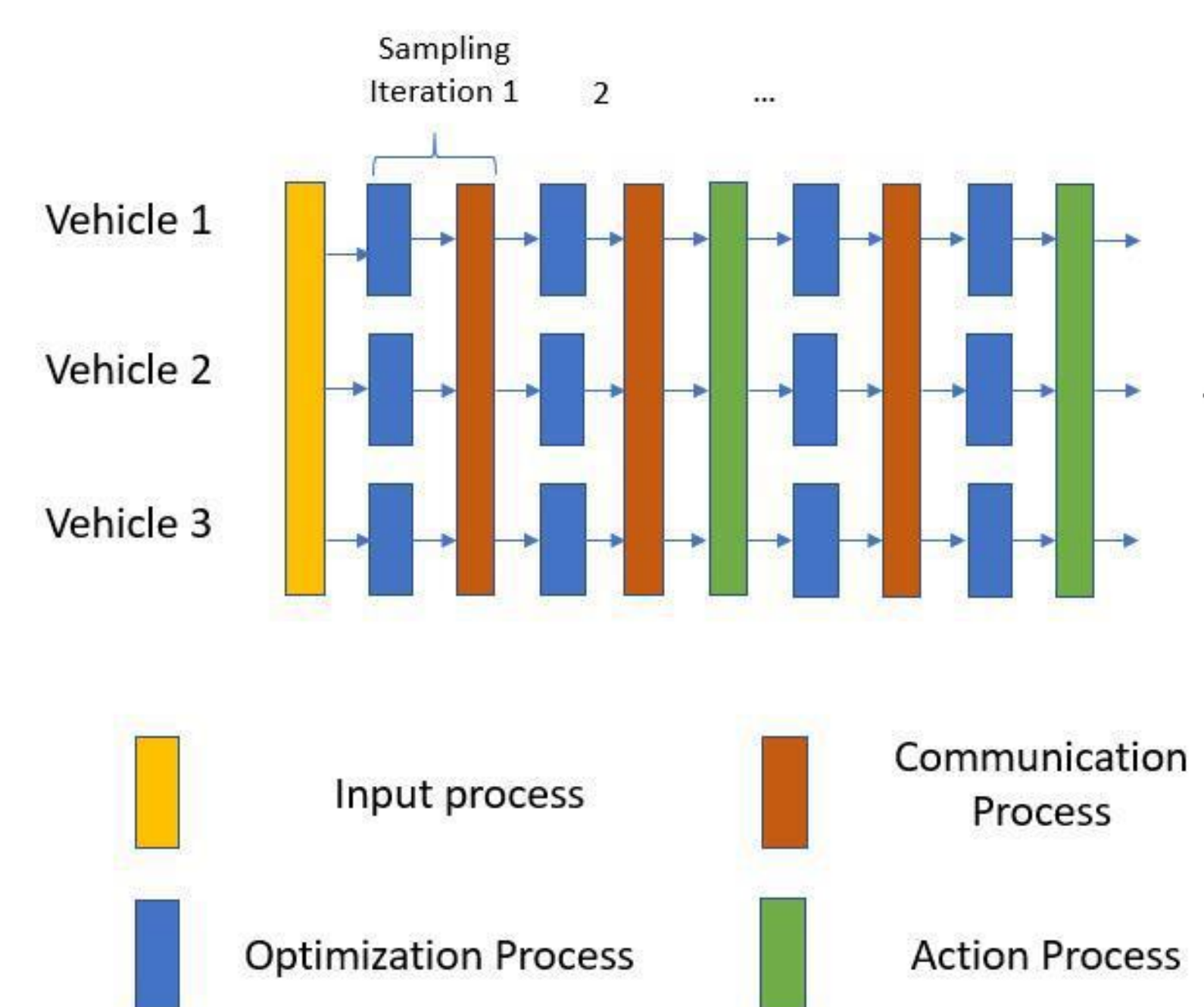


Figure 2: Negotiation and Optimization Mechanism

All CAVs near the intersection will follow this mechanism to negotiate, optimize, and make decisions at each sample time.

