



Smart traffic coordination using learnable digital twin



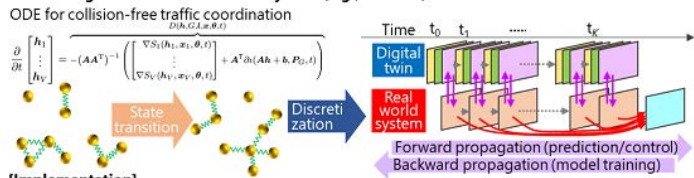
Background

We introduce "signal-free mobility project", in which a set of vehicles autonomously coordinates their traffic states (e.g., speed, position) without using traffic signals, expecting that a reduction transportation time to the limit while vehicles are collision-free.

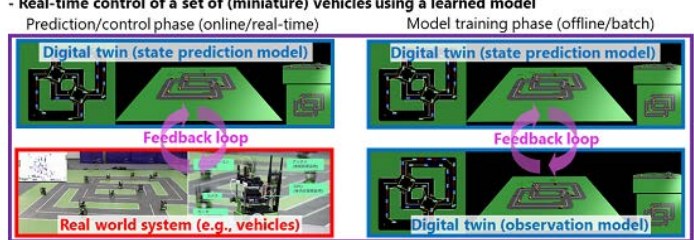
Summary

We succeeded to represent collision-free traffic flow as an ordinary differential equation (ODE) and its completely distributed solver for edge-computing. Then, optimal traffic coordination can be achieved via feedback loop between digital twin and real vehicles.

[Theory] Collision-free traffic coordination is represented by an ordinary differential equation (ODE). Its discretization using fully distributed ODE solver defines a special neural architecture in which digital twin and real world system (e.g., vehicles) interact with each other.



[Implementation]
 - Neural state prediction model is leaned such that vehicles will increase average speed subject to collision-free using data collected via traffic simulations
 - Real-time control of a set of (miniature) vehicles using a learned model



Feature 1

Distributed dynamics learning for optimally coordinate vehicle states for increasing average speed under collision-free constraints

Feature 2

Real-time vehicle state prediction and control by completely distributed ODE solver

Feature 3

State prediction model training on digital twin via a number of traffic simulations

Future benefits

This research shows a future of IoT communication, where autonomous dynamical communication following learned state transition model optimizes an overall system consisting of a large number of IoT devices.

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