Secure Collision Detection of Autonomous Vehicles and Drones



Autonomous vehicles and drones are becoming an increasingly common part of everyday life, driven by the added capabilities and flexibility they offer across a wide range of applications, including transportation, delivery and logistics, smart agriculture, disaster response, and military operations. Because no human operator is on board, these systems require reliable collision-free path-planning methods. Detecting potential collisions in advance, at any point along a planned trajectory, can significantly improve planning efficiency, reducing both delivery times and energy consumption. At the same time, the information needed to detect and prevent collisions, such as location and time data, is highly sensitive and cannot be shared freely with potentially malicious parties.

The goal of the project is to enable autonomous vehicles to continuously compare their trajectories with those of nearby vehicles in order to prevent collisions, while preserving privacy of the underlying data. The vehicles continuously outsource the computation of trajectory matching to the MOZAIK platform, a platform based on secure multi-party computation (MPC) protocols, for end-to-end secure data processing.

The internship consists of:

- Implementation of a secure trajectory-matching protocol in MP-SPDZ - an MPC framework with high-level Python-like language
- Integration into the MOZAIK platform
- Design of a scheduler to allow for data streaming and continuous analysis
- Evaluation on open-source dataset and simulation of swarms

Related works:

MP-SPDZ Repository: `https://github.com/data61/MP-SPDZ`.
MOZAIK Platform description: `https://arxiv.org/pdf/2601.02245`
An example of trajectory matching: `https://dl.acm.org/doi/10.1145/3564625.3564626`

Practicalities

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