Methodology

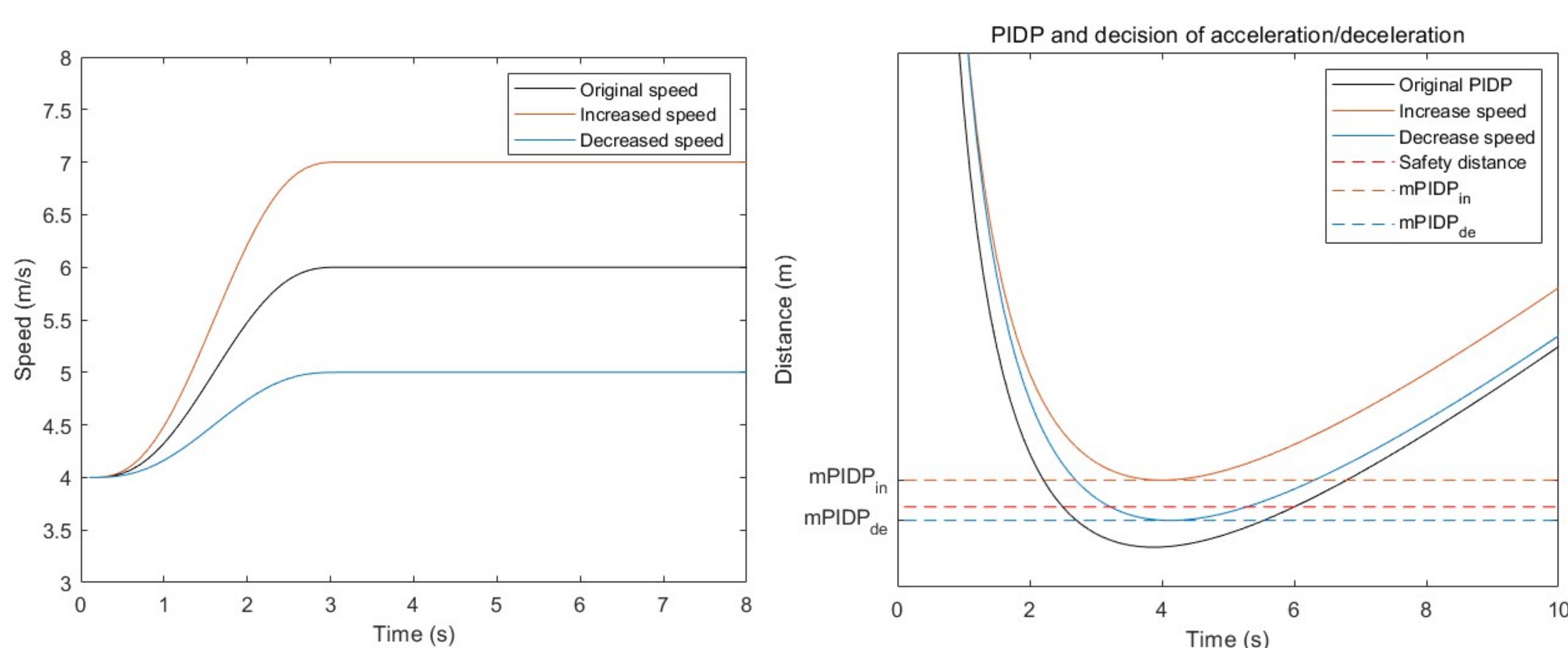


Figure 3: PIDP based decision-making

If an vehicle has risk of collision in the coming future, based on the current speed profile, the acceleration and deceleration speed profiles will be generated to calculate the corresponding PIDP curves.

1. If the PIDP curve is always above the safety distance: the maneuver is safe.
2. If the PIDP curve crosses the safety distance: the maneuver has a risk of collision.

Reference

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Acknowledgement

